Abstract
This article describes visual-based minimal-text food safety tools developed in Mandarin Chinese to educate Chinese-speaking food service workers about safe food handling practices. Ten posters and one PowerPoint presentation were developed, and their efficacy in conveying critical food safety messages was tested with Chinese-speaking food service workers in Iowa. Extension educators can use these tools for formal and informal food safety education, thereby contributing to protecting public health.

Keywords: Chinese, food service, food safety, training tools

Introduction

Food Handling in Chinese Restaurants

In addition to being a significant part of the U.S. economy, the restaurant industry also has a diverse workforce, employing more minority managers than any other industry. Additionally, the number of ethnic restaurants is on the rise, with the number of Asian-owned restaurants having increased by 60% in the past two decades (National Restaurant Association, 2018). Among ethnic cuisines, Chinese cuisine has been identified as the most preferred ethnic cuisine in the United States, followed by Mexican, Japanese, and Thai cuisines (Lee, Niode, Simonne, & Bruhn, 2012). With the increasing popularity of Chinese food among consumers, maintaining the safety of food served at Chinese restaurants is critical for preventing incidences of foodborne illness. Yet previous research has shown lower food safety handling compliance in ethnic restaurants as compared to nonethnic restaurants (Roberts, Kwon, Shanklin, Liu, & Yen, 2011). Additionally, Kwon, Roberts, Shanklin, Liu, and Yen (2010) found restaurant inspection scores to be lower for ethnic-owned restaurants than nonethnic restaurants, a finding that has been corroborated by other researchers (Harris, Murphy, DiPietro, & Rivera, 2015).

Use of Visual Tools for Food Safety Education
It has become essential to develop food safety training and education programs tailored to the needs of a diverse food service workforce. Arendt, Ellis, Strohbehn, and Paez (2011) found inconsistent or unclear messages to be a major barrier keeping workers from practicing food safety. Language barriers also are a major impediment to workers' understanding and practicing food safety (Rudder, 2006). One method for improving food safety training is to use visual-based minimal-text materials when training minorities for whom English is not their first language. Panchal, Liu, and Dworkin (2012) emphasized the need for targeted food safety educational materials in multiple languages to address language barriers. Appropriate translation and visual aids help workers overcome language barriers and relay critical food safety messages in short and more easily understood ways. The combination of visual-based training and hands-on activities was found to be effective in training Spanish-speaking food service workers about safe food handling practices, resulting in significantly improved food safety knowledge scores (Rajagopal, 2012, 2013; Rajagopal, Arendt, Shaw, Strohbehn, & Sauer, 2016). Liu and Kwon (2013) found that Chinese food service managers preferred to receive food safety training via materials translated into Chinese. Therefore, we undertook a process to develop and test food safety training materials for use with Chinese-speaking food service workers. Here, we describe the process, provide evidence of the efficacy of the materials, and make suggestions regarding their use by others in Extension.

**Development and Testing of the Tools**

We used a two-phase approach to develop visual-based minimal-text food safety training materials and test their effectiveness on food safety knowledge and attitudes of Chinese-speaking food service workers in independently owned Chinese restaurants.

**Phase One**

We modified previously developed visual-based minimal-text food safety training materials (Rajagopal 2012, 2013; Rajagopal et al., 2016; U.S. Department of Agriculture, 2016) to reflect the U.S. Food and Drug Administration's 2009 Food Code and subsequent 2011 supplement. The training materials were developed in English and reviewed by three experts in food safety and food service operations for content, construct, and face validity. The training materials were then translated into Mandarin Chinese and then translated back into English for accuracy and readability.

The training materials included handouts and a PowerPoint presentation specifically focusing on educating Chinese-speaking food service workers about preventing the top five risk factors that contribute to foodborne illness (U.S. Food and Drug Administration, 2013): poor personal hygiene, improper time-temperature control, cross-contamination, contaminated equipment and surfaces, and purchase of food from unsafe sources. We also developed training materials about food allergies and allergen handling. We used the concept of the "flow of food" (i.e., purchasing to storage to preparation to service) as the framework for identifying areas for which food safety training materials were needed.

**Phase Two**

To assess the impact of the training materials on food safety knowledge, we conducted pilot testing with Chinese-speaking food service workers ($n = 56$) whose native language was Mandarin Chinese and who worked in independently owned Chinese restaurants in Iowa, using a 30-question retrospective "post-then-
Evidence of Efficacy

We created visual-based minimal-text training materials comprising 10 handouts and one PowerPoint presentation. Themes of the handouts included glove use (Figure 1); the concepts of cleaning, separating, cooking, and chilling (Figure 2); hand hygiene (Figure 3); thermometer calibration/use (Figure 4); and cleaning and sanitizing of equipment and surfaces (Figure 5).

Figure 1.
Food Safety Educational Tool in English and Chinese: Glove Use
Figure 2.
Food Safety Educational Tool in English and Chinese: Clean, Separate, Cook, Chill
Figure 3.

Food Safety Educational Tool in English and Chinese: Hand Hygiene
**Figure 4.**
Food Safety Educational Tool in English and Chinese: Thermometer Calibration/Use

**Figure 5.**
Food Safety Educational Tool in English and Chinese: Cleaning and Sanitizing
Use of the training materials improved total food safety knowledge scores by 52.1%, from 12.9±2.7 before the training to 29.0±1.0 after the training (see Table 1). Each correct answer was worth 1 point for a total possible food safety knowledge score of 30. Results of the testing of the materials indicated that the visual-based minimal-text training including the 10 handouts and the PowerPoint presentation was useful in improving food safety knowledge of Chinese-speaking food service workers.

**Table 1.**

Food Safety Knowledge Scores of Chinese-Speaking Food Service Workers (n = 56)
<table>
<thead>
<tr>
<th>Knowledge topic</th>
<th>Number of items</th>
<th>Pretraining $M$ (SD)</th>
<th>Posttraining $M$ (SD)</th>
<th>Percent change</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>5</td>
<td>3.17 (1.06)</td>
<td>4.66 (0.48)</td>
<td>+29.64%</td>
<td>10.45***</td>
</tr>
<tr>
<td>Purchasing and receiving</td>
<td>2</td>
<td>0.68 (0.47)</td>
<td>1.92 (0.25)</td>
<td>+62.50%</td>
<td>18.22***</td>
</tr>
<tr>
<td>Storing</td>
<td>3</td>
<td>0.68 (0.74)</td>
<td>2.70 (0.47)</td>
<td>+66.07%</td>
<td>18.09***</td>
</tr>
<tr>
<td>Thawing</td>
<td>2</td>
<td>0.66 (0.61)</td>
<td>1.86 (0.35)</td>
<td>+59.82%</td>
<td>14.55***</td>
</tr>
<tr>
<td>Preparing</td>
<td>2</td>
<td>0.41 (0.53)</td>
<td>1.88 (0.33)</td>
<td>+73.21%</td>
<td>18.20***</td>
</tr>
<tr>
<td>Holding</td>
<td>2</td>
<td>0.88 (0.72)</td>
<td>2.0 (0.00)</td>
<td>+56.25%</td>
<td>11.77***</td>
</tr>
<tr>
<td>Cooling</td>
<td>2</td>
<td>0.77 (0.76)</td>
<td>1.89 (0.37)</td>
<td>+56.25%</td>
<td>11.02***</td>
</tr>
<tr>
<td>Reheating</td>
<td>2</td>
<td>1.38 (0.56)</td>
<td>1.80 (0.40)</td>
<td>+21.43%</td>
<td>4.52***</td>
</tr>
<tr>
<td>Service</td>
<td>2</td>
<td>1.39 (0.62)</td>
<td>2.00 (0.00)</td>
<td>+30.36%</td>
<td>7.29***</td>
</tr>
<tr>
<td>Cleaning and sanitizing</td>
<td>2</td>
<td>0.55 (0.6)</td>
<td>1.93 (0.26)</td>
<td>+68.75%</td>
<td>16.60***</td>
</tr>
<tr>
<td>Pest management</td>
<td>2</td>
<td>0.66 (0.67)</td>
<td>2.00 (0.00)</td>
<td>+66.96%</td>
<td>15.00***</td>
</tr>
<tr>
<td>Labeling</td>
<td>2</td>
<td>0.86 (0.75)</td>
<td>1.93 (0.26)</td>
<td>+53.57%</td>
<td>10.91***</td>
</tr>
<tr>
<td>Food allergies</td>
<td>2</td>
<td>0.79 (0.62)</td>
<td>1.96 (0.19)</td>
<td>+58.92%</td>
<td>14.55***</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>12.87 (2.72)</td>
<td>28.50 (1.01)</td>
<td>+52.08%</td>
<td>14.55***</td>
</tr>
</tbody>
</table>

Note. Total possible knowledge score = 30.

***$p < .001$.  

Summary

Overall, visual-based minimal-text food safety training was effective in training Chinese-speaking food service workers as observed by the increase in overall knowledge score. Extension educators and food safety trainers alike can use these Chinese-translated visual-based training materials (handouts and PowerPoint presentation) to help Chinese-speaking food service workers better understand food safety messages. The use of appropriately translated, visual-based materials can assist workers in overcoming language barriers and can relay critical food safety messages that are easily understandable. Copies of the educational tools can be obtained by emailing the primary author.

Acknowledgment

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References


