

Awareness of Risks Changing How Hamburgers Are Cooked

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More Americans are eating their hamburgers more thoroughly cooked, partly due to greater awareness of the health risks of eating undercooked meat. The change in behavior means fewer cases of foodborne illness than would otherwise have occurred because thorough cooking kills harmful bacteria that may be present in the meat, such as *E. coli* O157:H7, *Campylobacter* or *Salmonella*. The changes also mean lower medical costs and productivity losses due to foodborne illnesses associated with rare and medium-rare hamburger. Understanding which consumers already follow food safety recommendations and why can help food safety educators reach more consumers through targeting and designing food safety messages.

According to the Consumer Food Safety Surveys by the U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS), the percentage of

consumers serving hamburgers rare or medium-rare fell from 25 percent in 1988 to 16 percent in 1998. These findings are supported by a survey done by the Market Research Corporation of America (MRCA), a private market research firm. According to the MRCA survey, the percentage went from 24 percent in 1991 to 20 percent in 1996 for consumers cooking hamburgers rare or medium-rare at home and from 21 percent to 15 percent for consumers ordering hamburgers rare or medium-rare in restaurants.

Consumers Switched for Their Health

In 1996, MRCA asked consumers how they usually cooked and ordered their hamburgers at the time of the survey and in 1991 (see box on surveys analyzed). About 10 percent of the respondents switched from cooking hamburgers rare or medium-rare in 1991 to cooking them medium, medium-well, or well-done in 1996 (fig. 1). However, about 4 percent of respondents reported switching from cooking



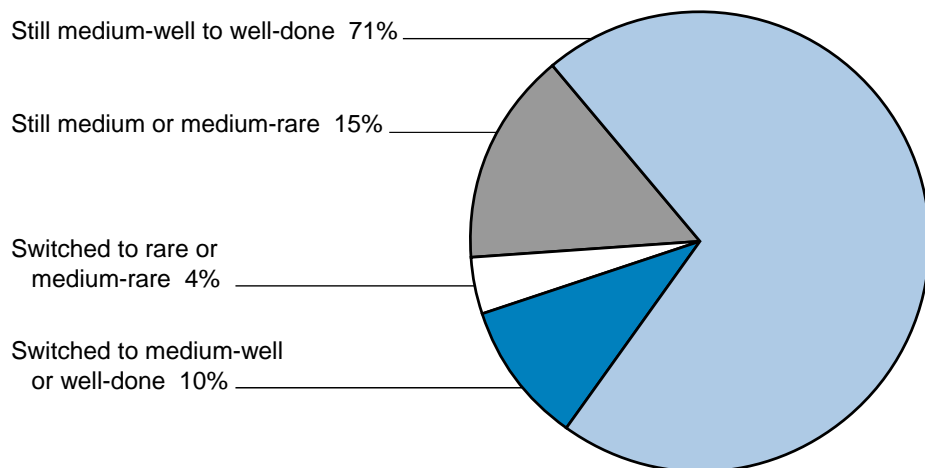
Surveys find U.S. consumers cooking their hamburgers more thoroughly and ordering rare and medium-rare hamburgers less often when eating out due to worry over foodborne illness.

Credit: PhotoDisc.

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Figure 1

In 1996, 10 Percent of Respondents Said They Switched From Cooking Rare or Medium-Rare to Cooking Medium or Well-Done



hamburgers medium to well-done in 1991 to cooking hamburgers only rare or medium-rare in 1996. The results were similar for hamburgers ordered in a restaurant.

Almost three-quarters of the respondents who switched from less well-done to more well-done explained they had made the change because of the possibility of becoming ill. Some reported making the change because of their peers, and some because of taste. One-quarter of respondents who changed their ordering behavior reported making the change because restaurants were no longer serving hamburgers rare or medium rare.

Taste was the most often-cited reason reported for cooking hamburgers less well-done than 5 years ago. Many in this group also cited nutrition as a reason for cooking less well-done. This could reflect a concern about loss of nutrients during cooking, but another reason comes from focus groups conducted by FDA and FSIS in 1995. Some participants expressed a concern about overcooking lean hamburger—lower fat hamburger may lose juiciness and flavor when cooked well-done. Therefore, some consumers

concerned about nutrition may be using lower fat ground beef and cooking it less well-done than they did in the past to preserve the juiciness and flavor.

Some consumers also cited fear of illness as a reason for cooking less well-done than 5 years ago. This concern about illness may be related to fears of carcinogens from the charred surface on a well-done hamburger—a concern also discussed by participants in the FDA/FSIS focus groups.

Food Safety Awareness Comes From Many Sources

Consumers receive food safety messages from a variety of sources—magazine articles, store brochures, television newscasts, and food labels. In 1995, FSIS began requiring safe handling labels on raw meat and poultry. The 2-by-1½-inch label reminds consumers to cook thoroughly, thaw properly, refrigerate unused portions quickly, and wash food preparation equipment and surfaces to avoid cross-contamination. FSIS worked with

supermarket chains and local health authorities to jointly produce supermarket brochures and materials for school children to draw attention to the safe handling label and reinforce its messages. More recently, the Partnership for Food Safety Education, a public-private partnership, began the *Fight BAC!* campaign, a national educational campaign with messages similar to those on the safe handling labels. Media coverage of foodborne illness outbreaks and recalls of contaminated food also increase consumer awareness of foodborne illness risks.

It is difficult to separate the effects of labels and brochures from the effects of publicity surrounding foodborne illness outbreaks and recalls. In fact, the two are intended to work together because food safety officials work with news providers to incorporate food safety education into news, magazine, and television stories, and to increase awareness of safe food handling recommendations. Thus, food safety messages often reach consumers indirectly through newspapers, magazines, and cookbooks rather than directly from consumer education materials such as labels and brochures.

The importance of the many channels for food safety education is reflected in the diversity of sources respondents cite as providing food safety information. The 1996 MRCA survey asked respondents where they obtained information about “how to cook a hamburger to minimize the chances of getting sick.” Newspapers and TV/radio were cited most frequently as information sources about how to cook hamburgers safely (71 percent of the sample for each). Word of mouth, magazines, and labels were also important, cited by 61, 58, and 50 percent of the sample, respectively. In the 1998 FDA/FSIS Consumer Food Safety Survey, food labels were the most frequently cited source of “a lot of information

about food safety," with 43 percent of respondents, followed by broadcast media (37 percent), print media (29 percent), and cookbooks (26 percent).

Respondents to other surveys say that both food safety education messages and media coverage of food

safety issues contributed to their shift in hamburger cooking behavior. The 1996 Food Marketing Institute's (FMI) annual survey of consumer trends in grocery shopping found that 59 percent of shoppers had seen the new safe handling label for raw meat and poultry. Of

those who had seen the labels, 43 percent said the safe handling labels had caused them to change their behavior and 8 percent (5.6 percent of the total sample) said they had begun to follow proper cooking directions. In FMI's 1997 survey, respondents were asked what they

Several Surveys Analyzed

FDA/FSIS Consumer Food Safety Surveys

FDA and FSIS conducted three Consumer Food Safety Surveys in 1988, 1993, and 1998. All three were conducted by telephone, with the adult in the household who most recently celebrated a birthday, in order to randomize the selection of respondents within a household. The 1988 survey covered 3,202 adults during the summer of 1988. The 1993 survey had a sample size of 1,620 and was conducted from December 1992 to February 1993. The 1998 survey had a sample size of 2,001 and was conducted from February to April 1998. The data for all three surveys were weighted using Census counts for 1990 based on proportions of the U.S. population categorized by ethnicity, gender, and education. That is, each observation was counted a certain number of times so that the proportions of the weighted observations in each demographic category would match the proportions of the 1990 U.S. population.

MRCA Hamburger Preparation Quiz

MRCA conducted this survey as a supplement to its ongoing Menu Census Survey from March 1996 to February 1997. The Menu Census Survey is a nationally representative mail survey in which respondents complete a 2-week diary on food consumption and a questionnaire on attitudes related to food purchases. The survey covers about 2,000 households that are selected from a 12,000-household purchase diary survey. The 12,000-household sample, 2,000 household subsample, and the Menu Census Survey are selected as stratified samples to

match U.S. Census data for geographic and demographic characteristics. The Hamburger Preparation Quiz was added as a supplement to the Menu Census Survey attitude questionnaire. The supplement included questions on the respondent's usual hamburger cooking style, and how the respondent usually orders hamburgers in a restaurant, as well as questions about taste preferences for hamburger styles, risk perceptions about foodborne illness, sources for food safety information, and foodborne illness experience.

The household adult who celebrated the most recent birthday completed the supplement in order to randomize the selection of adult respondents within the household. The survey supplement was completed by 1,133 individuals, of which 571 provided complete responses to the questions used in this study. The data for both the Hamburger Preparation Quiz and the Hamburger Consumption Diary were weighted using Census counts for 1990 based on proportions of the U.S. population categorized by ethnicity, gender, and education of the household head.

FMI Trends Survey

FMI sponsors an annual survey called "Trends in the United States: Consumer Attitudes & the Supermarket." The survey covers a wide variety of consumer opinion and shopping behavior including, for 1996 and 1997, awareness of safe handling labels on meat and poultry. Data are representative of shoppers rather than the general population and are not weighted to reflect Census counts. The 1996 survey data on

consumers' response to labels were collected from 1,007 telephone interviews during January 1996. The ratio of females to males in the survey is 73-27. The 1997 survey data on labels were collected from 1,011 telephone interviews conducted in January 1997, with a female-to-male ratio of 74-26.

How the Surveys Measured Hamburger Doneness

The FDA/FSIS and MRCA surveys used the respondent's judgement of the doneness of the hamburger (rare, medium-rare, medium, etc.) and the respondent's description of the color of a patty cooked to medium. These descriptions were based on the advice by FSIS, prior to 1997, that consumers cook hamburgers until neither the juices nor the meat showed any red or pink color.

In 1997, FSIS began recommending that consumers cook hamburgers to 160 degrees Fahrenheit using a food thermometer to accurately measure temperature. FDA and CDC joined in this recommendation in 1998. FSIS made the change because research at Kansas State University in 1997, confirmed by USDA's Agricultural Research Service in 1998, showed that some meat that has been frozen appears brown in the center before reaching a safe temperature (160 degrees Fahrenheit) while some meat still appears pink in the center even at temperatures above 160 degrees. The new thermometer recommendation was designed to prevent consumers from perceiving a brown, but unsafe, hamburger as thoroughly cooked, and to prevent wastage or overcooking of pink, but safe, hamburger.

were doing differently as a result of the safe handling labels. Thirteen percent reported they were “cooking properly,” “using correct temperatures,” or “following proper cooking directions.” The large increase over 5.6 percent the previous year could be due to the new format of the question, since it was asked of all respondents, and not just those who specifically said they saw the label.

In 1998, the FDA/FSIS Consumer Food Safety Survey asked a similar question and found that 65 percent of respondents had seen safe handling labels on raw meat and poultry. While only 11 percent of those who had seen the label said that they found some of the information new, 29 percent of those who had seen the label said they had changed their behavior as a result of the label. Of those who said they changed their behavior, 22 percent, or 4 percent of the original sample, said they were now cooking meat and poultry properly. Here, the format of the question is more like the FMI survey in 1996, and the result is similar. This suggests that the large increase reported by FMI in 1997 was more likely due to the change in the format of the question.

These reported changes in response to labels could account for some of the changes in hamburger style choices. Assuming those who changed their behavior were cooking their hamburgers unsafely before, the 4 percent of the total sample who began cooking their hamburgers more thoroughly could represent a sixth of the consumers who in 1993—2 years before labels were introduced—said they usually cook their hamburgers rare or medium-rare.

Several well-publicized incidents of foodborne illness or recalls have also contributed to the shift in consumer behavior. Sixty-eight percent of respondents to the 1998 FDA/FSIS Consumer Food Safety Survey had heard of the 1993 outbreak of foodborne illness associ-

ated with the Jack-in-the-Box fast food chain. Of those, 70 percent recalled that it was related to hamburger, and 38 percent recalled that it was caused by a strain of *E. coli*. Twenty-seven percent of those who recalled the Jack-in-the-Box outbreak said the incident affected their behavior even though only 5 percent identified “undercooked hamburger” as the culprit. Further analysis of the FDA/FSIS data will be required to determine how respondents changed their behavior in response to the incident.

Additionally, 40 percent of respondents had heard about an incident in 1997 involving Hudson Foods, and of those, 40 percent recalled it was associated with hamburger, and 42 percent could name the bacteria involved. Twenty-five percent of those who remembered the Hudson Foods recall said they had changed their behavior as a result of the news, although again, researchers have not yet determined what respondents are doing differently.

Risk and Taste Compete

Food safety messages can affect consumer behavior by increasing consumers’ perception of risk from eating a rare or medium-rare hamburger. Yet consumers also make decisions based on their taste preferences. The MRCA survey explored how these competing motivations affect hamburger preparation.

To measure motivation to avoid foodborne illness, the survey asked respondents to rate the chances of getting sick from hamburgers at each level of doneness and how important the chance of illness was to them. The perceived risk and importance ratings were then multiplied to create a “risk motivation index” where motivation to avoid getting sick grew as the respondent’s index increased from 1 to 16.

To measure perceived palatability of different hamburger styles, the survey asked respondents to rank hamburgers at each level of doneness on juiciness, taste, and tenderness and how important these factors were to them. The palatability measures were combined and multiplied by the respondents’ importance ratings for taste factors to create a “palatability motivation index” that captures how strongly respondents prefer the characteristics of a rare or medium-rare hamburger as the respondent’s index varies from 1 to 20.

Taste preferences were the most important factor affecting how hamburgers were cooked and ordered (table 1). A 10 percent higher palatability motivation index was associated with a 76 percent higher probability of cooking hamburgers rare or medium-rare and a 52 percent higher probability of ordering hamburgers rare or medium-rare.

Respondents with higher motivation to avoid getting sick were less likely to cook hamburgers underdone—5 percent less likely for a 10 percent higher risk motivation index. The response was stronger for hamburgers ordered away from home. Respondents with a 10 percent higher risk motivation index were 9 percent less likely to order hamburgers medium-rare or rare.

These results support the finding that consumers changed their behavior due to fear of illness, and suggest that taste preferences remain an obstacle to further change. The recommendation from FSIS—to cook hamburgers to 160 degrees Fahrenheit using a food thermometer—could improve the sensory characteristics of properly cooked hamburgers because some hamburger may be safe before turning brown in the center of the patty.

Interestingly, few personal and household characteristics were important after accounting for differences in risk motivation and tastes. Respondents with smaller

Table 1

Taste Matters More Than Safety in How Consumers Cook and Order Their Hamburgers

Personal and household characteristics	Effect of personal and household characteristics on the probability of—	
	Cooking hamburgers rare or medium-rare	Ordering hamburgers rare or medium-rare
	Percent	
Northeast ¹	0	86
South ¹	0	83
One additional household member	-22	0
Lives in a city with more than 500,000 (compared with those in rural areas, suburbs, or smaller cities)	0	75
A 10 percent higher risk motivation index ²	-5	-9
A 10 percent higher palatability motivation index ³	76	52

¹Compared with the West, which was the reference region.

²The risk motivation index captures how strongly respondents wish to avoid foodborne illness. It combines the respondent's rating of the risk of illness from a rare hamburger and how important the risk of illness was to the respondent.

³The palatability motivation index captures how strongly respondents prefer the characteristics of a rare or medium-rare hamburger. It combines the respondent's rating of the taste, tenderness, and juiciness of a rare or medium-rare hamburger and how important taste, tenderness, and juiciness were to the respondent.

Source: Estimated by ERS researchers from the 1996 Hamburger Preparation Quiz, Market Research Corporation of America. Statistically estimated effects are included only if they are significantly different from zero at the 10-percent confidence level.

households were more likely to cook hamburgers medium-rare or rare, while northeastern, southern, and urban respondents were more likely to order hamburgers medium-rare or rare in restaurants. Individuals with these characteristics may require more exposure to safe handling recommendations to change their behavior.

Many Factors Affect Palatability and Risk Motivation

Several household characteristics were associated with a higher palatability motivation index (table 2). White respondents reported a 14 percent higher value for the index compared with all other groups, and respondents reported a 1 percent higher value for each \$5,000 higher per capita income in the household. Male respondents reported an 4 percent lower palatability motivation index, and respondents in the Midwest reported a 8 percent lower index.

Experiencing a foodborne illness raised a respondent's risk motivation index by 34 percent (table 3), the highest effect of any factor. Thus, food safety messages may be more effective if they inform consumers of the symptoms of foodborne illness and the risk of serious consequences such as hospitalization.

Several information channels appear to be effective for communicating the risks of unsafe food preparation. Respondents who say they get their information from magazines, television, cookbooks, or government hotlines had 15 to 17 percent higher risk motivation than those who did not cite these sources of food safety information. Respondents who said they get information from labels did not have a higher risk motivation index after accounting for other factors that also increase awareness. Surprisingly, consumers who cited brochures as their information source had lower risk motivation than respondents who did not. These consumers may perceive less risk because the brochures and other information they obtain may help them feel they

can control their risk of foodborne illness.

More research is needed to explore these findings, but it is not surprising that it is difficult to separate the effects of different forms of information. Consumers are exposed to several sources at the same time, and information sources may work together to affect consumer perceptions.

Safer Cooking Means Less Foodborne Illness

Overall, survey respondents say they are cooking their hamburgers more, and this change may be due to many information sources working together. The change means there were fewer cases of foodborne illness—and lower medical costs and lost productivity—than would otherwise have occurred.

Assuming rates of contamination and cross-contamination and patterns of eating away from home had stayed the same, the reduction in cooking and ordering hamburgers rare and medium-rare due to con-

cern over foodborne illness between 1991 and 1996 would result in 4.6 percent fewer cases of *E. coli* O157:H7 infection from hamburger. This reduction translates to savings in medical costs and in productivity losses of \$7.4 million annually. This estimate is based on estimated total costs of foodborne *E. coli* O157:H7 of \$770 million, of which 21 percent are estimated to be caused by ground beef. Other illnesses are likely to have been avoided as well, since other bacteria, such as *Campylobacter* and *Salmonella*, can also be present in undercooked hamburger.

This reduction is smaller than the overall changes in cooking and ordering suggest. While the number of respondents who cook or order their hamburgers rare and medium-rare declined in 1991-96, the number of respondents cooking hamburgers rare at home increased from 3.7 percent in 1991 to 5.2 percent in 1996. Consumers, unable to order hamburgers rare in restaurants, may have chosen to eat them at home instead. We did not include this increase in our estimate of the

reduction in foodborne illness cases because the MRCA respondents cited taste rather than fear of foodborne illness as reason for the change. The fact that cooking rare at home did not decrease accounts for the limited effect of cooking and ordering changes on the risk of illness.

To estimate the change in risk of infection from *E. coli* O157:H7, we used a model of food illness risk from hamburgers developed by

researchers at USDA's Food Safety and Inspection Service and Economic Research Service. The model predicts the probability that a hamburger will cause *E. coli* O157:H7 infection depending on whether the hamburger is cooked rare, medium-rare, or well-done.

We used data from the MRCA Hamburger Preparation Quiz to estimate the changes in how many hamburgers at home are cooked rare and medium-rare, and how many

Table 2

White Consumers Prefer Lightly Cooked Hamburgers

Personal and household characteristics	Effect of personal and household characteristics on palatability motivation index
	Percent
Male (compared with female)	-4
Midwest (compared with the West)	-8
Additional \$5,000 per capita annual income	1
White (compared with all other ethnic groups)	14

Source: Estimated by ERS researchers from the 1996 Hamburger Preparation Quiz, Market Research Corporation of America. Statistically estimated effects are included only if they are significantly different from zero at the 10-percent confidence level.

Table 3

Consumers Who Get Information From Magazines, Cookbooks, Television, and Hotlines Are More Motivated To Avoid the Risk of Foodborne Illness

Personal and household characteristics	Effect of personal and household characteristics on risk motivation index
	Percent
Additional \$5,000 per capita annual household income	3
One additional household member	6
White (compared with other ethnic groups)	21
Gets food safety information from magazines (compared with those who don't)	17
Gets food safety information from cookbooks (compared with those who don't)	17
Gets food safety information from television (compared with those who don't)	15
Gets food safety information from brochures (compared with those who don't)	-13
Gets food safety information from hotlines and other government sources (compared with those who don't)	15
Has experienced illness from hamburger, other meat, or fish (compared with those who haven't)	34

Source: Estimated by ERS researchers from the 1996 Hamburger Preparation Quiz, Market Research Corporation of America. Statistically estimated effects are included only if they are significantly different from zero at the 10-percent confidence level.

hamburgers in restaurants are ordered rare and medium-rare. During 1991-96, the percentage of respondents who cooked medium-rare at home decreased from 20.2 to 14.8, while the percentage of respondents reporting they cooked rare at home actually increased from 3.7 to 5.2. The percentage of respondents reporting they order rare in restaurants decreased from 3.6 in 1991 to 2.0 in 1996. In the same period, the percentage of respondents ordering medium-rare in restaurants decreased from 17.1 to 12.8.

Consumer choice may not have been the only reason for the changes in restaurant ordering behavior, however. By 1996, some restaurants no longer served hamburgers rare. We used the MRCA data on the reasons that consumers changed their behavior in order to isolate "concern over illness" from "restricted choice" as causes for the reduction in rare-cooked hamburger consumption in restaurants.

Seventy-seven percent of those who no longer order hamburgers rare in restaurants and 71 percent of those who no longer order medium-rare reported they did so out of worry over foodborne illness. Thus, worry over foodborne illness, rather than restricted choices, caused a 1.2-

percentage-point reduction in ordering hamburgers rare and a 3.0-percentage-point reduction in ordering hamburgers medium-rare in restaurants.

We combined the estimated changes in cooking and ordering hamburgers with estimates of where hamburgers were eaten in 1991—at home, in a table-service restaurant, or in a fast-food establishment—from USDA's 1989-91 Continuing Survey of Food Intakes by Individuals. By using 1991 data on where hamburgers were eaten and not 1996 data, we excluded the fact that more hamburgers were being eaten in fast-food establishments in 1996. This increase was probably the result of a desire for convenience rather than concern over foodborne illness.

Our results suggest that most of the change in how hamburgers are cooked and ordered in restaurants was due to changing risk perceptions. While household size, region, and urbanization matter even after risk motivation is taken into account, these household characteristics changed little from 1988 to 1998, and not in the right direction to explain the change.

The Clinton Administration's 1997 Food Safety Initiative directs FSIS,

FDA, and CDC to conduct a national public education campaign on safe food handling practices as part of a comprehensive food safety effort. Our research results show that consumers who are more aware of risks from undercooked hamburgers are more likely to adopt safer behavior and thus contribute to a reduction in foodborne illness cases.

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