

## **Food Safety Related Practices and Acculturation of First Generation Chinese Americans in Pennsylvania**

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### **Abstract**

This study sought to assess food-safety-related practices among first-generation Chinese Americans and their relationship with demographic characteristics and level of acculturation. A convenience sample of 399 Chinese Americans participated in the study. Results indicated that most respondents (about 95 percent) applied some positive food safety practices. About 90 percent of respondents reported frequently or always engaging in practices that prevent cross-contamination. Approximately 40 percent reported always using a household disinfectant when cleaning the sink and/or cutting board(s). Improper refrigeration and thawing methods were common. Females, married individuals, and individuals with children reported that they more frequently applied positive food safety practices than did males, individuals who were never married, and respondents with no children. More acculturated respondents were less likely to report negative food safety practices.

### **Introduction**

In the U.S., approximately 76 million cases of foodborne illness occur each year, resulting in 325,000 hospitalizations and 5,000 deaths (Mead et al. 1999). Between 1988 and 1997, Chinese food was implicated in 31 (0.6 percent) of the 5,175 foodborne illness outbreaks that were reported in the United States (Centers for Disease Control and Prevention 2000; Centers for Disease Control and Prevention 1996). Cooked rice, particularly fried rice, (Gilbert, Stringer, and Peach 1974; Bryan, Bartleson, and Christopherson 1981; Lund 1990), and egg rolls (Boyce et. al. 1996) were the Chinese foods that were most commonly associated with foodborne illness outbreaks.

A study by Lund (1990) reported that fried rice prepared in Chinese restaurants was often steamed, allowed to "dry off", and then stored at room temperature overnight or even longer

before being fried. This food handling practice allows for some strains of *B. cereus* to survive and grow (Gilbert and Parry 1977). Improper temperature control is another practice that can lead to foodborne illness due to *B. cereus gastroenteritis* growing in steamed or fried rice (Bryan, Bartleson, and Christopherson 1981). Brief frying or reheating the rice after temperature abuse will not sufficiently destroy the toxin of this bacteria (Tsai 1999).

Egg rolls are associated with *Salmonella enteritidis* (Tsai 1999). Two outbreaks of *Salmonella enteritidis* occurring in the same Chinese fast food restaurant in El Paso, Texas, were linked to egg rolls (Boyce et. al. 1996). Improper holding temperatures and cross-contamination have also been found to be a common cause of foodborne illness in Chinese foods (Tsai 1999).

The literature regarding home food-safety-related practices of Chinese Americans is very limited. Only one study has been previously conducted (Tsai 1999). This study found that the majority of Chinese Americans was unable to identify foods associated with key foodborne illness microorganisms and used incorrect refrigeration and thawing methods (Tsai 1999). In China, food safety information is not readily available and dissemination of that information is not considered as important as it is in the United States. Therefore, some food-safety-related practices that are considered "risky," appear to be fairly common among this population group. It is believed that after immigrating to the United States, Chinese Americans might increase their awareness about food safety, but some food-safety-related practices might still be culturally driven and potentially risky. Thus, acquiring information about the typical food-safety-related practices of this segment of the population is important for the design and implementation of appropriate food safety education interventions.

This study was designed to assess the food-safety-related practices of first-generation Chinese Americans and to determine their relationship with demographic characteristics and acculturation.

## **Methods**

The study sample included subjects who were 18 years old or older, born outside of the United States, and permanent residents or citizens of the United States or applying for a Green Card. The questionnaire contained four parts. Section A consisted of 11 questions assessing socio-demographic and acculturation characteristics. Acculturation was measured using three acculturation indicators: length of residency in the U.S. (Wallendorf and Reilly 1983; Newman 1980; and Newman and Linke 1982), English proficiency (Schultz, Spindler, and Josephson 1994; Lee, Sobal, and Frongillo 1999; Yang and Fox 1979), and number of congenial American friends (Yang and Fox 1979). Congenial American friends were defined in the questionnaire as American friends who share the same aspiration and interests. These indicators were considered to be associated with acculturation and were used in the previously mentioned studies. Section B

included 10 questions about general food habits. Section C was a 97-item food frequency questionnaire. Section D consisted of 8 questions assessing frequency of applying food-safety-related practices -- six positive food-safety-related practice questions and two negative food-safety-related practice questions. One major criterion for choosing the food safety practice questions was that most of the practices were considered as potential risks in the studies by Tsai (1999) and Wenrich et. al. (2003). In this paper, only the results from Section D -- the food-safety-related practices -- and their relationship with demographic characteristics and acculturation (results from Section A) will be discussed. The questionnaire was available in English, simplified Chinese, and traditional Chinese. Respondents chose the version with which they felt most comfortable. The Chinese language versions were translated by the researcher and were reviewed for translation content accuracy by a Chinese American who has resided in the United States for 10 years and is fluent in both English and Chinese.

The survey was piloted with 30 Chinese Americans residing in State College, Pennsylvania. The questionnaire was revised according to comments received from the pilot test respondents and the expert panel (Katherine Cason, PhD, RD; Lynne Brown, PhD, RD; Catherine Cutter, PhD).

The final survey was completed by a convenience sample of 399 Chinese Americans. According to Census 2000 data, 50,650 Chinese Americans reside in Pennsylvania (0.4 percent of the total population in Pennsylvania) (U.S. Census Bureau 2000). According to the Creative Research System (2002) and Isaac and Michael (1997), a convenience sample of 399 is representative of the population under study, as the calculated minimum sample size for this population is 382. Various Chinese organizations in Pennsylvania were used to recruit study respondents.

The survey was administered using two different methods. The presidents of 5 Chinese organizations were given copies of the questionnaire and the consent form and were asked to distribute questionnaires to their members. Members then received a package containing the consent form, questionnaire, and an envelope with pre-paid postage. Respondents completed the questionnaires on their own time and then mailed the completed survey back to the researcher. The researcher mailed a check for \$8 to each participant who completed a survey. The second method was to administer the questionnaire in 6 selected Chinese schools. The principals of the Chinese schools agreed to announce the study to parents as an activity to participate in while they waited for their children to finish their classes. The principals notified parents in advance of the criteria for participating in the study. The researcher went to the schools and provided the eligible, interested parents with a package containing the consent form, questionnaire, and a pen. The respondents completed the questionnaire in the waiting room and were given an \$8 cash incentive when the survey was completed. The survey was limited to one person per household.

The questionnaire and administration protocol were approved by the Behavior and Social Science Committee of the Institutional Review Board at The Pennsylvania State University before the study began.

### **Data analysis**

The Statistical Package for the Social Sciences (SPSS) statistical analyses software, Version 10.0 for Windows, was used to analyze the data. Demographic questions, acculturation indicators, and food-safety-related practice questions were described using descriptive statistics. Frequencies and percentages were used to describe nominal and ordinal level data (Fink 1995). Means were used to describe ordinal data. Analysis of variance (ANOVA) and Tukey post-hoc tests were used to test the relationships between nominal level demographic variables (gender, marital status, presence of children, and place of origin) and all food-safety-related practice questions (Bryman and Cramer 2001). Spearman's rho rank-order correlation statistics was used to test the relationship between ordinal level demographic variables (age, last grade of school completed, and annual household income), acculturation indicators, and all food-safety-related practice questions. An alpha level of less than 0.05 was used to determine significance.

### **Results**

Table 1 shows the descriptive statistics for age, gender, marital status, last grade of school completed, income, presence of children in household, country of origin, and nutrition or food safety education experience. The most common age range of respondents was 35-44 years, followed by 45-54 years, 25-34 years, 18-24 years, 55-64 years, and above 65 years.

Approximately two-thirds of the respondents were female, and the majority were married. More than half of the respondents completed graduate or professional school. About 67% of the households earned more than \$50,000 per year. Most of the respondents reported having children at home. The majority of the respondents immigrated to the United States from Mainland China or Taiwan. Only a small percentage of the respondents (7.3 percent) reported that they had attended an education program on nutrition or food safety.

Table 2 provides descriptive statistics for the three acculturation indicators. Respondents were evenly distributed on length of residency in the United States. The majority of the respondents indicated having good or excellent English proficiency. Approximately 55% of the respondents indicated that they have one to five congenial American friends. About 25% reported having many congenial American friends (more than five).

Table 3 summarizes the frequency distribution of respondents for each food-safety-related practice question. The range of scores for frequency of applying a specific food safety related practice was 0 to 4, with "0" indicating never and "4" indicating always. The **majority reported**

always or frequently washing fresh foods with running water before eating them raw and washing their hands before preparing food. Similarly, 90.9 percent reported always or frequently using hot, soapy water to wash the plate before returning cooked meat back to the plate used for raw meat or putting the cooked meat onto another clean plate. When asked how often they washed the cutting board with hot water and soap after cutting raw meat, about 65% reported always and about 23% said frequently. About 40% reported always using a household disinfectant when cleaning the sink and cutting boards, respectively.

The majority of the respondents (80.3 percent) reported always or frequently allowing leftovers to cool to room temperature before refrigerating. About 33% reported always and frequently thawing frozen food at room temperature, respectively.

Table 4 presents the significant relationships between the food-safety-related practice questions, demographic characteristics, and acculturation indicators. Relationships were determined using ANOVA and Tukey post-hoc tests or Spearman's rho rank-order correlation statistics. Chinese Americans who were females, were married, had a higher education, had a higher income, had children, and were more proficient in English were shown to wash fresh foods with running water before eating them raw more often than those who were males, were never married, had a lower education, had a lower income, had no children, and were less proficient in English. Chinese Americans who washed their hands before preparing food more often were females, married, from mainland China, more highly educated, and had children. The frequency of using a household disinfectant when cleaning the sink was higher among respondents with a greater number of congenial American friends than those with fewer congenial American friends. Respondents with children were found to use a household disinfectant when cleaning cutting boards more often than those with no children. Frequency of washing the cutting board with hot water and soap after cutting raw meat was higher among females and respondents who had children than males and respondents with no children. Females, respondents with children, and those with higher household incomes washed the plate used for raw meat with hot, soapy water before returning the cooked meat back on it or put the cooked meat onto another clean plate more often than males, those with no children, and respondents with lower household incomes.

Allowing leftovers to cool to room temperature before refrigerating was not associated with any demographic characteristics or acculturation indicators, although the mean frequency of reported occurrence was 3.18. The frequency of thawing frozen food at room temperature was found to decrease among respondents who reported an increased length of residency and who had a greater number of congenial American friends. It was higher among those from mainland China than those from Taiwan.

## Discussion

This study indicates that the majority of respondents applied some positive food-safety-related practices, such as handwashing and washing raw foods before eating them. This is important because previous studies about food-safety-related practices mentioned that illnesses caused by cross-contamination could be severe (Hui et al. 1994; Medeiros et al. 2001). Although most respondents reported washing the cutting board and plate with hot, soapy water after handling raw meat or putting cooked meat onto another clean plate, there were still about 10 percent of respondents who only practiced this infrequently.

A large number of respondents (80.3 percent) always or frequently allowed leftovers to cool to room temperature before refrigerating. Because rice is a common food in Chinese Americans' diet, this behavior could increase their risk for foodborne illness. Nutrition and food safety educators who teach Chinese Americans should always address methods for safely cooling rice and egg rolls. Similarly, more than 60 percent of the respondents always or frequently thawed frozen food at room temperature. The results from this study were consistent with the results from a previous food safety study of Chinese Americans conducted by Tsai (1999). That study also showed that the majority of respondents believed hot food should be cooled down to room temperature before refrigerating and most frequently thawed frozen foods at room temperature.

In this study, females, married respondents, and those with children appear to more frequently apply positive food-safety-related practices. Previous studies have also found that females in general reportedly applied better food safety related practices than did males (Altekruse et al. 1996; Tsai 1999; Wenrich et al. 2003).

Respondents with a longer length of U.S. residency and those with a greater number of congenial American friends tended to thaw frozen food at room temperature less frequently. One explanation might be a greater access to correct food safety information for those who were more acculturated. However, this study found that only 7.3 percent of the respondents had attended an education program on nutrition or food safety.

This study has a number of limitations. First, a large portion of the Chinese Americans who participated were middle-aged and from mainland China or Taiwan. It is possible that the sample did not include enough respondents who were younger than 24 years old or older than 55 years old, and those who were from Hong Kong to make meaningful comparisons among different age groups and places of origin. Second, most of the questionnaires were collected with the assistance of Chinese organizations. The results might be biased because only a small portion of "isolated" Chinese Americans were included in the study. A large percentage of the respondents had high education levels, high incomes, and children living at home. Caution should be used

when drawing conclusions about Chinese Americans who exhibit different socioeconomic characteristics.

Despite these limitations, the findings from this study provide basic information about the food safety practices of Chinese Americans living in Pennsylvania. This information is important for the design and development of educational programs for this population group. Other studies indicate that educational interventions are more effective if they take into account the degree of acculturation, demographic/socioeconomic factors (e.g., place of origin, education, income), lifestyle, and perceived needs among the target population (Satia et al. 2002; Schultz, Spindler, and Josephson 1994; Lester 1998; Woodruff et al. 1997). For example, emphasis should be placed on education about more correct refrigeration and thawing methods. Targeting single males and those who are less acculturated with food safety information is particularly important.

Overall, findings from this study provide valuable information regarding food safety practices that can be integrated into new or existing food safety curricula and materials targeting Chinese Americans.

Future research should involve the development and investigation of the effectiveness of various food safety curricula and educational methodologies that are aimed at educating Chinese Americans about proper food safety practices.

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**Table 1. Demographic characteristics of the respondents (n=399)**

<b>Variable</b>	<b>N</b>	<b>Percent</b>
<b>Age</b>	18-24 years	19 4.8
	25-34 years	52 13.0
	35-44 years	223 55.9
	45-54 years	84 21.1
	55-64 years	14 3.5
	Above 65 years	7 1.8
	<b>Total</b>	<b>399 100.0</b>
<b>Gender</b>	Male	145 36.3
	Female	254 63.7
	<b>Total</b>	<b>399 100.0</b>
<b>Marital status</b>	Never married	38 9.5
	Married, except separated	343 86.2
	Divorced	9 2.3
	Widowed	5 1.3
	Separated	3 0.8
	<b>Total</b>	<b>398 100.0</b>
<b>Education level</b>	Less than 12th grade (3rd grade in high school)	15 3.8
	Graduated high school	28 7.1
	Some college or vocational training	18 4.5
	Graduated vocational/ technical college	33 8.3
	Graduated college (4 year Bachelor Degree)	70 17.6
	Graduate or professional school (Masters, PhD, MPA, lawyer)	233 58.7
	<b>Total</b>	<b>397 100.0</b>



<b>Annual income per household</b>	<b>Under \$10,000</b>	<b>21</b>	<b>5.4</b>
	<b>\$10,000-\$24,999</b>	<b>52</b>	<b>13.3</b>
	<b>\$25,000-\$49,999</b>	<b>53</b>	<b>13.6</b>
	<b>\$50,000-\$100,000</b>	<b>153</b>	<b>39.1</b>
	<b>Above \$100,000</b>	<b>112</b>	<b>28.6</b>
	<b>Total</b>	<b>391</b>	<b>100.0</b>
<b>Children in the household</b>	<b>Yes</b>	<b>342</b>	<b>85.7</b>
	<b>No</b>	<b>57</b>	<b>14.3</b>
	<b>Total</b>	<b>399</b>	<b>100.0</b>
<b>Place of origin</b>	<b>Mainland China</b>	<b>276</b>	<b>69.2</b>
	<b>Taiwan</b>	<b>90</b>	<b>22.6</b>
	<b>Hong Kong</b>	<b>17</b>	<b>4.3</b>
	<b>Other</b>	<b>16</b>	<b>4.0</b>
	<b>Total</b>	<b>399</b>	<b>100.0</b>
<b>Attendance at education programs about nutrition or food safety?</b>	<b>Yes</b>	<b>29</b>	<b>7.3</b>
	<b>No</b>	<b>367</b>	<b>92.7</b>
	<b>Total</b>	<b>396</b>	<b>100.0</b>

Table 2. Acculturation indicators of the respondents (n=399)

<b>Variable</b>	<b>N</b>	<b>Percent</b>
<b>Length of residency in the U.S.</b>	<b>0-5 years</b>	<b>79 19.8</b>
	<b>6-10 years</b>	<b>115 29.0</b>
	<b>11-15 years</b>	<b>109 27.5</b>
	<b>Above 15 years</b>	<b>94 23.7</b>
	<b>Total</b>	<b>397 100.0</b>
<b>Please identify your English level</b>	<b>Poor</b>	<b>25 6.3</b>
	<b>Fair</b>	<b>158 39.8</b>
	<b>Good</b>	<b>162 40.8</b>

	<b>Excellent</b>	<b>52</b>	<b>13.1</b>
	<b>Total</b>	<b>397</b>	<b>100.0</b>
<b>How many congenial American friends you have</b>	<b>None</b>	<b>77</b>	<b>19.4</b>
	<b>Some (1-5)</b>	<b>219</b>	<b>55.3</b>
	<b>Many (above 5)</b>	<b>100</b>	<b>25.3</b>
	<b>Total</b>	<b>396</b>	<b>100.0</b>

Table 3. Food-safety-related practices of the respondents (n=399)

<b>Food Safety Practice</b>	<b>N</b>	<b>Mean (a)</b>	<b>Always (%)</b>	<b>Frequently (%)</b>	<b>Sometimes (%)</b>	<b>Rarely (%)</b>	<b>Never (%)</b>
<b>Wash fresh foods with running water before you eat them raw.</b>	<b>397</b>	<b>3.76</b>	<b>82.9</b>	<b>12.6</b>	<b>3.0</b>	<b>0.5</b>	<b>1.0</b>
<b>Wash your hands before preparing food.</b>	<b>398</b>	<b>3.72</b>	<b>77.4</b>	<b>17.6</b>	<b>4.3</b>	<b>0.8</b>	<b>0.0</b>
<b>Use a household disinfectant when you clean the sink.</b>	<b>394</b>	<b>2.97</b>	<b>40.4</b>	<b>31.7</b>	<b>17.5</b>	<b>5.3</b>	<b>5.1</b>
<b>Use a household disinfectant when you clean cutting boards.</b>	<b>394</b>	<b>2.82</b>	<b>39.6</b>	<b>25.9</b>	<b>19.3</b>	<b>7.4</b>	<b>7.9</b>
<b>Wash cutting board with hot water and soap after cutting raw meat.</b>	<b>396</b>	<b>3.49</b>	<b>65.2</b>	<b>22.7</b>	<b>8.8</b>	<b>2.3</b>	<b>1.0</b>
<b>Wash with hot, soapy water the plate used for raw meat before returning the cooked meat back on it or return the cooked meat on another clean plate.</b>	<b>397</b>	<b>3.63</b>	<b>75.3</b>	<b>15.6</b>	<b>6.3</b>	<b>2.0</b>	<b>0.8</b>

<b>Allow leftovers to cool to room temperature before refrigerating.</b>	<b>395</b>	<b>3.18</b>	<b>45.6</b>	<b>34.7</b>	<b>14.4</b>	<b>3.3</b>	<b>2.0</b>
<b>Thaw frozen food at room temperature.</b>	<b>398</b>	<b>2.79</b>	<b>30.7</b>	<b>33.7</b>	<b>24.4</b>	<b>7.0</b>	<b>4.3</b>

(a) 0=Never; 1=Rarely; 2=Sometimes; 3=Frequently; 4=Always.

**Table 4. Food-safety-related practice questions significantly related to demographic characteristics and acculturation indicators (P<.05)**

<b>Food safety related practice</b>	<b>Demographic characteristic related to food safety question</b>	<b>Results</b>	<b>Statistical results (a)</b>
<b>Wash fresh foods with running water before you eat them raw.</b>	<b>Gender</b>	<b>Females wash more often.</b>	<b>F=13.627***</b>
	<b>Marital status</b>	<b>Those who are married wash more often than those who are never married.</b>	<b>F=3.210*</b>
	<b>Last grade of school completed</b>	<b>Those with a higher education wash more often.</b>	<b>r=0.204**</b>
	<b>Household income</b>	<b>Those with a higher household income wash more often.</b>	<b>r=0.135**</b>
	<b>Presence of children</b>	<b>Those who have children wash more often.</b>	<b>F=5.461*</b>
	<b>English proficiency</b>	<b>Those who have better English proficiency wash more often.</b>	<b>r=0.129*</b>
<b>Wash your hands before preparing food.</b>	<b>Gender</b>	<b>Females wash more often.</b>	<b>F=8.271**</b>
	<b>Marital status</b>	<b>Those who are married wash more often than</b>	<b>F=8.651***</b>

		those who are never married, those who are divorced, and those who are widowed.	
	Last grade of school completed	Those with a higher education wash more often.	$r=0.178^{**}$
	Presence of children	Those who have children wash more often.	$F=13.861^{***}$
	Place of origin	Those from mainland China wash more often than those from Hong Kong.	$F=2.785^*$
Use a household disinfectant when you clean the sink.	Marital status	Those who are married and those who are divorced use more often than those who are widowed.	$F=2.490^*$
	Number of American friends	Those who have more American friends use more often.	$r=0.132^{**}$
Use a household disinfectant when you clean cutting boards.	Presence of children	Those who have children use more often.	$F=7.512^{**}$
Wash cutting board with hot water and soap after cutting raw meat.	Gender	Females wash more often.	$F=6.272^*$
	Presence of children	Those who have children wash more often.	$F=10.799^{***}$
Wash with hot, soapy water the plate used for raw meat before	Gender	Females wash more often.	$F=24.539^{***}$
	Household income	Those with a higher household income wash more often.	$r=0.130^*$

<b>returning the cooked meat back on it or return the cooked meat on another clean plate.</b>	<b>Presence of children</b>	<b>Those who have children wash more often.</b>	<b>F=5.886*</b>
<b>Thaw frozen food at room temperature.</b>	<b>Place of origin</b>	<b>Those from Mainland China thaw more often than those from Taiwan.</b>	<b>F=6.340***</b>
	<b>Length of residency</b>	<b>Those who have resided in U.S. for a shorter period of time thaw more often.</b>	<b>r=-0.186**</b>
	<b>Number of American friends</b>	<b>Those who have less American friends thaw more often.</b>	<b>r=-0.125*</b>

\* Significant at  $P < .05$ ; \*\* Significant at  $P < .01$ ; \*\*\* Significant at  $P < .001$ .

(a) F values are the results of ANOVA and Tukey post-hoc tests; r values are the results of Spearman's rho rank-order correlation statistics.

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