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Food Safety Education Cube for Native Americans

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I. Introduction

Despite advances in food safety policies in recent years, an estimated 9.4 million cases of food-related illnesses are documented annually in the United States (Scallan et al., 2011). Approximately 31 different pathogens are responsible for these illnesses and of the reported cases, almost 56,000 individuals require hospitalization for their symptoms. Additionally, in 2011, over 1,300 individuals died from symptoms related to a foodborne illness (Scallan et al., 2011).

These statistics indicate that foodborne illness is a prevalent issue in the United States, and is a topic that requires public health attention. Of the pathogens frequently responsible for foodborne illness, symptoms from *Salmonella*, norovirus, and *Campylobacter* can be prevented through proper handling and preparation of food. Therefore, improvements in food safety practices may lower the incidence of foodborne illness in the United States (Scallan et al., 2011).

Certain members of the population may be at greater risk of contracting food-related illnesses compared to others. These include children and prenatal women (Buzby, 2001). Several factors that contribute to susceptibility in children include underdeveloped immune systems, lower body weight, the sensitive nature of fetal development, and the fact that children have little control over what they are eating and how it is prepared (PEW, 2009). The PEW Health Group estimates that approximately half of the annual documented foodborne illness cases have occurred in children under the age of 15 (PEW, 2009).

The long-term impacts for childhood and prenatal contraction of a foodborne illness can have devastating effects and extra efforts should be taken to prevent these illnesses. Buzby (2001) states that, “On the positive side, many cases of foodborne illness can be prevented by not eating raw or undercooked meats.” Therefore, foodborne illness occurrences can be reduced if consumers have proper knowledge and take responsibility for the safe handling of food products, especially proper cooking and handling meat products.

The United States of Department of Agriculture’s (USDA) Food Safety and Inspection Service (FSIS) is the governing body that provides information for the safe handling of meat. This includes procedures that aid in proper handling. The “Safe Handling Instructions” label (Figure 1) is a required piece of information for all uncooked or partially cooked meat products but is not mandatory for meat items that are deemed fully-cooked or “ready-to-eat” (Post et al., 2007). The FSIS specifies placement of the label in the following manner:

“The instructions must appear in lettering no less than 1/16 inch in height and be placed on the label with such conspicuousness as to render it likely to be read and understood under customary conditions of purchase and use” (Post et al., 2007).



Figure 1. “Safe Handling Instructions” label required by FSIS on all uncooked or partially cooked meat products

The “Safe Handling Instructions” label contains four key food safety aspects, including chilling and thawing raw meat/poultry, keeping the raw meat/poultry separate from already cooked foods, cooking meat/poultry, and storage of leftover cooked meat/poultry (Post et.al, 2007). Each individual food safety component has an accompanying graphic indicating the general idea of the instruction. The FSIS requirements for the “Safe Handling Instructions” label are detailed to ensure visibility and comprehensibility for consumers. However, given the prevalence of foodborne illness in the United States, food safety officials have to wonder if consumers are allocating appropriate attention to this label and its contents.

A 2001 study conducted by The Research Triangle Institute (RTI) on behalf of the USDA explored the effectiveness of these required “Safe Handling Instructions” labels (FSIS, 2000). While consumers’ knowledge and confidence regarding general handling of meat products has increased in the past several years, there is a gap between this general knowledge and confidence to execute specific meat safety principles required to reduce the risk of many foodborne illnesses. Some of these principles include knowledge about meat thermometers, when to store leftover prepared meat dishes, and temperatures at which meat is most likely to foster microbial growth (FSIS, 2000). A majority (76%) of study participants reported washing their hands with soap and water after touching raw meat products. However, a much smaller proportion of participants (17%) used a thermometer when cooking large pieces of meat, and only one participant checked the

temperature when cooking hamburgers (FSIS, 2000). Consumers also lack an understanding of the basic “clean,” “separate,” “chill,” and “cook” food safety principles, with “clean” being the most understood concept and “cook” identified as the most confusing concept. The USDA “Safe Handling Instructions” label instructs consumers to “cook thoroughly.” Consumers assume this to mean one of three things: cooking according to the package, cooking according to recipe instructions, or cooking until the meat was “cooked all the way through” (FSIS, 2000).

A majority (64%) of study participants indicated having seen the “Safe Handling Instructions” and when asked about food safety education, they recommended that the label be discussed in detail as a component of a food safety education program (FSIS, 2000). Study participants also reported getting their food safety information from food labels, television and radio, indicating an opportunity for social marketing tools as educational components.

A 2001 home food safety study sought to further explore food safety knowledge and practice among consumers (Daniels, Daniels, Gilmet & Noonan, 2001) and discovered that individuals consistently report a lack of implementation of food safety practices. Many consumers practice improper defrosting techniques and cooking methods, keep leftovers beyond their shelf life and do not use a thermometer to check meat doneness. These same consumers report that the meat package is their primary medium for food safety information and many (40%) report it as their only means of food safety information (Daniels et al., 2001). Additionally, less than 50% of study participants owned a thermometer and only 22% used it to check meat doneness (Daniels et al., 2001).

Food handling practices were explored and compared to consumer food safety recommendations in a 2004 study (Anderson, Thomas, Shuster, Hansen, Levy, & Volk, 2004). Only 5% of the consumers reported using a food thermometer to check for meat doneness and a majority of study participants did not know how to use a food thermometer (Anderson et al., 2004). Additionally, only 45% of study participants washed their hands before beginning meal preparation. More recently, Lando and Chen, 2012 reported an increase in use of a food thermometer for determining doneness of roasts and chicken. They reported only 23% of consumers used a thermometer for hamburgers. Despite the self-reported increase in thermometer use, Phang and Bruhn, (2011) conducted an observational study of consumer burger preparation. They found that only 4% of the volunteers used a meat thermometer and 13% knew the recommended temperature for burger doneness.

In 2001, FSIS published a report that addressed concerns regarding the lack of consumer adherence to meat food safety messages. The report focused on consumers reporting more food safety knowledge than they practice. This gap between reported food safety knowledge versus food safety practices may be partially attributed to a lack of detail in the current meat safety instructions and suggested a need to increase food safety education (FSIS, 2001).

These research findings suggest a need for more comprehensive consumer education regarding proper meat handling and preparation to bridge the gap between consumer food safety knowledge and practice. The findings also indicate a need for a revised “Safe Handling Instructions” label that includes specific cooking temperatures, importance of thermometer use, hand washing, and more detailed information regarding proper meat storage.

Social marketing campaigns have been used to influence a variety of health behaviors, including physical activity and food safety (Baldwin Group, 2001; Nash et al., 2006; USDA-FSIS, 2005). Andreason (1994) defines these social marketing campaigns as “programs designed to influence the voluntary behavior of target audiences to improve their personal welfare.” These campaigns include a variety of methods to address behaviors, including posters, ads and social media. The purpose of this study was to develop and evaluate a social marketing tool to provide safe meat handling information to Native American families with young children.

II. Materials and Methods

Food Safety Cube Development and Placement

The food safety educational tool was developed from literature review findings and a series of focus groups conducted with Nebraska Native Americans regarding their meat/poultry handling practices (Vlasin-Marty, 2013). This information was used to develop a “Food Safety Cube” which was displayed in various locations on the Native American reservations. After approximately 2 months, a follow-up intercept survey was administered to assess the impact of the food safety cube. The objectives of the survey were to assess if the “Food Safety Cube” had been seen and to explore the knowledge of basic safe meat handling and preparation principles.

The “Food Safety Cube” was developed using information from the USDA’s “Safe Handling Instructions” as the basis for its content. The cube was comprised of four sides containing meat safety information and was placed on a mechanism that allowed consumers to rotate the cube as they viewed all pieces of information (Figure 2).

The USDA’s “Safe Handling Instructions” contains four key concepts which were expanded on in the “Food Safety Cube” to include more details regarding cooking temperatures, room temperature holding times and recommendations for discarding of cooked meat products (Table 1).

The “Food Safety Cubes” were placed in several strategic locations on the Native American reservation communities, including grocery stores, health clinics, Supplemental Program for Women, Infants and Children (WIC) clinics, and local libraries. These locations were chosen to make the information accessible to a majority of the families with young children throughout the communities.

Meat Food Safety Cube



Chill- Raw Meat



Keep uncooked meat in the refrigerator or freezer

Your refrigerator should stay at 40°F and freezer at 0°F

Use raw meat in the refrigerator within 2 days after purchasing OR Place in freezer bags and store in the freezer for up to 4 months

Clean & Separate



Wash, Wash, Wash! Keeping your hands, surfaces, and cooking utensils clean helps stop bacteria from getting into your family's food

Keep raw meat and all other foods away from each other. Juices from meat can carry yucky germs that can make you and your family sick

Cook



A meat thermometer will help you know when meat or poultry is safely cooked

Cook hamburger to 160°F

Cook chicken/poultry to 165°F

Chill- Cooked Meat



Put leftover cooked meat in the refrigerator within 2 hours

Keep leftovers in the refrigerator for 4 days. Then throw away

Created by Kelsey L. Crews; Undergraduate Research Assistant

Figure 2. The four sides of the Food Safety Cube

Table 1. Comparison of “Safe Handling Instructions” label content and “Food Safety Cube” content

	USDA Safe Handling Instructions	Food Safety Cube
Concept One (Chill/Thaw-Raw Meat)	“Keep refrigerated or frozen.” Thaw in refrigerator or microwave.”	<ul style="list-style-type: none"> • “Keep uncooked meat in the refrigerator or freezer” • “Your refrigerator should stay at 40° F and your freezer at 0° F” • “Use raw meat in the refrigerator within 2 days after purchasing OR place in freezer bags and store in the freezer for up to 4 months”
Concept Two (Clean & Separate)	“Keep raw meat and poultry separate from other foods. Wash working surfacing (including cutting boards), utensils, and hands after touching raw meat or poultry.”	<ul style="list-style-type: none"> • “<i>Wash, Wash, Wash!</i> Keeping your hands, surfaces and cooking utensils clean helps stop bacteria from getting into your family’s food” • “Keep raw meats and all other foods away from each other. Juices from meat can carry yucky germs that can make you and your family sick.”
Concept Three (Cook)	“Cook thoroughly.”	<ul style="list-style-type: none"> • “A meat thermometer will help you know when meat or poultry is safely cooked.” • “Cook hamburger to 160° F” • “Cook chicken/poultry to 165° F”
Concept Four (Chill-Cooked Meat)	“Keep hot foods hot. Refrigerate leftovers immediately or discard.”	<ul style="list-style-type: none"> • “Put leftover cooked meat in the refrigerator within 2 hours.” • “Keep leftovers in the refrigerator for 4 days. Then throw away”

Meat Safety Survey

A knowledge survey was developed from the information provided on the “Food Safety Cube.” The survey also included questions on demographic information. IRB approval was obtained from the University of Nebraska-Lincoln. Native Americans adults aged 19 years and over living in northeastern Nebraskan Native American reservations were randomly asked to participate in the survey. Upon survey completion participants were offered a compensatory meat thermometer. The chi-square test was used to compare responses from survey participants who viewed the “Food Safety Cube” to those who reported not having seen the cube with the significance level set at $p \leq 0.05$ using Statistical Analysis System (SAS).

III. Results and Discussion

Demographic information for the 101 survey participants is listed in Table 2. This study sought to provide meat safety education to families with young children. Of the survey participants, over half (55%) reported children under the age of 10 at home. The participants had between zero and six children with an average of 1.37 children. Of the 101 participants completing the survey, a majority (75%) were female.

Results of the knowledge questions are listed in Table 3. Of the 101 participants, 53% indicated that they had seen the “Food Safety Cube” educational tool. This indicates that the “cube” drew the community members’ attention. When asked what refrigerator temperature is needed for safe meat storage, responses were varied, ranging from 0°F - 165°F (mean 42.4°F \pm 20.1). While 19% ($n=19$) of participants provided a correct response, the remainder of participants provided temperatures that were above or below temperature recommendations. When asked about the longest length of time for meat can remain at room temperature, participants’ responses ranged from zero to 24 hours, with a mean of 1.57 hours (\pm 2.69). A total of 81% of respondents ($n=82$) provided appropriate timeframes to keep meat safe at room temperature (two hours or less).

To assess meat doneness, 50% of the participants ($n=50$) identified using a thermometer to check internal temperature as the safest way to determine if meat is thoroughly cooked. An important consideration is that this concept was depicted pictorially on the “Food Safety Cube,” while the other concepts were presented in textual format on the “cube.”

When asked about the refrigerator temperature required to keep meats safe, participants who had seen the cube were more likely to provide an accurate response, however these results were not statistically significant (Figure 3). Survey participants who saw the “Food Safety Cube” were more likely to identify correct timeframes to refrigerate cooked meats and the proper method to assess meat doneness (Figures 4 and 5), and these differences reached statistical significance ($p=0.0214$ and $p=0.0085$, respectively).

Table 2. Demographic information of the food safety knowledge survey participants

Characteristic	Frequency (n=101)	Percent of Sample (%)
Gender		
Male	19	18.8
Female	76	75.2
No Response	6	5.9
Do you have children under age of 10 at home?		
Yes	55	54.5
No	40	39.6
No Response	6	5.9

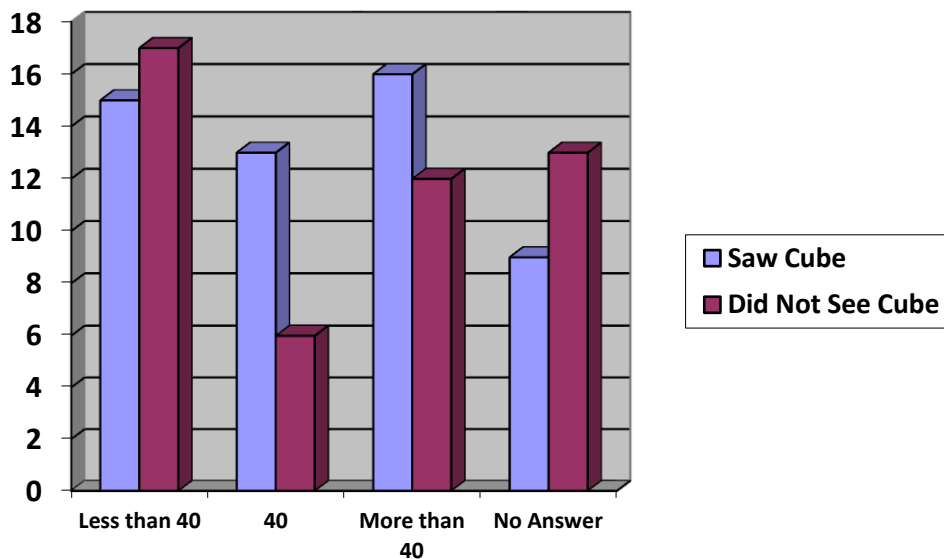


Figure 3. What temperature should your refrigerator stay at to keep meat safe?

Table 3. Results of knowledge survey questions

Question	Frequency (n=101)	Percent of Sample (%)
What temperature should your refrigerator stay at, to keep meat safe?		
>40° F	28	27.7
40° F	19	18.8
<40° F	32	31.7
No/Other Response	22	21.8
Have you seen this ‘Meat Safety Cube’?		
Yes	53	52.5
No	48	47.5
What is the best way to tell if hamburgers or chicken is cooked enough to prevent food poisoning?		
Cut one to check the color of the meat inside	13	12.9
Check color of the juice to make sure it’s not pink	8	7.9
Measure the temperature with a food thermometer	50	49.5
Check the texture or firmness of meat	6	5.9
Multiple answers	23	22.8
No response	1	1.0
How long can cooked meat be at room temperature before it needs to be put in the refrigerator?		
< 1 hour	23	22.8
1-2 hours	38	37.6
2 hours	21	20.8
> 2 hours	5	4.9
No/Other Response	14	13.9

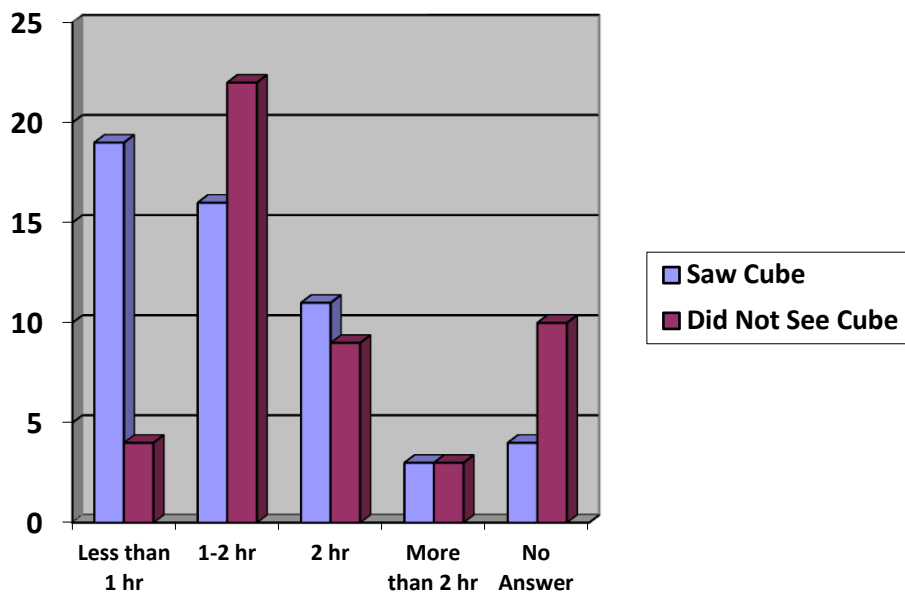


Figure 4. How long can cooked meat be at room temperature before it needs to be put in the refrigerator?

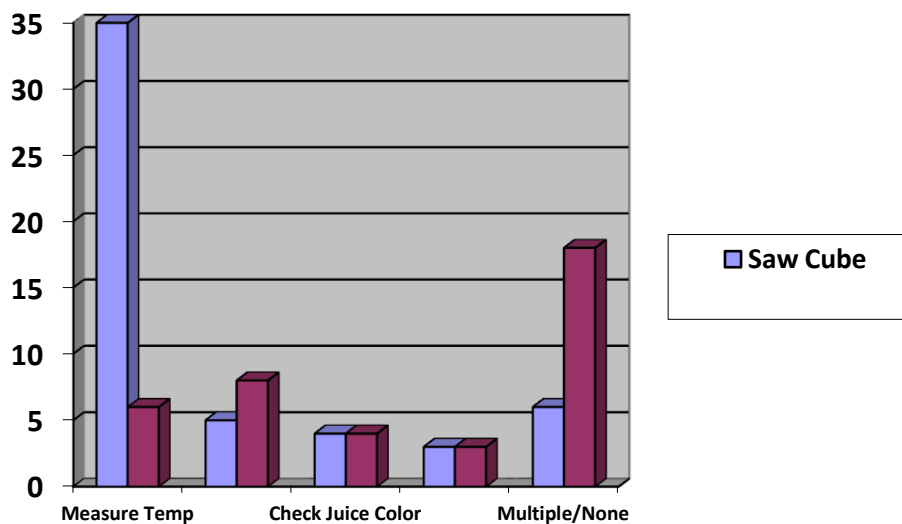


Figure 5. What is the best way to tell if hamburger or chicken is cooked enough to prevent food poisoning?

IV. Conclusion

Researchers have reported that while some consumers may have general knowledge of safe meat handling practices, there is a need for education that includes more in-depth instruction (Anderson et al., 2004; Daniels et al., 2001; FSIS, 2001). Key principles requiring further education include raw meat storage, cooking temperatures and storage of cooked meat products. The Safe Handling Instructions label on meat and poultry products should be revised to contain more specific instructions for the key points. The “Food Safety Cube” was developed and utilized as a community food safety tool that expanded on the current “Safe Handling Instructions” label to provide more detailed, yet comprehensible information. After leaving the “cubes” in strategic locations across Native American reservations and community clinics for a two month period, the knowledge surveys were conducted to determine if the “cubes” had been viewed and to assess meat handling knowledge. Approximately half of the individuals did view the cube and, when compared to individuals who did not view the educational tool, they were able to communicate understanding of key meat safety principles including the proper way to assess meat doneness and the appropriate timeframe to refrigerate cooked meats.

Findings indicate that when food safety information is presented graphically, it may be more likely to be recalled. Future research should focus on exploring a food safety educational tool that readily expands on the “Safe Handling Instructions” label and the “Food Safety Cube” with key information pictorially illustrated. These social marketing tools have the potential to increase food safety knowledge and awareness and lead to subsequent safe food safe handling practices among families with young children, which can ultimately reduce the prevalence of foodborne illnesses among an at-risk population.

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