Food Safety and Food Quality Perceptions of Farmers' Market Consumers in the United States

Heyao Yu^a, Kristen E. Gibson^b, Kathleen G. Wright^b, Jack A. Neal^a, Sujata A. Sirsat^{a,*}

^aConrad N. Hilton College of Hotel and Restaurant Management,

University of Houston, Houston, TX 77204-3028

^bCenter for Food Safety, Department of Food Science,

University of Arkansas, Fayetteville, AR 72704

*Corresponding author

Dr. Sujata A. Sirsat

4450 University Drive, S230

Houston, TX 77204-3028

Telephone: 713-743-2624

Fax: 713-743-3696

Email: sasirsat@central.uh.edu

ABSTRACT

The number of farmers' markets in United States (U.S.) increased dramatically from 1775 markets in 1994 to 8,476 markets in 2014. However, few studies have investigated consumers' food safety perceptions toward products in farmers' market or their impact on consumers' purchasing behaviors. The objectives of this study were to understand consumers' perception of food safety at farmers' markets and to explore the role of food safety perception on their purchasing fresh produce at a farmers' market. Analysis of covariance was used to investigate food safety perceptions at farmers' market among different demographic groups. In addition, multiple linear regression was used to explore factors including consumers' food safety perception and quality perception on their purchasing at a farmers' market. The results from the ANCOVA indicated that millennial generation consumers perceived better food safety conditions at farmers' markets. The linear regressions indicated quality perception and willingness to support local foods are primary reasons that consumers purchase products at farmers' markets, while food safety perception is not significantly related to purchasing fresh produce. The results imply that consumers generally hold a positive food safety perception that may be in contrast to actual microbial safety of produce obtained from farmers' markets. The results highlight an increasing need for consumer education specifically related to food safety awareness at farmers' markets.

Key words: Farmers' market food safety, consumer food safety perception, fresh produce, purchasing behavior

1. Introduction

The farmers' market concept with a shorter food supply chain has achieved success worldwide (Åsebø, Jervell, Lieblein, Svennerud, & Francis, 2007; Lanfranchi, & Giannetto, 2014; D'Amico, Di Vita, Ghinnici, Pappalardo, & Pecorino, 2014). The number of farmers' markets registered by the U.S. Department of Agriculture (USDA) has increased dramatically from 1,775 markets in 1994 to 8,669 markets in 2016 (USDA AMS, 2016) to meet consumer demand for products that are perceived as more wholesome than their retail supermarket counterparts (Feldmann & Hamm, 2015). Farmers' markets provide opportunities for growers to sell their products and provide consumers with alternative ways to access fresh, locally grown, and organic food (Gao, Siwisher, & Zhao, 2012). In addition, these direct-to-consumer markets are an integral link between the rural and urban areas.

While a variety of locally grown and produced products are available at farmers' markets, fresh produce is the most common commodity (USDA LFD, 2016) and accounts for more than 82% of the total foods sold at these direct-to-consumer venues (Duarte, O'Neal, Liu, & O'shea, 2011). Moreover, because of the ready to eat (RTE) status of many fresh produce items (e.g., leafy greens, tomatoes, fresh herbs, fresh fruit/berries), if not handled and prepared properly, fresh produce can be a vehicle for transmission of foodborne illnesses—whether it is produced locally or internationally. Chapman, Eversley, Fillion, McLaurin, and Powell (2010) reported that fresh produce accounted for more than 46% of the foodborne disease outbreaks in the U.S. from 1998 to 2008. Farmers' markets present unique challenges to the prevention and control of foodborne pathogen transmission. For instance, hand washing and toilet facilities may not be available because of the outdoor temporary locations of many farmers' markets (Worsfold, Worsfold, & Griffith, 2004). Moreover, the outdoor environment makes temperature control very

difficult—a crucial and critical control point for farmers’ market products such as fresh and fresh-cut produce (Worsfold et al., 2004; Smithers, Lamarche, & Joseph, 2008; Norwood, 2015; Pollard Boyer, Chapman, di Stefano, Archibald, Ponder, & Rideout, 2016).

Only a few studies investigate consumers’ perceptions about locally grown produce at farmers’ markets. In a survey conducted by Onozaka, Nurse, & McFadden (2010), the authors reported that approximately 60% of the respondents felt that locally grown produce had superior food safety level than conventional produce. Smithers et al. (2010) revealed that consumers perceived locally grown produce as safer and carried less risk than produce grown elsewhere because the decrease in distance from “farm to fork”. However, most studies associated with consumers’ perceptions about farmers’ market did not include food safety in their research scope (Byker, Shanks, Misyak, & Serrano, 2012; Wolf, 1997; Wolf, Spittler, & Ahern, 2005). Of the studies discussing consumers’ food safety perceptions of farmers’ markets, these surveys were conducted in only one to four farmers’ markets—failing to represent the national farmers’ market consumer. Also, no previous studies discussed the impact of food safety perceptions of farmer’ market consumers on their purchasing decisions for fresh produce using the correlational method. Hence, the objectives of the current study were 1) to investigate consumers’ food safety perceptions of the products in farmers’ markets nationwide and 2) to identify the impact of demographic factors (age, gender, education level) and food safety perceptions on consumers’ purchasing decisions of fresh produce at farmers’ market.

2. Material and methods

2.1 Participants and Data Collection

A survey instrument was designed to investigate consumers' perceptions about food safety issues and purchasing behaviors at farmers' markets. Questions were screened and approved by the University of Houston's Human Subjects Review Board. Fifty participants pilot tested the questionnaire to assess items and clarified and identified whether response options were clear. The questionnaire was revised based on the results of pilot tests. The survey instrument was distributed to participants nationwide through an online panel (www.Qualtrics.com). The participants included 1,050 respondents (55.5% female and 44.5% male). The survey was equally distributed to ten regions of the U.S. based on regions assigned by the U.S. Environmental Protection Agency (Table 1; EPA, 2016) with 105 respondents (10.1%) per region. This was done to ensure that the responses reflected a national representation of consumer perception of food safety at farmers' markets. In addition, to participate in the survey, respondents had to self-report visiting a farmers' market at least once a month during a regular market season. Three filter questions were included in the survey to examine the quality of responses. After the data cleaning procedure, 917 valid responses remained for further data analysis.

2.2 Measures

The questionnaire was divided into five sections. Section One included questions about participants' gender, age, education level, and household income. In Section Two, food safety perceptions and food safety practices of the participants were assessed. A panel of food safety experts developed the questions based on previously published studies (Milton & Mullan, 2010;

Yarrow, 2006). General food safety perception was measured by four items using a five-point Likert scale ranging from strongly disagree to strongly agree. For example, one of the items is as follows: “I think unsafe food can make people really sick”. Similarly, four items were used to measure food safety practices. An example of a food safety practice item is: “Proper food safety practices reduce the risk of food poisoning”.

The questions included in Section Three were designed to ask respondents about purchasing behaviors at a farmers’ market. Respondents were required to answer whether they purchase produce, meat and poultry, non-food items, and plants at a farmers’ market. All the questions in Section Three were rated on a five-point Likert scale. An example is “I purchase most of my vegetables and fruits at a farmers’ market”.

The questions in Section Four were designed to measure participants’ food safety and food quality perceptions towards items available in farmers’ markets as well as other reasons that motivate them to visit a farmers’ market (e.g., to support local foods or because of health concerns/awareness). Since limited literature was found to measure farmers’ market consumers’ food safety and quality perceptions using multi-item methods, items were developed by the authors of the present study. The survey instrument is demonstrated in Table 2.

2.3 Statistical analysis

The data were analyzed in three steps. The first step was scale validation, which was used to ensure self-generated items were able to measure respondents’ perceptions accurately. For this validation, IBM SPSS Statistics 22.0 for Windows (IBM Corporation, Armonk, NY) and AMOS 4.0 for Windows (IBM Corporation) were used. SPSS 22.0 software was used for data screening,

reliability analysis, and exploratory factor analysis (EFA). Confirmatory factor analysis (CFA) was conducted using AMOS 4.0 to present the construct validity of self-generated items. In the second step, descriptive analysis and analysis of covariance (ANCOVA) using SPSS 22.0 were conducted. This step demonstrated how different groups of participants (based on gender, generation, and level of food safety training) perceived the food safety and quality of products available at farmers' markets. Linear regression for the investigation of factors influencing purchasing behavior at farmers' markets was conducted using SPSS 22.0.

3. Results

3.1 Preliminary Scale Validation

The construct validity of data was examined by CFA (Table 2). The results of the CFA demonstrated a reasonable model fit ($\chi^2 = 123.11$, $df = 51$, $p < .001$, $\chi^2/df = 2.41$, CFI = .987, RMSEA = .037) where χ^2 is chi-square test, df is degrees of freedom, CFI is comparative fit index, and RMSEA is root mean square error of approximation. Factor loadings of each item varied from .65 to .92, indicating a good model. Convergence validity was assessed by using average variance extracted (AVE) score. All AVE scores were over .50 (varied from .51 to .64), indicating convergence (Hair, Black, Babin, & Anderson, 2010). Second, discriminant validity was assessed. The AVE values were compared with the square of the correlation estimates between them. In all cases, the AVE scores were greater than the squared correlation estimates. Therefore, results provided evidence of discriminant validity (Hair et al., 2010). Since data on these four scales were collected from a single source at the same time, common method bias could be an issue.

Harman's single-factor test was used to address the issue of common method variance (Podsakoff, Mackenzie, and Podsakoff, 2012). The CFA results indicated that the four-factor model fit the data significantly better ($\chi^2 = 109.29$, $df = 69$, $p < 0.001$, $\chi^2/df = 1.58$, CFI = .989, RMSEA = .041) than the one-factor model in which all items were loaded onto one latent construct ($\chi^2 = 3596.87$, CFI = .314, RMSEA = 0.335), providing support that common method bias was not an issue in this study. Overall, preliminary analyses demonstrated adequate data integrity.

3.2 Descriptive Analysis

Table 3 displays demographics of the survey respondents ($n = 917$). The sample included 504 females (55.5%) and 413 males (44.5%) respondents. In terms of generation, baby boomer and millennial generations account for most of the sample with 350 (38.2%) and 365 (39.8%), respectively, while only 202 (22.1%) respondents were generation X. More than half of the participants had a bachelor's degree or higher (54.9%) and approximately one third of the respondents (37.1%) had received some form of food safety training in the past.

All four scales—food safety knowledge, food safety practices, perception of farmers' market food safety, and perception of fresh produce quality available at farmers' markets—had normality problems after using the Shapiro-Wilk test ($p < .001$). After transforming the scales, no normality problems were encountered. Internal reliability and descriptive analyses were conducted for all scales. The Cronbach's alpha for all four scales was above .70, indicating all four scales had acceptable internal reliability.

The results of the descriptive analysis showed that most of the respondents agreed that foodborne illness was able to make people really sick and even result in death (Mean = 4.53) and were confident about using safe practices with respect to food handling (Mean = 4.67). Respondents also held positive perceptions toward the food safety conditions at farmers' markets (Mean = 3.702) as well as toward the fresh produce quality at a farmers' market (Mean= 3.77). For the questions related to food safety perceptions toward farmer' markets, 47.7% of the respondents indicated they agreed or strongly agreed that food safety procedures are available for farmers' markets while only 11.6% of them disagreed or strongly disagreed with this statement. In addition, 38.6% of respondents agreed or strongly agreed that the odds of contracting a foodborne illness at a farmers' market is very small and only 17.2% of respondents disagreed or strongly disagreed with this statement.

3.3 Consumers' Food Safety Perceptions About Farmers' Market

The results of consumers' food safety perceptions towards farmers' markets were further investigated by analyzing potential associations with their food safety knowledge and practices and other demographic factors using ANCOVA. Five demographic factors were included in this test: gender (male, female), generation (baby boomers, generation X, and millennial), region located, education level (High school, college degree, and post-graduate), and food safety training (yes, no). Also, two covariates (food safety knowledge and practices) were included to test for their relationship with food safety perception.

The results reported in Table 4 indicate that only generation was significantly related to consumers' food safety perceptions towards farmers' markets, and the interaction effect of

gender and generation was also significant. Other factors including food safety knowledge and practices, education level, and food safety training had no impact on consumers' food safety perceptions towards farmers' markets. As shown in Table 5, the results of *Bonferroni post hoc* showed that the average food safety perceptions of millennials (Mean = 3.718) were significantly higher than those of generation X (Mean = 3.443), which indicated that millennial consumers tended to believe food safety conditions at farmers' markets are better when compared to the perceptions of generation X consumers. The interaction effects tested by L-matrix showed that for baby boomer respondents, males (Mean = 3.874) had significantly higher food safety perceptions than female counterparts (Mean = 3.539), while females of generation X (Mean = 3.726) had significantly higher food safety perceptions for farmers' market than males (Mean = 3.255).

3.4 Factors Affecting Consumers' Produce Purchasing Behaviors at Farmers' Markets

Factors affecting consumers' fresh produce purchasing behaviors (i.e. as represented by purchasing frequencies) at a farmers' market were investigated by multiple linear regression using ordinal least square (OLS). In this regression model, the dependent variable is fresh produce purchasing behavior rated on a five-point Likert scale. The independent variables included food safety perceptions towards farmers' markets, perceptions toward fresh produce at a farmers' market, support of local food systems, and social demographic factors (gender, age, education levels). The determinant coefficient (R^2) was .244, indicating a reasonable model fit.

The results (Table 6) show the perceptions toward fresh produce at farmers' markets (β = .218, $p < .001$) and support of local food systems (β = .166, $p < .001$) had significant positive

relationships with the consumers' fresh produce purchasing behaviors at farmers' markets while age ($\beta = -.242$, $p < .001$) had a significant negative relationship with produce purchasing at a farmers' market. Food safety perception towards farmers' markets ($\beta = .111$, $p < .304$) was not significantly related to fresh produce purchasing behaviors.

4. Discussion

The study investigated how consumers perceived food safety conditions at farmers' markets, the factors associated with their food safety perceptions towards farmers' markets, and the role of food safety perceptions towards farmers' markets in consumers' fresh produce purchasing behaviors at farmers' markets.

First, the study developed a multi-item scale to measure food safety perception towards farmers' markets and validated the construct validity of this scale by using CFA following the guidance of Hinkin and Tracey (1999). Most of the previous studies measured food safety perceptions towards farmers' market using a single item (Crandall, Friedly, Patton, O'Bryan, Gurubaramurugesan, Seideman, & Rainey, 2011; Rainey, Crandall, O'Bryan, Ricke, Pendleton, & Seideman, 2011; Connell, Smithers, & Joseph, 2008), which may have resulted in lower content validity. By using validated multi-item scales and a nationwide survey tool, the present study provided more internal validity and external reliability to the data analysis. The results of the study confirmed the findings of Onozaka et al. (2010) and Smithers et al. (2010) that a majority of farmers' market consumers have positive food safety perceptions towards farmers' markets. However, Sirsat et al. (2015) reviewed the published literature related to the prevalence of microorganisms on food products sold at farmers' markets and highlighted that in some

instances there was higher bacterial prevalence on food items from farmers' markets when compared to their retail super market counterparts. For instance, several independent studies published from 2012 to 2014 demonstrated that bacterial concentrations on leafy greens purchased at farmers' markets were significantly higher than retail super markets (Sirsat & Neal, 2013; Scheinberg, Doores, & Cutter, 2013; Soendjojo, 2012; Su, 2014). Therefore, contrary to the currently available evidence, positive safety perceptions of farmers' markets were widely held among surveyed consumers.

The results on factors associated with food safety perceptions towards farmers' markets indicated variations among generations. Even though previous studies showed that typical consumers at farmers' markets are more than 40 years old and majority females (Byker, et al., 2012; Conner, *et al.*, 2010), the results of the present study indicate that the millennial generation tended to have a greater perception of food safety at a farmers' market compared to generation X, especially males in generation X. One possible reason for this may be due to an inflation in health-related risk concerns as people get older (Davidson & Freudenburg, 1996). In an independent study conducted by Crandall et al. (2010), the authors reported that older generations tended to believe that more food safety risks existed at farmers' markets compared to younger generations. This provides useful information for farmers' market managers and vendors. For instance, market managers may be able to attract elderly consumers to the farmers' market by implementing more control measures such as handwashing sinks or produce washing stations.

The last part of the study explored the factors associated with fresh produce purchasing at farmers' markets. The results showed that fresh produce quality and support of local food systems are the two significant predictors of fresh produce purchasing at a farmers' market.

Similar results have been reported by previous studies (Wolf et al., 2005; Kezis, Gwebu, Peavey & Cheng, 1998; Conner, Colasanti, Ross, & Smalley, 2010; Wolf, 1997; Byker et al., 2012; Gao, et al, 2012). For example, Byker et al. (2012) conducted a literature review of farmers' market studies and concluded that food quality is the primary reason reported for shopping at farmers' markets. Wolf et al. (2005) and Bellows et al. (2010) both used methods that compared the factors related to visiting farmers' markets between farmers' market shoppers and non-shoppers to explore the reasons. Surprisingly, age showed a negative correlation to purchasing fresh produce at a farmers' market, which is in contrast to some of the previous independent studies (Wolf et al., 2005; Kezis et al., 1998; Conner et al., 2010; Wolf, 1997; Byker et al., 2012). Velasquez, Eastman, and Masiunas (2005) found that younger generations (as of the 21st c.) are more interested in locally grown foods and would like to purchase foods at a farmers' market. This may be the reason that our nationwide study found that millennials are more likely to purchase fresh produce at a farmers' market.

Although food safety perception is a primary objective of our study, it is not surprising that food safety perceptions towards farmers' markets had no significant relationship with fresh produce purchasing at a farmers' market. Several previous studies indirectly implied a similar conclusion (Conner et al., 2010; Worsfold et al., 2004; Crandall et al., 2011). Conner et al. (2010) indicated that even though food safety concerns were the second most important reason that consumers chose to shop at farmers' markets, it did not influence farmers' market attendance based on binary probit analysis. Worsfold et al. (2004) investigated farmers' market consumers' food safety concerns and reported that most (86%) consumers have few or no concerns about the safety of the food available for purchase. However, as outlined in several recent reviews (Sirsat et al., 2015; Wright et al., 2015), foodborne disease outbreaks linked to farmers' markets have

been reported in the past decade, and therefore, it is necessary to increase consumers' food safety awareness towards food products available at farmers' markets in order to better protect public health.

Several limitations are associated with this study. First, asking respondents to rate the degree of "I purchase most of my produce at a farmers' market" may not accurately measure consumers' real produce purchasing frequency at a farmers' market when compared to obtaining real observational data. The survey participants may respond inaccurately or just guess their fresh produce purchasing frequencies. In addition, social desirability bias (i.e., the participants' tendency toward a perception of what is "correct" or socially acceptable) may affect variable means and cause misleading results when they self-report general food safety perception (De Jong, Pieters, & Fox, 2010). For instance, the statement "I feel confident in my ability to store food at safe temperatures" is considered socially desirable as everyone should follow good food safety practices. However, in reality, some consumers may not actually utilize proper food safety practices, even though they are likely to respond favorably to this statement, regardless of their intentions.

5. Conclusion

To conclude, the study indicated that a majority of consumers hold positive perceptions towards food safety at farmers' markets, especially the millennial population. However, food safety perceptions towards farmers' markets are not significantly related to consumers' fresh produce purchasing behaviors at a farmers' market. Since this is only a preliminary study about consumers' food safety perceptions towards farmers' markets, there are several

recommendations for future studies. First, since this study only proved there is no significant relationship between food safety perception and the purchase of fresh produce sold at farmers' markets, a more comprehensive model about purchasing behavior could be developed to investigate the role of food safety perceptions in the purchasing and decision-making process and the reasons that food safety perceptions have no direct linear relationship with purchasing behaviors. In addition, based on the results of this study, an intervention study could be conducted in the future to investigate whether sufficient training specifically about food safety in farmer' market will change consumers' perceptions and their food safety practices related to products available at farmers' markets.

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Table 1. U.S. Environmental Protection Agency (EPA) Region Distribution.

Region	States
Region 1	CT, MA, ME, NH, RI, VT
Region 2	NY, NJ, PR, VI
Region 3	DC, DE, MD, PA, WV, VA
Region 4	AL, FL, GA, KY, MS, NC, SC, TN
Region 5	IL, IN, MN, OH, MI, WI
Region 6	AR, OK, NM, LA, TX
Region 7	IA, KS, MO, NE
Region 8	CO, MT, ND, SD, MT, UT
Region 9	AZ, CA, HI, NV
Region 10	AK, ID, OR, WA

Table 2: Confirmatory Factor Analysis: items and loadings.

Variable	Items	Factor loading ^a	Cronbach's alpha
Food Safety Perception	Foodborne illness can be life threatening	.56	.813
	A foodborne illness could be dangerous	.92	
	I think unsafe food can make people really sick.	.88	
	AVE	.65	
Food Safety Practice	Proper food safety practices reduce the risk of food poisoning.	.55	.826
	Proper food safety practices reduce bacteria growth.	.60	
	I feel confident in my ability to store food at safe temperatures.	.79	
	I feel confident in my ability to clean and sanitize cooking utensils properly.	.87	
	AVE	.51	
Perception of Food Quality	I shop at farmers' market because the food is superior to that sold in grocery stores.	.62	.774
	I feel the quality of produce at a farmers' market are better than the quality of produce at a grocery store.	.76	
	I feel the produce and ready-to-eat foods sold at a farmers' market are healthier than foods sold at a grocery store.	.87	
	AVE	.54	
Perception of Food Safety	The odds of contracting a foodborne illness at a farmers' market is very small.	.71	.809
	I feel that fresh produce sold at a farmers' market have lower levels of bacteria than	.87	

conventional produce.

AVE

.63

^a All factors loadings are significant at $p < .001$.

AVE = average variance extracted

Table 3: Demographic profile of the respondents (n = 917)

Characteristics	N (frequency %)
Gender	
Male	413 (44.5)
Female	504 (55.5)
Generation	
Baby boomers (52 years above)	350 (38.2)
Generation X (37 years to 51 years)	202 (22.1)
Millennial (18 years to 36 years)	365 (39.8)
Education level	
High school degree	215 (23.5)
Associate degree	198 (21.6)
Bachelor degree	292 (31.8)
Graduate degree	88 (9.6)
Post-graduate degree	124 (13.5)
Food Safety	
On-job training	135 (12.9)
Formal training at work	74 (7.1)
Country health card training	44 (4.2)
National restaurant association ServSafe Course and/or Certification	62 (5.9)
Others	51 (4.9)
No formal food safety training	657 (62.9)

Table 4: Results of ANCOVA on Consumers' Food Safety Perception

Source	Type III Sum of Square	<i>df</i>	Mean Square	F-value
Food safety knowledge	1.215	1	1.215	3.053
Food safety practices	1.197	1	1.197	2.923
Regions	2.810	9	.312	.784
Gender	.000	1	.000	.001
Generation	6.216	2	3.108	5.102**
Education level	.368	4	.092	.231
Food safety training	.266	1	.266	.668
Gender*Generation	7.390	2	3.695	6.065**

*p< .05. ** p< .01

Table 5: Mean Food Safety Concerns for Main Effect

Conditions	Millennials	Baby Boomer	Generation X	Main effect means
Male	3.740	3.874	3.355	3.623
Female	3.696	3.539	3.626	3.621
Main effect means	3.718**	3.707	3.441**	3.622

*p< .05. ** p< .01

Table 6: The OLS Multiple Regression for Purchasing Behaviors at Farmers' Markets

Construct	Coefficient	t-statistic	p-value
Produce Quality Perception	.218	6.175	.000
Food Safety Perception	.111	1.055	.304
Gender	.019	.612	.542
Education Level	.037	.1224	.221
Age	-.242	-8.048	.000
Local Food Support	.166	4.785	.000

OLS = ordinal least square