



## Assessing Food Safety Culture: A Comparative Study between Independent and Chain Mexican and Chinese Restaurants

### ABSTRACT

This study aimed to assess the food safety culture in independent and chain Mexican and Chinese restaurants based on food handlers' demographics and operational characteristics. A self-administered questionnaire was designed to collect data on-site from a stratified random sample of 300 food handlers, with the goal of having 75 food handlers from each stratum of independent and chain Mexican and Chinese restaurants. A total of 106 restaurants agreed to participate. This included 31 independent Chinese restaurants, 28 independent Mexican restaurants, 16 chain Chinese restaurants, and 31 chain Mexican restaurants. Independent *t*-tests and a one-way analysis of variance were used to analyze the data. There were significant differences in food handlers' perceptions of leadership and environmental support in Mexican versus Chinese restaurants. Significant differences were found between the food handlers who received food safety training and those who did not. The respondents' perception of leadership was significantly different among restaurants with different types of service. Perception

of commitment to food safety was significantly different among food handlers of different ethnicities. Restaurant operators are recommended to focus on leadership styles, enhanced food safety training, and a physical environment more supportive of a positive food safety culture.

### INTRODUCTION

It was estimated that 80% of American consumers eat at least one ethnic meal per month (28). The growing interest of consumers and restaurant operators is a crucial driver for the popularity of ethnic foods, such as Mexican and Chinese (46). Consumer demand for ethnic foods has driven ethnic restaurants of all types to flourish in the United States. However, along with the increasing demand for ethnic food, foodborne illnesses resulting from such foods have risen (45). Although ethnic restaurants are not the sole source of foodborne illness outbreaks, outbreaks are still problematic because of poor food safety practices (20, 52). Previous research that used health inspection data demonstrated that ethnic restaurants had more violations than nonethnic restaurants and that chain restaurants had fewer violations than independent restaurants (22, 26).

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Safety culture emerged as a vague concept as many researchers provided varied views on what constitutes an organizational safety culture (17). However, food safety culture has been defined as the shared and prevailing values, beliefs, and attitudes governing an organization's food safety behavior (8, 15, 39). Food safety culture can be viewed as how employees think about food safety and their routinely practiced behavior in their organization (59). When an ethnic restaurant employs people of a single ethnic group, their culture may overlap with the business culture (16). The organizational safety culture could shape the employees' behavior by acting as a guide that directs their behavior (17). Therefore, the bottom line for improving food safety is promoting behavioral change and developing an organizational food safety culture (60).

The food safety culture is concerned with promoting proper food safety practices to a standard way of doing business by establishing compliance among all employees (30). In a study that explored the causes of poor hand hygiene of caterers, it was suggested that the cause of most foodborne illnesses lies in a poor food safety culture (6). In addition, it was found that food safety culture varies between commercial and noncommercial foodservice operations based on organizational support (52). Therefore, the importance of changing the focus of food safety training to changing employees' behavior and the organization's culture is paramount (27). Previous studies in different foodservice settings reported mixed results regarding the relationship between demographic characteristics (i.e., age, years of experience, ethnicity, education, and employment status) and food safety culture (9, 30, 52).

Previous research highlighted the importance of developing a food safety culture to promote the effectiveness of food safety risk management (39, 59). Although improper holding temperature, poor personal hygiene, and cross-contamination have been commonly identified as the most common risk factors for outbreaks of foodborne illnesses (55), a negative food safety culture has been implicated as an impediment to proper food safety practices (11, 38). Environmental support as a component of the organizational culture can help promote appropriate food safety behavior (15). For instance, lack of resources (e.g., financial, supply, and time) have been frequently cited among the barriers to ensuring safe food handling practices (10, 47). Low priority or attention to food safety, inadequate sick leave policies, and lack of organizational commitment to food safety are some precursors of a negative food safety culture (56). However, a positive food safety culture features the prevailing atmosphere where people consider food safety a foremost priority (5). A strong food safety culture helps guide daily decisions, actions, and behaviors, ensuring safe food practices are used in an operation (44).

A profound understanding of what a food safety culture constitutes could support positive food safety behaviors.

Even though there is no explicit agreement on the dimensions of a food safety culture (53), previous research identified a range of elements of food safety culture, including management systems, leadership, commitment, knowledge, employees' confidence in the food safety management system in place, risk awareness and perception, communication, accountability, work environment, values and behavior, and work pressure (1, 15, 30, 39, 53, 58, 60). Several studies have used various approaches and tools to measure food safety culture, including questionnaires and maturity models (19, 30, 53). However, food safety culture research is fragmented and needs to be developed and to follow a holistic approach to account for the several determinants of a food safety culture (e.g., an organization's food risks and context), organizational and administrative characteristics, facilities characteristics, and demographic characteristics (34).

It has been argued that self-administered questionnaires are unreliable for measuring organizational safety culture and suggested that an audit tool be used instead (18). Nevertheless, given the complexity of food safety culture, its time reliance, and context-based specificity, other researchers have acknowledged the importance of using manageable assessment tools, like questionnaires, to measure food safety culture (34, 53).

It is essential to tailor food safety training programs to address cultural misconceptions of workers in ethnic restaurants, which may lead to improper food safety behaviors (32). Further research was recommended to explore the ethnic background of employees and the role it may play in food safety (43).

Several studies have been conducted on food safety practices and food safety knowledge in ethnic restaurants (41, 42, 43). However, to the researchers' knowledge, no study has been shown to assess the food safety culture in ethnic restaurants and compare the culture of independent and chain-operated ethnic restaurants. Therefore, this study aimed to assess the food safety culture in Mexican and Chinese restaurants. Specific objectives were to (1) assess the food safety culture within Mexican and Chinese restaurants, (2) compare food handlers in independent and chain Mexican and Chinese restaurants based on their demographics and their perception of food safety culture in their workplace, and (3) identify differences in food handlers' perception of food safety culture based on the operational characteristics in independent versus chain Mexican and Chinese restaurants.

## **MATERIALS AND METHODS**

### **Study design and sampling**

The minimum sample size estimated to achieve a 95% confidence interval with  $\pm 0.06$  margin of error was 210 food handlers (G\*Power, version 3.1.9.2). To allow for comparison of the participants, a stratified random sample of 300 food handlers was targeted for data collection. The

goal was to obtain 75 respondents from each stratum of independent Chinese restaurants, independent Mexican restaurants, Chinese chain restaurants, and Mexican chain restaurants. In this study, independent ethnic restaurants were defined as those that serve “foods originating from a heritage and culture of an ethnic group who use their knowledge of local ingredients of plants and animal sources” (21). Chain ethnic restaurants are company-owned or franchised ethnic restaurants that operate under the same brand name and sell similar menu items (2). A list of Chinese and Mexican restaurants in the greater Dayton area in Ohio and in Houston, Texas, that meet the definition of an independent or chain restaurant was prepared. Further cross-checking was done on the websites of the restaurants to determine whether a restaurant was independent or part of chain.

### Questionnaire design

A questionnaire (*Appendix*) was designed and used to collect data about food handlers’ perceptions of the six components of the food safety culture proposed by Griffith et al. (15). These consisted of management style, leadership, communication, commitment, environmental support, and risk perception and awareness. Eleven demographic and operational information questions were included to describe and understand the sample. To ensure criterion validity of the measurement scales, all questionnaire items were adapted from previous studies with validated instruments. The food safety culture constructs were measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The leadership construct included 10 items adapted with modification from Ball et al. (1) and Seward et al. (44). The commitment construct included 11 items adapted from Ball et al. (1) and Neal et al. (30). The communication construct included 9 items adapted from Ball et al. (1), Seward et al. (44), and Ungku Fatimah et al. (54). The environmental support construct had 11 items adapted from Ball et al. (1) and Ungku Fatimah et al. (53). The risk perception and awareness construct included 6 items adapted from Ungku Fatimah et al. (53, 54). The management style construct contained 6 items adapted from Neal et al. (30) and Ungku Fatimah et al. (53). The questionnaire was reviewed by two experts in foodservice and food safety for content and face validity. Two professional translators translated the questionnaire into Spanish and Chinese, and then it was translated back to English by an independent translator to ensure it was accurate.

The research protocol and design (proposal IRB-2020-321) were reviewed and approved by the Institutional Review Board at Sam Houston State University before proceeding with data collection. The questionnaire was pilot tested with a convenience sample of 25 food handlers from independent and chain Chinese and Mexican restaurants. Restaurant owners/managers were contacted in person to request the participation of their employees. The

questionnaire was administered on-site to employees who agreed to participate. Each participant who completed the pilot test received a \$5 token of appreciation. No significant issues were noted during the pilot testing, although minor modifications to a few questions were made.

### Data collection

Participants were chosen based on two criteria: (1) participants had to be at least 18 years of age at the time of recruitment, and (2) they had to be food handlers. Participants who read the consent form and checked the box beside “I understand the above and consent to participate” were presumed to have given informed consent. Each participant who completed the questionnaire received a \$5 token of appreciation for their participation in the survey. If a restaurant’s owner/manager declined the participation of their food handlers, a replacement was taken from another restaurant of the same category until the target number of participants ( $n = 300$ ) was obtained. Therefore, to allow for dropout, 360 questionnaires were distributed on-site. Because of invalid or incomplete responses, 300 valid and complete copies were retained.

### Data analysis

The data were analyzed using IBM SPSS 27.0 for Windows (IBM Corporation, Armonk, NY). Descriptive statistics were used to summarize the data, including mean ( $M$ ), standard deviation ( $SD$ ), frequency, and percentage. Cronbach’s alpha was computed to determine the reliability of the instrument. Independent  $t$ -tests and a one-way analysis of variance (ANOVA) were conducted to examine significant differences among the respondents in independent and chain Mexican and Chinese restaurants in their perception of food safety culture based on their demographics (gender, years of foodservice experience, participation in food safety training, and completion of a food safety certification) and operation characteristics (type of operation, service style, and theme). An  $F$ -test was conducted when there were equal variances between groups, whereas the Welch test was run for unequal variances between groups. Post hoc tests were conducted to determine within-group differences.

## RESULTS AND DISCUSSION

### Profile of the respondents

A total of 106 restaurants agreed to participate in the study. They consisted of 58 Mexican (30 chains and 28 independent) restaurants and 48 Chinese (32 chain and 16 independent) restaurants. A total of 300 food handlers completed the survey. The respondents’ demographic characteristics and operational data are presented in *Table 1*. Slightly more than half of the respondents (53%) were female. Most respondents were Hispanic (46.3%), Caucasian (23.3%), and Asian (19.3%). Almost 75% of the respondents reported having worked 5 years or less

**TABLE 1. Demographics of respondents and their operational information (N = 300)**

Characteristic	Frequency <sup>a</sup>	Percentage	Characteristic	Frequency <sup>a</sup>	Percentage
<b>Gender</b>			<b>Restaurant ownership and theme</b>		
Female	159	53	Independent Chinese	75	25
Male	139	46.3	Independent Mexican	75	25
<b>Ethnicity</b>			Chain Chinese	75	25
Hispanic or Latino	139	46.3	Chain Mexican	75	25
Caucasian	70	23.3	<b>Type of service</b>		
Asian	58	19.3	Casual dining	50	46.7
African American	20	6.7	Quick service (fast food)	33	30.8
Native American, Pacific Islander, and other	12	4	Quick casual	16	15
			Fine dining	6	5.6
			Buffet	2	1.9
<b>Education</b>			<b>Food safety training</b>		
High school/GED	119	39.7	Yes	230	76.7
Less than high school	57	19	No	64	21.3
Some college	55	18.3	<b>Food safety certification</b>		
Associate degree	34	11.3	Yes	165	55
Bachelor's degree	31	10.3	No	122	40.7
Other	3	1			
<b>Position</b>					
Server	128	42.7			
Other	71	23.7			
Line cook	47	15.7			
Prep cook	27	9			
Executive chef	25	8.3			
<b>Years of experience</b>					
5 years or less	224	74.7			
6–15 years	59	19.7			
16 years or more	12	4			

<sup>a</sup>Responses may not equal 300 because of nonresponse to an item.

in the restaurant industry. Most respondents (76.7%) indicated they had received food safety training. In the survey, 55% of respondents indicated they had completed food safety certification, such as ServSafe or equivalent state certification. State of Texas regulations require food handlers to complete certified training in food safety and a certified manager to be on duty during the operating hours of a food establishment (49, 50). The state of Ohio mandates that all foodservice operations must have a designated food safety-certified Person in-Charge of each shift and a manager

with supervisory responsibilities who completed the Ohio Manager Certification in food protection (35).

**Descriptive statistics of food safety culture constructs**

Table 2 presents the means, standard deviations, and reliability coefficients for the 51 items representing the six constructs of food safety culture: leadership; commitment; communication; environment, training, and resources; risk perception and awareness; and management style. The initial reliability analysis suggested the removal of two problematic

items from the risk perception construct to improve reliability. The removed items were “when there is pressure to finish food production, I work faster by taking shortcuts with food safety” and “I believe that written food safety policies and procedures are nothing more than a cover-up in case there is a lawsuit.” The constructs demonstrated acceptable levels of reliability, which exceeded the cutoff point of 0.70 (33). The overall mean agreement scores for five of the six constructs were 4.3 or above on the 5-point scale. Leadership had the highest mean score ( $M = 4.39$ ,  $SD = 0.60$ ) followed by commitment ( $M = 4.34$ ,  $SD = 0.64$ ). Environment, training, and resources had the lowest overall score ( $M = 4.22$ ,  $SD = 0.69$ ).

### Demographic characteristics and perception of food safety culture

Table 3 provides the results of a comparison of the food safety culture based on the respondents' demographic characteristics. The results demonstrated that the level of agreement regarding the components of food safety culture was not significantly different among respondents of different gender, education, years of foodservice experience, position, and food safety certification received. However, there were statistically significant differences based on the respondents' ethnic background regarding the level of commitment to food safety ( $F = 2.291$ ,  $P = 0.035$ ). Tukey's Honestly Significant Difference (HSD) post hoc test showed that food safety culture agreement scores for commitment among Caucasian respondents ( $M = 4.12$ ,  $SD = 0.78$ ) were significantly lower than those of Hispanic and Latino respondents ( $M = 4.45$ ,  $SD = 0.59$ ;  $P = 0.006$ ). Food handlers who had received on-the-job food safety training rated all components of food safety culture higher than did those without training. The results of a  $t$ -test showed that each of the components of food safety culture – leadership ( $t = 3.15$ ,  $P = 0.002$ ), commitment ( $t = 3.00$ ,  $P = 0.003$ ), communication ( $t = 2.01$ ,  $P = 0.045$ ), environmental support ( $t = 2.61$ ,  $P = 0.009$ ), risk perception ( $t = 2.26$ ,  $P = 0.024$ ), and management style ( $t = 2.68$ ,  $P = 0.008$ ) – had a statistically significant higher mean score among respondents who received on-the-job training compared with those without food safety training. The  $t$ -test results did not show a significant difference in food handlers' perception of food safety culture based on the completion of food safety certification.

A previous study indicated that a negative impact on food safety could occur because employees from various ethnicities could carry out food safety practices based on their cultural traditions, which do not always align with their organizational food safety culture (29). According to Griffith et al. (14), new employees may change their practices to fit the prevailing food safety culture in their operation. Therefore, restaurant operators could benefit from instilling their food safety culture values in their food workers through training. Managers' commitment to food safety can motivate food workers' adherence to proper practices and improve the results of food safety training (31).

The results demonstrated that respondents who received food safety training showed a more positive view regarding all food safety culture components than untrained food handlers. Although the length of the foodservice experience did not significantly differentiate the respondents' opinions of food safety culture, training can increase food safety knowledge and support proper practices. Understanding the cultural values of food handlers in ethnic restaurants regarding food safety is vital to appreciate the challenges of implementing proper food safety practices and tailoring food safety training programs that address the potential misconception of food safety culture (25, 32). These results coincide with the findings of Taylor et al. (51) and Ungku Fatimah et al. (54), who found that the frequency of on-the-job training positively affected the prevailing food safety culture.

The findings of this study showed that food handlers' perception of food safety culture was not significantly influenced by whether they had a food safety certification. This is consistent with the findings of Ungku Fatimah et al. (54), who studied on-site foodservice operations. Conversely, it was found that the relationship to employees' perception of food safety culture, transformational leadership, attitudes, and behavioral intentions was significantly different between employees with certification and those without (23). The contradictory findings explain how food safety culture can be specific to the operational context and characteristics (34). For instance, it was stated that workplace incentives like promotions, bonuses, and pay increases could motivate employees with no food safety certification to acquire food safety knowledge and perform safe practices (23).

### Operational characteristics and perception of food safety culture

The results of comparing food safety culture based on the operational characteristics of the investigated restaurants are presented in Table 4. The  $t$ -test results indicated no statistically significant difference between independent and chain restaurants regarding food safety culture.

The results of one-way ANOVA showed that there were statistically significant differences among restaurants with different service styles regarding the level of agreement scores for leadership ( $F = 2.936$ ,  $P = 0.021$ ). A Games-Howell post hoc test noted that food safety culture agreement scores for leadership of respondents in casual dining restaurants ( $M = 4.29$ ,  $SD = 0.71$ ) were significantly lower than those of respondents in fine dining restaurants ( $M = 4.57$ ,  $SD = 0.46$ ;  $P = 0.044$ ). Further analysis showed that mean agreement scores for leadership of respondents in Chinese restaurants ( $M = 4.46$ ,  $SD = 0.53$ ) were significantly higher ( $t = 2.00$ ,  $P = 0.046$ ) than those of respondents in Mexican restaurants ( $M = 4.32$ ,  $SD = 0.66$ ). In addition, mean agreement scores for environmental support of respondents in Chinese rest-

**TABLE 2. Mean scores for food safety culture measurement scales**

Scale items	Mean ± SD
<b>Leadership (α = 0.90)</b>	
My manager/supervisor is clear about the expectations concerning hygiene and food safety towards employees.	4.53 ± 0.71
My manager/supervisor motivates their employees to work in a hygienic and food safe way.	4.45 ± 0.77
My manager/supervisor leads by example on food safety.	4.43 ± 0.74
My restaurant/chain management sets clear policies and objectives concerning hygiene and food safety.	4.42 ± 0.85
In my restaurant, the wearing of gloves, aprons, hairnets, etc. is well controlled and supervised.	4.42 ± 0.84
My manager/supervisor encourages me to report poor hygiene standards and food safety issues.	4.36 ± 0.89
In my restaurant/chain, management deals with food safety issues quickly and effectively.	4.36 ± 0.87
My manager/supervisor listens to employees if they have remarks or comments concerning hygiene and food safety.	4.36 ± 0.82
In my restaurant, plans and reporting on food safety performance are effectively implemented.	4.35 ± 0.81
In my restaurant, food safety records and logs are recorded accurately.	4.23 ± 0.93
<b>Overall mean</b>	<b>4.39 ± 0.60</b>
<b>Commitment (α = 0.90)</b>	
In my restaurant, food safety has a significant impact on customer satisfaction.	4.57 ± 0.65
My manager/supervisor acts quickly to correct problems/issues that affect hygiene and food safety.	4.52 ± 0.72
My manager/supervisor clearly considers hygiene and food safety to be of great importance.	4.51 ± 0.74
My manager/supervisor encourages everyone to take appropriate actions when they identify a food safety or hygiene issue.	4.46 ± 0.75
I know how to report any unsafe food or poor hygiene standards.	4.42 ± 0.80
In my restaurant, employees are actively involved by the leaders in hygiene and food safety related matters.	4.36 ± 0.87
In my restaurant, adequate time is given to undertake cleaning, food safety, and housekeeping activities.	4.35 ± 0.87
My colleagues are convinced of the importance of hygiene and food safety for the restaurant.	4.30 ± 0.89
Even if no one was looking, workers would follow all food safety rules.	4.27 ± 0.95
All employees in the restaurant take personal responsibility for food safety.	4.17 ± 0.96
In my restaurant, working in a hygienic and food safe way is recognized and rewarded.	4.10 ± 0.97
<b>Overall mean</b>	<b>4.34 ± 0.64</b>
<b>Communication (α = 0.87)</b>	
It is possible for me to communicate about hygiene and food safety with my manager/supervisor.	4.44 ± 0.77
I believe that my restaurant's food safety policies and procedures are clear and easy to follow.	4.40 ± 0.80
I believe if employees are identified as undertaking activities that have a negative impact on food safety, corrective actions would be taken.	4.40 ± 0.69
The importance of hygiene and food safety is permanently present by means of, for example, posters, signs and/or icons related to hygiene and food safety.	4.39 ± 0.85
I can discuss problems concerning hygiene and food safety with colleagues in my restaurant.	4.38 ± 0.80
My manager/supervisor communicates regularly with all employees about hygiene and food safety.	4.34 ± 0.86
I am made aware of changes to policies and procedures relevant to my job role and responsibilities.	4.31 ± 0.81
I am made aware of any food safety issues within the restaurant on an on-going basis.	4.19 ± 0.96
I have been included in the review of food safety policies and procedures of my restaurant.	4.17 ± 0.93
<b>Overall mean</b>	<b>4.31 ± 0.62</b>

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**TABLE 2. Mean scores for food safety culture measurement scales (cont.)**

Scale items	Mean ± SD
<b>Environment, training, and resources (<math>\alpha = 0.93</math>)</b>	
I believe there is recognition of the fact that employees have a role to play in food safety within my restaurant.	4.32 ± 0.81
In my restaurant, necessary infrastructure (e.g., good workspace, good equipment, etc.) is available to be able to work in a hygienic and food safe way.	4.30 ± 0.91
In my restaurant, suitable food safety training is provided to all employees.	4.29 ± 0.87
In my restaurant, employees get sufficient time to work in a hygienic and food safe way.	4.28 ± 0.89
I have access to policies and procedures relevant to food safety.	4.26 ± 0.92
The food safety training provided by my restaurant gives us the necessary skills and/or knowledge to follow the food safety rules.	4.26 ± 0.88
In my restaurant, food safety standards are maintained between shifts.	4.25 ± 0.91
In my restaurant, sufficient staff is available to follow up hygiene and food safety.	4.24 ± 0.90
In my restaurant, job descriptions contain details of responsibilities for food safety.	4.24 ± 0.88
In my restaurant, sufficient financial resources are provided to support hygiene and food safety.	4.14 ± 0.97
In my restaurant, all employees receive refresher training on food safety on a regular basis.	3.97 ± 1.04
<b>Overall mean</b>	<b>4.22 ± 0.71</b>
<b>Risk perception and awareness (<math>\alpha = 0.84</math>)</b>	
My manager/supervisor has a realistic picture of the potential problems and risks related to hygiene and food safety.	4.34 ± 0.81
My colleagues are alert and attentive to potential problems and risks related to hygiene and food safety.	4.32 ± 0.85
In my restaurant, the risks related to hygiene and food safety are under control.	4.31 ± 0.84
In my restaurant, the risks related to hygiene and food safety are known.	4.30 ± 0.83
<b>Overall mean</b>	<b>4.32 ± 0.69</b>
<b>Management style (<math>\alpha = 0.91</math>)</b>	
My managers'/supervisor's actions show that providing safe food to customers is a top priority.	4.55 ± 0.74
My manager is actively involved in making sure safe food handling is practiced.	4.33 ± 0.84
Management enforces food safety rules consistently with all employees.	4.32 ± 0.86
Our restaurant/chain food safety policies and procedures give detailed guidance for practices.	4.27 ± 0.83
My manager/supervisor always watches to see if employees are practicing safe food handling.	4.25 ± 0.95
Management inspires me to follow safe food handling practices.	4.25 ± 0.88
<b>Overall mean</b>	<b>4.33 ± 0.71</b>

**TABLE 3. Results of comparison of food safety culture by demographic characteristics**

Characteristic	Leadership		Commitment		Communication		Environmental support		Risk perception		Management style	
	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value
<b>Gender</b>												
Male	4.41 ± 0.51	0.442	4.41 ± 0.52	0.075	4.29 ± 0.53	0.654	4.22 ± 0.62	0.975	4.33 ± 0.62	0.824	4.38 ± 0.61	0.235
Female	4.36 ± 0.67		4.42 ± 0.72		4.32 ± 0.692		4.22 ± 0.78		4.31 ± 0.75		4.28 ± 0.80	
<b>Ethnicity</b>												
Caucasian	4.25 ± 0.71	0.228	4.12 ± 0.78 <sup>A</sup>	0.035*	4.25 ± 0.71	0.303	4.03 ± 0.93	0.268	4.18 ± 0.83	0.327	4.15 ± 0.96	0.304
Hispanic or Latino	4.45 ± 0.59		4.45 ± 0.59 <sup>B</sup>		4.38 ± 0.60		4.30 ± 0.64		4.37 ± 0.68		4.41 ± 0.65	
African American	4.50 ± 0.48		4.34 ± 0.48 <sup>B</sup>		4.43 ± 0.47		4.14 ± 0.62		4.38 ± 0.49		4.44 ± 0.52	
Native American	4.43 ± 0.52		4.24 ± 0.92 <sup>B</sup>		3.94 ± 0.83		4.16 ± 0.65		4.46 ± 0.77		4.21 ± 0.61	
Asian	4.39 ± 0.50		4.37 ± 0.47 <sup>B</sup>		4.22 ± 0.56		4.30 ± 0.58		4.39 ± 0.52		4.36 ± 0.56	
Pacific Islander	4.45 ± 0.49		4.50 ± 0.32 <sup>B</sup>		4.44 ± 0.62		4.14 ± 0.57		4.13 ± 0.53		4.17 ± 0.70	
Other	3.90 ± 1.01		4.18 ± 0.92 <sup>B</sup>		4.11 ± 0.72		4.23 ± 0.75		3.75 ± 1.25		4.00 ± 0.83	
<b>Education</b>												
Less than high school	4.36 ± 0.62	0.964	4.34 ± 0.61	0.972	4.31 ± 0.56	0.851	4.30 ± 0.54	0.613	4.26 ± 0.63	0.925	4.38 ± 0.59	0.826
High school/GED	4.42 ± 0.54		4.35 ± 0.57		4.34 ± 0.53		4.27 ± 0.65		4.34 ± 0.69		4.34 ± 0.69	
Associate degree	4.36 ± 0.74		4.31 ± 0.79		4.26 ± 0.82		4.04 ± 0.81		4.38 ± 0.77		4.25 ± 0.80	
Some college	4.41 ± 0.69		4.33 ± 0.78		4.36 ± 0.76		4.19 ± 0.92		4.35 ± 0.77		4.35 ± 0.86	
Bachelor's degree	4.39 ± 0.49		4.42 ± 0.52		4.27 ± 0.51		4.18 ± 0.65		4.31 ± 0.59		4.33 ± 0.67	
Other	4.17 ± 0.30		4.15 ± 0.18		3.95 ± 0.32		4.12 ± 0.43		4.00 ± 0.00		3.83 ± 0.16	

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**TABLE 3. Results of comparison of food safety culture by demographic characteristics (cont.)**

Characteristic	Leadership		Commitment		Communication		Environmental support		Risk perception		Management style	
	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value
<b>Position</b>												
Executive chef	4.53 ± 0.53	0.644	4.48 ± 0.65	0.588	4.46 ± 0.44	0.422	4.33 ± 0.56	0.426	4.40 ± 0.59	0.613	4.40 ± 0.52	0.751
Line cook	4.41 ± 0.51		4.39 ± 0.60		4.23 ± 0.71		4.10 ± 0.81		4.29 ± 0.78		4.26 ± 0.83	
Prep cook	4.31 ± 0.54		4.26 ± 0.55		4.16 ± 0.63		4.13 ± 0.59		4.26 ± 0.67		4.22 ± 0.55	
Server	4.40 ± 0.59		4.35 ± 0.60		4.33 ± 0.59		4.29 ± 0.68		4.38 ± 0.65		4.38 ± 0.68	
Other	4.33 ± 0.73		4.26 ± 0.74		4.33 ± 0.66		4.16 ± 0.77		4.23 ± 0.74		4.30 ± 0.81	
<b>Years of foodservice experience</b>												
5 years or less	4.38 ± 0.62	0.944	4.31 ± 0.66	0.303	4.30 ± 0.62	0.536	4.21 ± 0.73	0.962	4.29 ± 0.72	0.420	4.30 ± 0.76	0.679
6–15 years	4.41 ± 0.54		4.37 ± 0.56		4.38 ± 0.57		4.25 ± 0.63		4.41 ± 0.58		4.41 ± 0.53	
16–25 years	4.45 ± 0.48		4.70 ± 0.52		4.13 ± 0.78		4.18 ± 0.71		4.59 ± 0.56		4.52 ± 0.53	
26 years or more	4.50 ± 0.58		4.57 ± 0.51		4.58 ± 0.50		4.34 ± 0.76		4.44 ± 0.65		4.33 ± 0.77	
<b>Received food safety training</b>												
Yes	4.44 ± 0.60 <sup>A</sup>	0.002*	4.40 ± 0.60 <sup>A</sup>	0.003*	4.35 ± 0.59 <sup>A</sup>	0.045*	4.27 ± 0.65 <sup>A</sup>	0.028*	4.37 ± 0.65 <sup>A</sup>	0.024*	4.39 ± 0.66 <sup>A</sup>	0.008*
No	4.18 ± 0.58 <sup>B</sup>		4.13 ± 0.74 <sup>B</sup>		4.18 ± 0.69 <sup>B</sup>		4.01 ± 0.86 <sup>B</sup>		4.15 ± 0.81 <sup>B</sup>		4.12 ± 0.87 <sup>B</sup>	
<b>Received food safety certification</b>												
Yes	4.42 ± 0.60	0.256	4.37 ± 0.62	0.266	4.34 ± 0.64	0.304	4.25 ± 0.71	0.237	4.36 ± 0.65	0.212	4.36 ± 0.70	0.332
No	4.33 ± 0.61		4.28 ± 0.67		4.26 ± 0.59		4.15 ± 0.71		4.26 ± 0.75		4.28 ± 0.75	

\*Means within a column with different capital letters indicate significant differences at P-value <0.05 (e.g., the mean score for leadership among food handlers who received food safety training was significantly higher than those who did not receive training).

**TABLE 4. Results of comparison of food safety culture by operational characteristics**

Characteristic	Leadership		Commitment		Communication		Environmental support		Risk perception		Management style	
	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value
<b>Operation</b>												
Independent	4.39 ± 0.69	0.890	4.38 ± 0.69	0.273	4.30 ± 0.66	0.891	4.22 ± 0.79	0.901	4.32 ± 0.76	0.967	4.33 ± 0.79	0.955
Chain	4.38 ± 0.51		4.30 ± 0.57		4.31 ± 0.57		4.21 ± 0.62		4.32 ± 0.61		4.33 ± 0.63	
<b>Service</b>												
Quick service	4.50 ± 0.48 <sup>A</sup>	0.021*	4.40 ± 0.51	0.264	4.39 ± 0.60	0.140	4.27 ± 0.65	0.133	4.39 ± 0.58	0.368	4.37 ± 0.62	0.609
Quick casual	4.34 ± 0.47 <sup>B</sup>		4.47 ± 0.49		4.37 ± 0.51		4.16 ± 0.60		4.31 ± 0.52		4.44 ± 0.43	
Casual dining	4.29 ± 0.71 <sup>B</sup>		4.26 ± 0.74		4.23 ± 0.66		4.13 ± 0.80		4.25 ± 0.81		4.26 ± 0.83	
Fine dining	4.57 ± 0.46 <sup>A</sup>		4.47 ± 0.58		4.44 ± 0.51		4.47 ± 0.54		4.47 ± 0.49		4.43 ± 0.64	
Buffet	4.16 ± 0.42 <sup>AB</sup>		4.19 ± 0.41		4.06 ± 0.49		4.19 ± 0.43		4.16 ± 0.56		4.35 ± 0.40	
<b>Theme</b>												
Chinese	4.46 ± 0.53 <sup>A</sup>	0.046*	4.40 ± 0.53	0.113	4.34 ± 0.56	0.400	4.31 ± 0.62 <sup>A</sup>	0.025*	4.39 ± 0.57	0.105	4.37 ± 0.64	0.351
Mexican	4.32 ± 0.66 <sup>B</sup>		4.28 ± 0.72		4.28 ± 0.68		4.13 ± 0.78 <sup>B</sup>		4.26 ± 0.79		4.29 ± 0.78	

\*Means within a column with different capital letters indicate significant differences at  $P$ -value  $< 0.05$  (e.g., the mean score for leadership among Chinese restaurants was significantly higher than Mexican restaurants).

aurants ( $M = 4.31$ ,  $SD = 0.62$ ) were significantly higher ( $t = 2.258$ ,  $P = 0.025$ ) than those of respondents in Mexican restaurants ( $M = 4.13$ ,  $SD = 0.78$ ).

It was argued that food safety culture could vary among types of businesses as they call for different attitudes toward food safety (29). However, the diverse ethnic culture of employees can interweave with the business culture in ethnic restaurants (15). Therefore, these results imply that the prevailing food safety culture in the investigated restaurants differs because of contextual characteristics. Nyarugwe et al. (34) explained that these characteristics include the different

products, production processes, and environmental factors that may impose different demands on the operation's food safety culture.

This study investigated whether food safety culture was different based on the service style used in the restaurants. Out of the six components, leadership concerning food safety was better perceived by food handlers in fine dining restaurants than those in casual dining restaurants. This result signified that managers and owners of fine dining restaurants exhibited a commitment to food safety, motivated their employees, led by example, and developed policies

and procedures to control food safety. Because casual dining and fine dining restaurants accounted for 46.7 and 5.6% of the investigated restaurants, this finding may need further investigation. Previous research explained that leadership is often linked to the success or failure of a food safety culture, because managers are vested with spreading the beliefs and values that shape the organizational culture (62).

Establishing a food safety culture starts with owners and senior management setting strategies and creating policies and documentation (13). Deficiencies in food safety leadership, represented by a lack of policies, supervision, and managers serving as role models, resulted in poor food safety practices by employees (14).

Leadership was also rated higher by food handlers in Chinese restaurants compared with those in Mexican restaurants. “Face” is one of the Chinese cultural values and represents the reputation someone establishes in the community (25). This could explain the role of managers and owners of Chinese restaurants in upholding a food safety culture as perceived by their employees. Previous studies explained that Hispanic and Chinese food handlers tend to value collectivism rather than individualism and thus are likely to follow proper food safety practices if food safety training highlights the benefits to their restaurants (3, 24).

Food handlers in Chinese restaurants gave more favorable perceptions regarding environmental support (physical environment, training, time, and resources) than those in Mexican restaurants. This result is consistent with Wiśniewska et al. (57), who found a significant difference among food handlers regarding their assessment of their work environment, including the availability of equipment and tools to comply with food safety principles and the availability of training tools for managers. The work environment is usually essential to maintaining a food safety culture. Several studies’ findings highlighted the work environment’s role in supporting proper food safety practices (7, 40, 48, 62). Inadequate resources and supplies, lack of training, and lack of time were significant barriers to effectively performing and documenting food safety practices (12, 14, 36, 61).

Food safety culture was described as a jigsaw of various sub-components that work in tandem (14). In a previous study, leadership, communication, and environmental support appeared to have shortcomings in the investigated foodservice operations despite the food safety training provided and the hygiene auditing that existed (14). The top management has a significant role in assigning resources, establishing and implementing work methods, and influencing the overall culture of the work environment (14). Therefore, managers need to strengthen their food safety leadership and show commitment to creating a feeling of involvement, attachment, and responsibility, which results in more positive food safety practices (4, 7).

## CONCLUSIONS

An interesting finding from this study is the importance of food safety education but not necessarily certification.

Although the knowledge to pass a certification exam is essential, perhaps equally and maybe more important for ethnic populations unfamiliar with the food customs in the United States is completing a training class. Such a class can orient them to U.S. customs and expectations and expose them to the hazards of preparing and serving food, which they may have never considered.

Food safety training may also play an essential role in building the food safety culture in an organization, especially with ethnic populations. Requiring employees to attend training shows the importance owners and managers place on food safety education. This commitment is demonstrated when they need and pay for employees to attend training and when they encourage employees to pass the certification exam. Although passing the exam is essential to show knowledge acquisition, the support of food safety education may be enough to instill in employees the importance of food safety to the management team in the organization. Further research could explore this phenomenon.

Although the results of this study showed that commitment as an element of food safety culture was perceived differently by food handlers of different ethnicities, questions remain unanswered to fully understand the role ethnicity plays in safe food practices and the development of a food safety culture. Operators of Mexican and Chinese restaurants would benefit from establishing and demonstrating a commitment to a positive food safety culture that considers the significance of the ethnic background and culture of their employees.

This study showed that Chinese and Mexican restaurants perceived leadership and environmental support regarding food safety significantly differently. This suggests that the owners’/managers’ leadership plays a vital role in supporting a positive food safety culture and providing adequate resources, equipment, and motivation to reinforce proper food safety practices.

The anonymity of respondents and their answers was ensured in the design of the survey instrument and data collection to reduce the effect of evaluation apprehension and social desirability bias. However, the computed mean values of most items of the elements of food safety culture were higher than 4 on the 5-point scale. Herman’s single-factor test was used to diagnose whether a single factor can explain most of the variance. The unrotated factor solution of all scale items indicated that a single factor did not account for the majority of variance (<50% of the variance) (37). Future studies are encouraged to investigate any potential link between the recent inspection results of Mexican and Chinese restaurants and the prevalent food safety culture.

In this study, the sample consisted of food handlers in independent and chain Mexican and Chinese restaurants in two metropolitan cities in Ohio and Texas. Therefore, the results may not be generalized to other ethnic restaurants.

There were no significant differences observed between the Mexican and the Chinese restaurants in both cities. Future studies are encouraged to investigate that further and replicate the study in different foodservice settings. Food safety culture is time and context-based. Therefore, a survey in this study provided a limited assessment of the prevailing food safety culture in the investigated restaurants.

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# *In Memory*

*The family of Dr. Irving Pflug notified the Association that he has passed away. IAFP extends our deepest sympathy to his family. Dr. Pflug joined the Association in 1975. IAFP will always have sincere gratitude for his contribution to the Association and the profession.*

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## APPENDIX QUESTIONNAIRE

### PART I: LEADERSHIP

Please indicate your *level of agreement* with each of the following statements by circling the corresponding number.

Leadership	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1. My restaurant/chain management sets clear policies and objectives concerning hygiene and food safety.	1	2	3	4	5
2. My manager/supervisor leads by example on food safety.	1	2	3	4	5
3. In my restaurant/chain, management deals with food safety issues quickly and effectively.	1	2	3	4	5
4. In my restaurant, food safety records and logs are recorded accurately.	1	2	3	4	5
5. In my restaurant, the wearing of gloves, aprons, hairnets, etc. is well controlled and supervised.	1	2	3	4	5
6. My manager/supervisor is clear about the expectations concerning hygiene and food safety towards employees.	1	2	3	4	5
7. In my restaurant, plans and reporting on food safety performance are effectively implemented.	1	2	3	4	5
8. My manager/supervisor motivates their employees to work in a hygienic and food safe way.	1	2	3	4	5
9. My manager/supervisor listens to employees, if they have remarks or comments concerning hygiene and food safety.	1	2	3	4	5
10. My manager/supervisor encourages me to report poor hygiene standards and food safety issues.	1	2	3	4	5

### PART II: COMMITMENT

Please indicate your *level of agreement* with each of the following statements by circling the corresponding number.

Commitment	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
11. My manager/supervisor encourages everyone to take appropriate actions when they identify a food safety or hygiene issue.	1	2	3	4	5
12. All employees in the restaurant take personal responsibility for food safety.	1	2	3	4	5
13. In my restaurant, food safety has a significant impact on customer satisfaction.	1	2	3	4	5
14. I know how to report any unsafe food or poor hygiene standards.	1	2	3	4	5

15. My manager/supervisor clearly considers hygiene and food safety to be of great importance.	1	2	3	4	5
16. My colleagues are convinced of the importance of hygiene and food safety for the restaurant.	1	2	3	4	5
17. In my restaurant, working in a hygienic and food safe way is recognized and rewarded.	1	2	3	4	5
18. My manager/supervisor acts quickly to correct problems/issues that affect hygiene and food safety.	1	2	3	4	5
19. In my restaurant, employees are actively involved by the leaders in hygiene and food safety related matters.	1	2	3	4	5
20. In my restaurant, adequate time is given to undertake cleaning, food safety, and housekeeping activities.	1	2	3	4	5
21. Even if no one was looking, workers would follow all food safety rules.	1	2	3	4	5

### PART III: COMMUNICATION

Please indicate your *level of agreement* with each of the following statements by circling the corresponding number.

Communication	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
22. I am made aware of any food safety issues within the restaurant on an on-going basis.	1	2	3	4	5
23. I believe if employees are identified as undertaking activities that have a negative impact on food safety, corrective actions would be taken.	1	2	3	4	5
24. I believe that my restaurant's food safety policies and procedures are clear and easy to follow.	1	2	3	4	5
25. I am made aware of changes to policies and procedures relevant to my job role and responsibilities.	1	2	3	4	5
26. It is possible for me to communicate about hygiene and food safety with my manager/supervisor.	1	2	3	4	5
27. My manager/supervisor communicates regularly with all employees about hygiene and food safety.	1	2	3	4	5
28. I have been included in the review of food safety policies and procedures of my restaurant.	1	2	3	4	5



29. I can discuss problems concerning hygiene and food safety with colleagues in my restaurant.	1	2	3	4	5
30. The importance of hygiene and food safety is permanently present by means of, for example, posters, signs and/or icons related to hygiene and food safety.	1	2	3	4	5

#### PART IV: ENVIRONMENT, TRAINING, AND RESOURCES

Please indicate your *level of agreement* with each of the following statements by circling the corresponding number.

Environment, training, and resources	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
31. In my restaurant, suitable food safety training is provided to all employees.	1	2	3	4	5
32. I believe there is recognition of the fact that employees have a role to play in food safety within my restaurant.	1	2	3	4	5
33. In my restaurant, food safety standards are maintained between shifts.	1	2	3	4	5
34. In my restaurant, all employees receive refresher training on food safety on a regular basis.	1	2	3	4	5
35. In my restaurant, job descriptions contain details of responsibilities for food safety.	1	2	3	4	5
36. In my restaurant, sufficient staff is available to follow up hygiene and food safety.	1	2	3	4	5
37. In my restaurant, necessary infrastructure (e.g., good workspace, good equipment, etc.) is available to be able to work in a hygienic and food safe way.	1	2	3	4	5
38. In my restaurant, employees get sufficient time to work in a hygienic and food safe way.	1	2	3	4	5
39. In my restaurant, sufficient financial resources are provided to support hygiene and food safety.	1	2	3	4	5
40. The food safety training provided by my restaurant gives us the necessary skills and/or knowledge to follow the food safety rules.	1	2	3	4	5
41. I have access to policies and procedures relevant to food safety.	1	2	3	4	5

**PART V: RISK PERCEPTION AND AWARENESS**

Please indicate your *level of agreement* with each of the following statements by circling the corresponding number.

Risk perception and awareness	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
42. In my restaurant, the risks related to hygiene and food safety are known.	1	2	3	4	5
43. In my restaurant, the risks related to hygiene and food safety are under control.	1	2	3	4	5
44. My colleagues are alert and attentive to potential problems and risks related to hygiene and food safety.	1	2	3	4	5
45. My manager/supervisor has a realistic picture of the potential problems and risks related to hygiene and food safety.	1	2	3	4	5
46. When there is pressure to finish food production, I work faster by taking shortcuts with food safety.	1	2	3	4	5
47. I believe that written food safety policies and procedures are nothing more than a cover-up in case there is a lawsuit.	1	2	3	4	5

**PART VI: MANAGEMENT STYLE**

Please indicate your *level of agreement* with each of the following statements by circling the corresponding number.

Environment, training, and resources	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
48. Management enforces food safety rules consistently with all employees.	1	2	3	4	5
49. Management inspires me to follow safe food handling practices.	1	2	3	4	5
50. My manager/supervisor always watches to see if employees are practicing safe food handling.	1	2	3	4	5
51. My manager is actively involved in making sure safe food handling is practiced.	1	2	3	4	5
52. Our restaurant/chain food safety policies and procedures give detailed guidance for practices.	1	2	3	4	5
53. My managers'/supervisor's actions show that providing safe food to customers is a top priority.	1	2	3	4	5

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**PART VII: DEMOGRAPHIC AND OPERATIONAL INFORMATION**

Please answer the following questions about you and the operation in which you work.

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**54. What is your age?**

\_\_\_\_\_ years

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**55. What is your gender?**

- A. Male
  - B. Female
- 

**56. What is your ethnicity?**

- A. Caucasian
  - B. Hispanic or Latino
  - C. African American
  - D. Native American
  - E. Asian
  - F. Pacific Islander
  - G. Other, please specify
- 

**57. What is your highest level of education?**

- A. Less than high school
  - B. High school/GED
  - C. Associate degree
  - D. Some college
  - E. Bachelor's degree
  - F. Other, please specify:
- 

**58. Which of the following most accurately describes your role?**

- A. Executive chef
  - B. Line cook
  - C. Prep cook
  - D. Server
  - E. Other, please specify:
- 

**59. How long have you been employed at your current restaurant?**

- A. 5 years or less
  - B. 6–15 years
  - C. 16–25 years
  - D. 26 years or more
- 

**60. How would you describe your operation?**

- A. Independent
  - B. Part of a chain
  - C. Other, please specify: \_\_\_\_\_
-

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**61. The theme of your restaurant is:**

A. Chinese

B. Mexican

C. Italian

D. Indian

E. Other, please specify: \_\_\_\_\_

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**62. How would you classify your service?**

A. Quick service (fast food)

B. Quick casual

C. Casual dining

D. Fine dining

E. Buffet

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**63. Have you received food safety training in the past year?**

A. Yes

B. No

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**64. Do you have a current food safety certification?**

A. Yes, please specify:

B. No

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