

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

Stephanie B Jilcott Pitts¹, Alison Gustafson², Qiang Wu³, Mariel Leah May⁴, Rachel K Ward⁵, Jared T McGuffert⁶, Ann P Raftery⁷, Mandee F Lancaster^{8,9}, Kelly R Evenson¹⁰, Thomas C Keyserling¹¹ and Alice S Ammerman¹²

Abstract

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

Methods: Cross-sectional surveys were conducted with a purposive sample

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 farmer's markets is one potential strategy to increase access to and consumption of fruits and vegetables, which would decrease risk of chronic disease [7]. Thus, farmer's markets are thought to potentially improve population health and reduce population health disparities; yet little is known about their impact on produce consumption [8].

Farmer's 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(r

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 farmersmarket 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)	1.4		4	7.8	6	4.9, 2.9	9	7.3, 3.9
FarmersMarket Nutrition Program (FMNP)								
Supplemental Nutrition Assistance Program (SNAP)	0	0	5	5.0	25	17.0, 4.7	18	9.5, 4.0
Senior FarmerMarket Nutrition Program (SFMNP)	1	1.4	4	4.0	6	4.4, 2.5	3	5.8, 3.8

¹For continuous weighted variables, the cells include the weighted mean and standard error of the mean, For categorical variables, the cells contain n, weighted %, standard error of %.

¹NA = 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. 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-

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 23 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 state 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

survey administration (in person at the farmer's market versus over the phone for the RDD survey). This difference could also indicate that farmer's 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 farmer's 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 farmer's market use and BMI among farmer's market customers or RDD respondents.

Strengths of this study included use of the validated Block Fruit and Vegetable Screener, and RDD methods including cell phone numbers to select participants. Also, we assessed the frequency of farmer's market shopping in a fairly unusual experience for most people, such shopping may be easier to recall compared to other behaviors. Another strength of this study was the examination of rural populations, including two geographically diverse, rural southern populations, which have not been widely studied in farmer's market research.

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 farmer's market, such that they overestimated healthy behaviors. However, farmer's market customers may also have reported more accurately about healthy behaviors than RDD respondents. Farmer's market customer recruitment methods may have led to systematic bias within the NC and KY farmer's market customers. For example, farmer's market customers who were willing to complete the survey may have been more likely to be male, higher socio-economic status, and thus able to spend more money at farmer's markets, compared to those who were not willing to respond to our survey. In Pitt County, 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 these 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

desirability bias, particularly among those sampled in-person at the farmer's market, such that they overestimated healthy behaviors. However, farmer's market customers may also have reported more accurately about healthy behaviors than RDD respondents. Farmer's market customer recruitment methods may have led to systematic bias within the NC and KY farmer's market customers. For example, farmer's market customers who were willing to complete the survey may have been more likely to be male, higher socio-economic status, and thus able to spend more money at farmer's markets, compared to those who were not willing to respond to our survey. In Pitt County, 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 these 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

in-person at the farmer's market, such that they overestimated healthy behaviors. However, farmer's market customers may also have reported more accurately about healthy behaviors than RDD respondents. Farmer's market customer recruitment methods may have led to systematic bias within the NC and KY farmer's market customers. For example, farmer's market customers who were willing to complete the survey may have been more likely to be male, higher socio-economic status, and thus able to spend more money at farmer's markets, compared to those who were not willing to respond to our survey. In Pitt County, 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 these 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

Conclusions
The results provided here can assist in planning and evaluation of the NC Community Transformation Grant Projects farmer's market initiative, which has the goals of starting new farmer's markets and making enhancements to farmer's markets which include: creating or enhancing land use protections to support markets, improving physical structure of markets, increasing transportation to/from markets, and implementing SNAP EBT at markets. These enhancements are to be coupled with increased market promotion activities. Our results shed light on the farmer's market enhancements that may be most needed in NC. First, to address the barrier of the way location, more farmer's markets are needed, including incorporating supports for farmer's markets in land use planning and local zoning ordinances. Second, to address the barrier of 'market days and hours' existing farmer's markets should consider extending or rearranging hours to be more convenient to customers, and new markets should open during hours that existing markets are not open. As the two top scenarios that would encourage individuals to shop more frequently at farmer's markets are more vendors and more promotional activities, both these enhancements should be explored. The knowledge gained from this evaluation can also be shared with other CTG-funded states, especially those states funded at the CTG-capacity.

26. Ritenbaugh P, Ritenbaugh C, Treiber F, Block G. Validation of a brief telephone questionnaire to estimate fruit and vegetable consumption in diverse study populations. *Epidemiology* 1993;4:455-463.
27. Spencer EA, Appleby PN, Davey GK, Key TJ. Validity of self-reported height and weight in 4808 EPIC-Oxford participants. *Public Health Nutr* 2002; 5:561-565.
28. Brunner Huber. Validity of self-reported height and weight in women of reproductive age. *Matern Child Health* 2007;11(2):137-144.
29. Racine EF, Vaughn AS, Laditka SB. Farmers market use among African-American women participating in the special supplemental nutrition program for women, infants, and children. *J Am Diet Assoc* 2010; 110(3):444-446.
30. Grin BM, Gayle TL, Saravia DC, Sanders LM. Farmers markets by mothers of WIC recipients, Miami-Dade county, Florida, 2011. *Prev Chronic Dis* 2013;10:E95.
31. Jilcott SB, Keyserling TC, Crawford T, McGuirt JT, Ammerman AG. Examining associations among obesity and per capita farmers markets, grocery stores/supermarkets, and supercenters in US counties. *J Am Diet Assoc* 2011;111(4):567-572.
32. Jilcott SB, Wade S, McGuirt JT, Wu Q, Lazorick S, Moore SB. Association between the food environment and weight status among eastern North Carolina youth. *Public Health Nutr* 2011;14(9):1610-1617.

doi:10.1186/1475-2891-13-1

Cite this article as: Jilcott Pitts et al: Farmers market use is associated with fruit and vegetable consumption in diverse southern rural communities. *Nutrition Journal* 2014 13:1.

Submit your next manuscript to BioMed Central and take full advantage of:

€ Convenient online submission

€ Thorough peer review

€ No space constraints or color figure charges

€ Immediate publication on acceptance

€ Inclusion in PubMed, CAS, Scopus and Google Scholar

€ Research which is freely available for redistribution

