

Research Note

Recipe Modification Improves Food Safety Practices during Cooking of Poultry

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ABSTRACT

Many consumers do not practice proper food safety behaviors when preparing food in the home. Several approaches have been taken to improve food safety behaviors among consumers, but there still is a deficit in actual practice of these behaviors. The objective of this study was to assess whether the introduction of food safety instructions in recipes for chicken breasts and ground turkey patties would improve consumers' food safety behaviors during preparation. In total, 155 consumers in two locations (Manhattan, KS, and Nashville, TN) were asked to prepare a baked chicken breast and a ground turkey patty following recipes that either did or did not contain food safety instructions. They were observed to track hand washing and thermometer use. Participants who received recipes with food safety instructions ($n = 73$) demonstrated significantly improved food safety preparation behaviors compared with those who did not have food safety instructions in the recipe ($n = 82$). In addition, the majority of consumers stated that they thought the recipes with instructions were easy to use and that they would be likely to use similar recipes at home. This study demonstrates that recipes could be a good source of food safety information for consumers and that they have the potential to improve behaviors to reduce foodborne illness.

Key words: Food safety; Hand washing; Instructions; Poultry; Recipe; Thermometer

Improving food safety among consumers to prevent foodborne illness is an important public health priority. Consumer homes have been identified as one of the primary sources of foodborne illness by many experts (2, 3, 14, 15, 18, 20). Of the outbreaks of foodborne illness that occurred in the United States between 2009 and 2010, 21% were attributed to food consumed in the home (4). In Europe, an estimated 39% of outbreaks in 2013 were attributed to food consumed in the home (8). Many cases of foodborne illnesses in the home may be unreported, making it difficult to determine the actual rate of illness from improper handling in the home, with some authorities believing that the true incidence level may be much higher (2, 18).

Food safety studies with consumers have demonstrated the need for improving food safety behaviors in several key areas. When observed, consumers frequently either fail to wash their hands at appropriate times during the cooking process, or wash their hands incorrectly (6, 7, 16). Thermometer use when cooking meat is similarly very low among consumers, especially with smaller cuts or ground meat (1, 6). These unsafe food handling practices, such as cross-contamination through improper hand washing and undercooking meat, can result in foodborne illnesses such as those caused by *Salmonella* and *Campylobacter* (5, 9, 17, 21).

Recipes are common sources of cooking information for consumers, but one study (12) found that only 20% of cookbooks contained any safety information, despite a desire by consumers to have this information included (10, 13). A study by Godwin et al. (11) found that recipes with incorporated food safety instructions had the potential to change reported food safety behaviors in older adults, but an observational study with consumers has not been done to determine the extent of those changes. The goal of this study was to determine whether the addition of food safety behaviors in recipes leads to improved consumer behaviors and to assess consumers' opinions and attitudes toward recipes that include safety information.

MATERIALS AND METHODS

Participant recruiting. Two locations were used to observe consumers during this study: Manhattan, KS, and Nashville, TN. A convenience sample of 155 consumers was recruited for the study, with 103 participants at the Manhattan location and 52 participants at the Nashville location. Participants were recruited from databases available to researchers in those communities, and they were asked to take a screening survey to ensure they qualified. To participate in the study, consumers had to do more than 40% of the cooking in their homes, had to have experience cooking each type of item by using the same method of cooking that would be used in the study, and could not have taken formal cooking classes or food safety classes.

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MUSHROOM TURKEY BURGER

1. **Wash your hands with soap and warm water before you begin this recipe.**
2. **Run cold water over the mushroom while rubbing gently with your fingertips. Use a paper towel to dry.**
3. Remove the stem from the mushroom and chop using a cutting board.
4. Spray a medium sauté pan with cooking spray. Preheat pan over medium high heat.
5. Remove the wrapper from the ground turkey. Place the ground turkey into a medium bowl.
6. **Wash your hands with warm soap and water after handling the ground turkey.**
7. Add the chopped mushroom, soy sauce, onion powder, salt and pepper to the ground turkey. Mix with hands or a wooden spoon. Once mixed thoroughly form into a burger patty and place into the preheated pan.
8. **Wash your hands with soap and warm water after placing the patty into the pan.**
9. Cook the patty for 5 minutes on each side.
10. **Using a spatula, tilt the patty up and insert the cooking thermometer into the side of the burger, with the tip extending into the center. If the temperature is less than 165°F, return the patty to the pan and continue cooking until the internal temperature reaches 165°F.**
11. **If you touched the turkey when checking the temperature, wash your hands with warm soap and water.**

This study was approved by the Committee on Research Involving Human Subjects at Kansas State University.

Test groups. Participants in the study were randomly assigned to one of two groups: a control, given typical recipes with no food safety instructions or a test group, given the same recipes modified by adding food safety instructions (Fig. 1). In total, 73 consumers completed the study with food safety instructions, and 82 consumers completed the study without food safety instructions. No participants observed other participants during the study.

Cooking and observation. Participants were asked to prepare two poultry items following a recipe they were given: a baked whole chicken breast and a ground turkey patty cooked on the stove top. Each of the locations contained home-style kitchens, meaning that each kitchen contained an oven, a stove (or stove top if ovens were separate), cookware, utensils, and a simple dial-type thermometer that could be found in a normal home kitchen. All of the necessary ingredients to prepare each item were supplied to the consumers. Cookware, including thermometers, was placed inside drawers and cabinets, similar to a home setup; thermometers were not specifically pointed out to the participants to avoid bias in their use during the study. Before cooking, the participants were given time to orient themselves to the kitchens and the location of all of the items. Participants were asked to prepare the items as they would in their own home as if they had been given the recipes by a friend.

The participants were instructed to prepare one item at a time to prevent distractions from switching back and forth between recipes. As the participants prepared each item, they were observed for food safety behaviors, especially for hand washing and thermometer use. Observers were introduced to the consumers as “helpers” who could provide assistance in finding items in the kitchen if needed. Observers noted the length of hand washing, if there was potential cross-contamination before hands were washed, if the thermometer was used, and if so, if it was inserted correctly into the center of the thickest part of the item. Each participant was instructed to put the item on a clean plate once they were finished cooking. Observers used a standardized observation form to ensure accuracy. During observer training, consistency was verified by having multiple observers watch the same participant, determine inconsistencies, and repeat the process until observers were able to produce equivalent data.

FIGURE 1. *Example recipe with included food safety instructions. The recipe without food safety instructions did not include steps 1, 2, 6, 8, 10, and 11.*

Recipes. The recipes used for the study were chosen to include a poultry part (chicken breast), a ground meat item (turkey patty), and a raw egg (used in the preparation of the chicken breast), foods that typically have some of the lowest adherence to using a thermometer and hand washing. Recipes were initially selected for ease of preparation and ability to be prepared within the allotted time frame, and they were edited for clarity. Food safety instructions were added to the recipe mainly to emphasize hand washing and thermometer use. Recipes included basic instructions on how to use the thermometer.

Survey. A brief survey was given to the participants after the completion of cooking both items to avoid biasing their food safety behaviors during their observation. The survey included questions to assess the ease of use and information provided in the recipes, what their opinion on the included safety instructions were, and how often they normally used a food thermometer at home. Participants who did not see the food safety instructions while preparing their items were shown a copy of the recipes with food safety instructions after their cooking and before they were asked their opinion on the food safety items. Responses were collected using Qualtrics software (Qualtrics, Provo, UT).

Statistical analysis. The data were compiled and summarized with basic statistics (including means, standard deviations, and percentages) in Excel (Microsoft Corporation, Redmond, WA). Pearson’s chi-square and Fisher’s exact tests were calculated using R (R Core Team, Vienna, Austria).

RESULTS

Participants. In total, 45 men and 110 women participated in the study. Of the participants, 13% were between 18 and 24 years old, 33% were between 25 and 44 years old, 44% were between 45 and 64 years old, and 10% were ≥ 65 years old. Household annual income was reported as 26% that earned less than \$30,000, 44% that earned between \$30,000 and \$75,000, and 29% that earned more than \$75,000. Race of the participants was 65% white and 28% black or African American, with the remainder choosing another category. There were no significant differences (at a $P = 0.05$ significance level) in sex, age, or household income distribution between the test groups.

TABLE 1. Hand washing (HW) and thermometer use during the preparation of the items

	With safety instructions (%) (n = 73)	Without safety instructions (%) (n = 82)	χ^2 (1 df)	P value
Parmesan sesame chicken				
HW before cooking	90	59	18.56	<0.0001
HW after handling egg	63	22	25.20	<0.0001
HW after handling chicken	84	56	12.37	0.0004
Used thermometer	85	30	44.30	<0.0001
Mushroom turkey burger				
HW before cooking	63	39	7.96	0.0048
HW after putting in bowl	53	20	17.95	<0.0001
HW after mixing	79	79	0.00	1
Used thermometer	86	20	66.29	<0.0001

Behavior observations. Participants who received recipes that contained food safety instructions demonstrated better food safety behaviors overall compared with those who received recipes without food safety instructions. For hand washing, the proportion of participants who washed their hands before cooking and after handling raw poultry products was significantly higher ($P < 0.005$) among those with the food safety instructions (Table 1). An exception was the equal proportion of hand washing after mixing ingredients into the raw turkey. This was expected and was likely because of the majority of participants mixing the ground turkey with their hands and then needing soap to remove the mixture from their hands.

Participants were significantly more likely ($P < 0.0001$) to use a thermometer if they received recipes with food safety instructions, which included both time and end-point temperature, compared with the control recipes that included only time. For the chicken recipe, 85% of participants used a thermometer when they had food safety instructions, compared with only 30% of those who did when the recipes did not have food safety instructions. Similarly, during preparation of the turkey burger recipe, 86% of consumers used a thermometer when they had the food safety instructions included in the recipes, compared with only 20% who used a thermometer when they did not receive recipes containing food safety instructions.

In addition to increasing thermometer use, the food safety instructions improved how the consumers used the thermometer. For those who did not have the food safety instructions in the recipe, only 4 consumers (16%) of the 25 consumers who used a thermometer inserted the thermometer from the side into the center of the chicken. For those who did have the food safety instructions, 42 consumers (68%) of the 62 consumers who used a thermometer inserted the thermometer correctly into the chicken. Likewise, during the preparation of the turkey patty recipe, two consumers (13%) of those who did not have the instructions inserted the thermometer from the side, whereas 38 consumers (76%) of those who did have the safety instructions inserted the thermometer correctly.

Survey. Upon completion of cooking, consumers were asked to rate the ease of use of the recipes on a 5-point scale

(from “difficult” to “easy”), and their liking of the recipes on a 9-point hedonic scale (from “dislike extremely” to “like extremely”). Most consumers (between 78 and 87%) responded that the recipes were easy to follow, regardless of which set they were given. The majority of the participants liked the recipes that contained the food safety instructions, with an average liking score of 6.6 for those who did receive the food safety instructions and average liking score of 6.7 for those who did not receive the instructions. There was no significant difference in liking of the food safety instructions between the two groups. Furthermore, 59% of those who received the safety instructions and 56% of those who did not stated they were likely or very likely to use recipes with safety instructions if they were available.

Of the participants in the study, 64% reported that they owned a food thermometer, with the remaining stating they did not own a thermometer (35%), or were not sure (2%). Participants were the most likely to use a thermometer when cooking a large piece of meat, with 71% of those who owned a thermometer stating they used it either most of the time or always. For small pieces of meat and ground meat, this use dropped to 20 and 15%, respectively.

Consumers were also asked various questions about food thermometers to gauge their perceptions about potential benefits of thermometer use. Participants who used a thermometer during the study, for either or both dishes, were significantly more likely to agree that thermometer use was important for ground meat items ($P = 0.0047$) and small meat items ($P = 0.0004$), and they also were more likely to agree that it is convenient and easy to use a thermometer ($P < 0.0001$). The majority of participants (>87%) agreed that thermometer use in large meat items was important and that thermometer use could lead to safer food. Beliefs were similar for thermometer use giving more nutritious food (32 to 35% agreement) and better quality food (54 to 63% agreement) regardless of whether they used a thermometer or not.

DISCUSSION

This study demonstrated that food safety behaviors can be significantly improved through the addition of food safety instructions within the preparation steps of recipes. The majority of consumers reacted positively to these additions,

stating they were easy to use and that they liked having them. Interestingly, 88% of those who do not own a thermometer still stated that they thought a thermometer was important for large items and that it would improve safety. These results indicate that those who do not use a thermometer may believe that it is not easy or convenient to do so, or that it is not necessary for smaller meat items (19).

Limitations to this study include the use of a model kitchen rather than the home kitchens of the participants; however, research by Redmond and Griffith (17) found that key consumer behaviors remained similar regardless of location. Only specific instructions were given to the participants, so the efficacy of other types of safety instructions such as cross-contamination prevention were not tested during this study.

Although it is uncertain if consumers would continue to demonstrate improved behaviors when preparing recipes that incorporate food safety instructions, the responses to the survey indicate that the majority of consumers would use similar recipes at home if they were available. Common sources of recipes such as publishers, online repositories, and government and commodity groups could incorporate these and other food safety instructions into their own recipes. Improving these behaviors would require the consumers to have food thermometers available for use during cooking. This study, as well as previous studies, indicate that there are a large number of consumers who do not own a food thermometer. However, as consumers are more aware of appropriate food safety measures, they may have an increased desire to improve their food safety behaviors, including acquiring food thermometers, though this has not been tested.

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