Introduction

Flour, a low moisture product, has not been considered a vehicle of pathogenic bacteria over time. However, wheat flour has been identified as a source of pathogenic bacteria, including Salmonella and E. coli. Some flour and flour product packages have started to include food safety messages regarding the potential risk and how to handle flour properly. However, their impact has not been evaluated. The content and the position of these messages can influence consumers’ practices. Understanding these may help improve consumers’ handling behaviors and prevent the risk of foodborne illness.

Objective

This study reviewed flour packages and utilized an online survey to evaluate three food safety messages’ effectiveness in changing consumers’ flour handling practices. This study focused only on frequent flour handlers of households in the United States because they commonly prepare baking goods.

Materials and Methods

Pilot Study: The questions of the survey were developed by two food safety experts in consumer research and were distributed to a convenient sample of 194 flour handlers to pilot-test validity and reliability.

Participants: Participants were recruited in May 2019, from Qualtrics XM. A total of 4,199 participants answered the survey, in which 1,045 passed the instructional manipulation checks (IMC). Participant inclusion criteria included: (a) the primary food handler of the household; (b) the primary grocery shopper of the household; and (c) use of flour or quick-bread mix at least once a month. Quotas for sociodemographic characteristics were set by the researcher to mirror the U.S. population, however due to challenges recruiting participants the criteria of gender was loosened.

Survey Questions: The survey had a total of 72 questions. The questions consisted of inclusion criteria and sociodemographic, flour knowledge and practices, and the evaluation of food safety messages on flour packages, including the position and content.

Data Analysis: Data were analyzed by using Excel 2016 for descriptive analysis, and SPSS version 9.4 for student t-test and one-way ANOVA

Results

Table 1. Logistic regression of the attention to flour package information among sociodemographic characteristics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Food safety messages OR (95% CI)</th>
<th>Cooking instructions OR (95% CI)</th>
<th>Storage instructions OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1.26 (0.93; 1.71)</td>
<td>1.17 (0.89; 1.53)</td>
<td>1.37 (1.02; 1.83)</td>
</tr>
<tr>
<td>Education level</td>
<td>0.76 (0.57; 1.03)</td>
<td>1.01 (0.78; 1.32)</td>
<td>0.66 (0.49; 0.89)</td>
</tr>
<tr>
<td>Age</td>
<td>0.61 (0.43; 0.87)</td>
<td>0.68 (0.49; 0.95)</td>
<td>0.77 (0.54; 1.11)</td>
</tr>
<tr>
<td>Do not eat or play with dough</td>
<td>1.67 (1.23; 2.27)</td>
<td>1.15 (0.87; 1.52)</td>
<td>1.08 (0.79; 1.46)</td>
</tr>
</tbody>
</table>

• **Gender**: Male vs. Female
• **Education level**: Bachelor vs. Bachelor or higher
• **Age**: Between 18-64 years vs. 65 years and above
• **Do not eat or play with raw dough or batter**: Yes vs. No

Figure 1. Preferences of flour handlers on the position of safety messages on flour and flour-product packages compared to current food safety messages on flour and flour-product packages.

Table 2. Mean score of message effectiveness in changing consumers’ flour handling behavior.

- **Messages**: Food safety messages vs. cooking instructions vs. storage instructions
- **Messages position**: On the side of the package, Top of the package, Middle of the package, Back of the package
- **Flour handlers with improper flour handling practices (N = 9999)**
- **Mean score of the message for both groups, was significantly higher than M1 and M2:** by student t-test.

- **Flour handlers who do not eat or play with raw dough or batter perceived all messages to be significantly more effective than those who eat or play with raw dough or batter.**

Figure 2. Effectiveness of three food safety messages on flour packages presented to flour handlers with improper and proper flour handling practices (N = 9999)

Conclusions

- Must flour handlers do not pay attention to food safety messages on flour packages.
- The content of the food safety message showed that it could be an influencing factor for flour handlers’ attention.
- Those who have improper flour handling practices are less likely to follow food safety messages.

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References