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Farmers' market use is associated with fruit and vegetable consumption in diverse southern rural communities

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Abstract

Background: While farmers' markets are a potential strategy to increase access to fruits and vegetables in rural areas, more information is needed regarding use of farmers' markets among rural residents. Thus, this study's purpose was to examine (1) socio-demographic characteristics of participants; (2) barriers and facilitators to farmers' market shopping in southern rural communities; and (3) associations between farmers' market use with fruit and vegetable consumption and body mass index (BMI).

Methods: Cross-sectional surveys were conducted with a

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Background

In the United States, obesity is a major public health problem, disproportionately affecting rural residents [1,2]. Disparate obesity rates among rural residents may be partially due to less access to healthy and fresh foods [3,4]. Policies and environmental changes to increase availability of healthy foods are suggested as contributing solutions to the obesity epidemic [5,6]. In particular, increasing use of farmers' markets is one potential strategy to increase access to and consumption of fruits and vegetables, which would decrease risk of chronic disease [7]. Thus, farmers' markets are thought to potentially improve population health and reduce population health disparities; yet little is known about their impact on produce consumption [8].

Farmers' markets may be a particularly effective strategy to improve access to healthy foods in rural areas, where improving the health status of rural residents may involve more effectively leveraging of the strong rural historical

(RDD) procedure. Both land lines (n = 887) and cellular telephone lines (n = 500) were included in the purchased sample provided by Survey Sampling International (http://www.surveysampling.com/), and numbers were called during a variety of days and times. Eligibility criteria for participation included being over 18 years of age, a Pitt County resident, and one of the primary food shopper95.8(i)11[(Co)16.p((od)-2(du)18.42.)0(t0.7((nho)13.8(t90(d)1s(e)0(,1(ry)h3.8(t90

Table 2 Participant characteristics from farmers' market intercept interview participants and random digit dial survey participants in Pitt County, eastern North Carolina and in Boone, Jackson, and Fayette Counties, eastern Kentucky

Characteristic	NC farmers' market intercept interview participants (n = 70)		Kentucky farmers' market intercept interview participants (n = 102)		Random digit dial participants in North Carolina (n = 109)		Random digit dial participants in Kentucky (n = 149)	
	Mean	Standard deviation	Mean	Standard deviation	Weighted mean	Standard error of the mean	Weighted mean	Standard error of the mean
Age in years	52.9	18.3	50.8	16.4	43.9	2.2	58.5	2.1
Length of time at current residence in years	8.9	9.6	13.9	13.5	10.6	1.8	NA	NA
Fruit and vegetable Servings per day	4.3	2.0	3.7	1.8	7.2	0.4	7.3	0.2
BMI (kg/m^2)	27.9	6.9	28.1	6.1	29.3	1.0	27.4	0.5
	n	%	n	%	n	Weighted %, SE of %	n	Weighted %, SE of %
Female, n (%)	47	67.1	74	72.6	82	68.5, 6.9	111	79.4, 4.2
Race								
African American/Other	19	27.5	1	1.0	58	38.5, 6.3	7	5.9, 3.1
White	50	72.5	100	99.0	50	61.5, 6.3	142	94.1, 3.1
Education								
College graduate	44	62.9	56	55.5	34	35.4, 6.7	60	35.2, 5.0
Non-college graduate	4	37.1	45	44.6	74	64.6, 6.7	86	64.8, 5.0
Participation in Federal Food Assistance Programs								
Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)	2	2.9	1	1.0	10	11.0, 4.5	5	6.8, 3.9
Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Farmers' Market Nutrition Program (FMNP)	1	1.4	4	7.8	6	4.9, 2.9	9	7.3, 3.9
Supplemental Nutrition Assistance Program (SNAP)	0	0	5	5.0	25	17.0, 4.7	18	9.5, 4.0
Senior Farmers' Market Nutrition Program (SFMNP)	1	1.4	4	4.0	6	4.4, 2.5	3	5.8, 3.8

[1]For continuous weighted variables, the cells include the weighted mean and standard error of the mean, For categorical variables, the cells contain the true n, weighted %, standard error of %.
[1]NA = Not asked and thus not available.

Table 3 Participant shopping practices among farmers' market customers and random digit dial survey participants in

month consumed on average 1.3 servings of fruit and vegetable more than those who visited a farmers' market at most once a month. There were no significant associations between the independent variables of interest and BMI.

Among KY RDD respondents, in adjusted models with fruit and vegetable consumption as the dependent variable, consumption was positively related to farmers' market use (estimate = 1.0, standard error = 0.4, $p = 0.02$). Those who visited a farmers' market at least 2–3 times a month consumed on average 1.0 servings of fruit and vegetable more than those who visited a farmers' market at most once a month. There were no significant associations between BMI and the independent variables of interest.

Finally, the NC and KY RDD samples were pooled together and weights were adjusted by the states' population sizes. In the adjusted model with fruit and vegetable consumption as the dependent variable, consumption was still positively associated with farmers' market use within each state but the difference between the two states was not significant. There were no significant associations between BMI and the independent variables of interest, and there were no significant differences between the two states.

Discussion

In this paper, not surprisingly, farmers' market customers reported shopping more frequently at farmers' markets compared to RDD respondents: Among farmers' market customers, about half reported shopping at a farmers' market at least once per week, compared to less than one fifth of NC and KY RDD respondents. This finding is in agreement with a previous study in Pitt County, finding that 17% of Pitt County, NC residents receiving food stamp benefits shopped at a farmers' market, [15] and sug-

survey administration (in person at the farmers' market versus over the phone for the RDD survey). This difference could also indicate that farmers' market customers are more health-aware in general, when compared to a representative sample of county residents, and thus may be better able to accurately estimate fruit and vegetable consumption. Counter to previous findings of inverse associations between access to farmers' markets and obesity in an ecologic, national sample, [31] and in an individual analysis of eastern NC children from rural and urban areas, [32] we found no associations between farmers' market use and BMI among farmers' market customers or RDD respondents.

Our study findings should be interpreted with caution. This is a cross-sectional study design and thus demonstrates association and not causation. In addition, participant responses may have been influenced by social desirability bias, particularly among those sampled in-person at the farmers' market, such that they overestimated healthy behaviors. However, farmers' market customers may also have reported more accurately about healthy behaviors than RDD respondents. Farmers' market customer recruitment methods may have led to systematic bias within the NC and KY farmers' market customers. For example, farmers' market customers who were willing to complete the survey may have been more likely to be female, higher socio-economic status, and thus able to spend more money at farmers' markets, compared to those who were not willing to respond to our survey. In Pitt County, to increase survey administration efficiency, 25/70 customer surveys were completed by the customers versus by interviewers, and had incomplete responses, especially in terms of items in which an individual was supposed to mark only one choice. In addition, shopping patterns, fruit and vegetable consumption, and height and weight were self-reported among all respondents, and may be systematically biased. For instance, heavier individuals may underreport weight to a greater extent than normal weight individuals. Slightly different RDD methods were used in NC versus KY, but these methods were designed to be as consistent as possible, and the substantive benefits of conducting simultaneous analyses of the four samples in the two diverse rural areas outweighed the limitations. Another limitation is the small sample size, large standard errors, and lack of inclusion of potential confounders such as other dietary or physical activity factors that may influence BMI. Although we included cell phone numbers in the RDD survey, we may have had systematic bias in the sample. KY RDD response rate may have been higher than the NC RDD response rate because more call attempts were made in KY, and because the sample was older and only land lines were called. Finally, responses for the question regarding how often the respondents purchased fruits and vegetables locally grown from a farmers' market, CSA (community supported agriculture), roadside stand, or pick-your-own produce farm may vary by the season in which the surveys were conducted, and may lead to an underestimation or an over-

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