

Consumer Decisions on Storage of Packaged Foods

AMY M. LANDO* and SARA B. FEIN

Consumer Studies Staff, HFS 020, Center for Food Safety and Applied Nutrition, Food and Drug Administration, 5100 Paint Branch Parkway, College Park, MD 20740, USA

SUMMARY

We investigate the causes of consumer uncertainty regarding storage of packaged foods by examining the characteristics of the consumers, the type of food products and packaging, and where the product was stored at purchase. Consumers' self-reported refrigeration practices from the 1998 Food Safety Survey are analyzed descriptively and by logistic regression. Eleven percent of the 2,001 respondents reported difficulty during the past three months in deciding whether to refrigerate a packaged food. When consumers do have difficulty, it is likely that the products either are new to them or need to be stored in an unexpected way. Those most likely to report uncertainty about whether to refrigerate were people of middle age and people likely to be more attuned to food safety issues — those who have some college or higher education, who look at many sources of food information, and who thought that a household member had a recent foodborne illness. The results suggest that additional education may be needed to inform consumers about proper refrigeration and that storage information on packages is particularly important for foods that are stored at room temperature until opened but that then need refrigeration.

INTRODUCTION

Proper storage of food at home is an important practice for preventing foodborne illness. Improper cooling and a lapse of 12 or more hours between preparing and eating food were found to be the fourth and fifth leading factors contributing to 345 outbreaks of foodborne illness caused by mishandling and/or mistreating foods in homes in the United States between 1973 and 1982 (3). Proper storage of packaged foods is also essential; at least three cases of botulism have been reported that were probably contracted because of failure to refrigerate a packaged food. One of the cases was from an improperly stored bean dip and the other two from improperly stored clam chowder (4, 11).

Although many factors related to consumer food safety behaviors have been described, including at which consumers keep their refrigerators, temperature cooling practices for cooked foods, and storage times for refrigerated foods (8), this is the first study to investigate consumer storage decisions for packaged foods.

After purchasing food, consumers must decide where to store each product — in the refrigerator, in the freezer, or at room temperature. Although in the past this may have been an easy decision, new preserving and packaging technologies have extended the life of some foods that

A peer-reviewed article

*Author for correspondence: 301.436.1996; Fax: 301.436.2505
E-mail: Amy.lando@fda.hhs.gov

TABLE 1. Percent of consumers who reported having difficulty deciding how to store a packaged food by demographic characteristics

Characteristic	Difficulty deciding %
Total sample	11
Race	
White	11
Black	14
Other	14
	$\chi^2_{df=2} = 3.2 \quad P = 0.2$
Gender	
Female	13
Male	10
	$\chi^2_{df=1} = 3.33 \quad P = 0.07$
Age	
18–25	9
26–39	14
40–60	12
60+	7
	$\chi^2_{df=3} = 15.51 \quad P < 0.01$
Education	
< High School	7
High school	10
Some college	13
College grad +	15
	$\chi^2_{df=3} = 13.05 \quad P < 0.01$

N=2,001

Based on weighted data

need refrigeration (5, 9). Some of these foods may be in a form that confuses consumers. The type of packages involved in the three cases of botulism may have contributed to the confusion (4). Also, consumers may not know that some other types of foods, such as mayonnaise and ketchup, need to be refrigerated after opening (12).

This study examines consumer storage decisions in terms of the characteristics of people who are uncertain as to how to store a packaged product; the types of products and packaging most likely to be confusing; and where the product was stored at purchase.

MATERIALS AND METHODS

Sample

Data are from the Food and Drug Administration's 1998 Food Safety Survey (FSS). A total of 2,001 adults aged 18 and over participated in this national, random digit dial telephone survey. Telephone numbers were selected using the GENESYS list-assisted method (2), and the respondent from each household was selected by the last birthday method. The data were weighted for both design weight (the number of adults in the household and number of phone lines) and population weight (to adjust the sample to 1998 Census proportions on race, education, and gender).

Variables

The 1998 version of the Food Safety Survey contained a set of questions about storage of packaged foods. Participants were asked if they had trouble deciding whether to refrigerate a packaged product in the past three months. Those who said "yes" were asked a series of follow-up questions: what type of food was problematic, how it was packaged, how it was stored when purchased, and whether the consumer had trouble deciding how to store it before or after opening the package. Those who said "no" were asked only how they decide whether a packaged food needs to be stored in the refrigerator after opening.

Variables from other parts of the survey were also used in this analysis, including such demographic variables as education, race, gender, and age. An information sources index was created from questions that asked consumers about the sources of their information on safe food handling. A factor analysis showed that five sources loaded together: cookbooks, newspapers and magazines, news programs, food labels, and grocery store handouts. Therefore, only these five sources were included in the index. This index had a Cronbach alpha of 0.64.

Risk sensitivity variables included respondents' perceptions of how commonly they believe people get a foodborne illness from foods prepared at home, whether the respondent believes that someone in the household recently experienced foodborne illness, and whether the respondent reports eating at least one of four raw foods from animals (raw clams, raw oysters, raw fish, or steak tartare). A personal risk perception variable was created from questions about how likely respondents think it is that they would get sick from four specific food-handling errors: forgetting to wash hands before beginning to cook, allowing contact between vegetables to be eaten raw and raw meat or chicken, eating a piece of chicken that is not thoroughly cooked, and leaving food unrefrigerated for more than 2 hours after it is cooked.

Cooking experience variables included whether the respondent prepares the main meal in the household either most or some of the time and a cross-contamination prevention index. The cross-contamination prevention index consisted of five separate questions about food-handling behaviors in the home: washing hands before cooking and after touching raw meat or chicken and seafood, and washing cutting boards after cutting raw meat or chicken and raw fish.

FIGURE 1. Distribution of food types that caused refrigeration uncertainty in consumers (N=237)

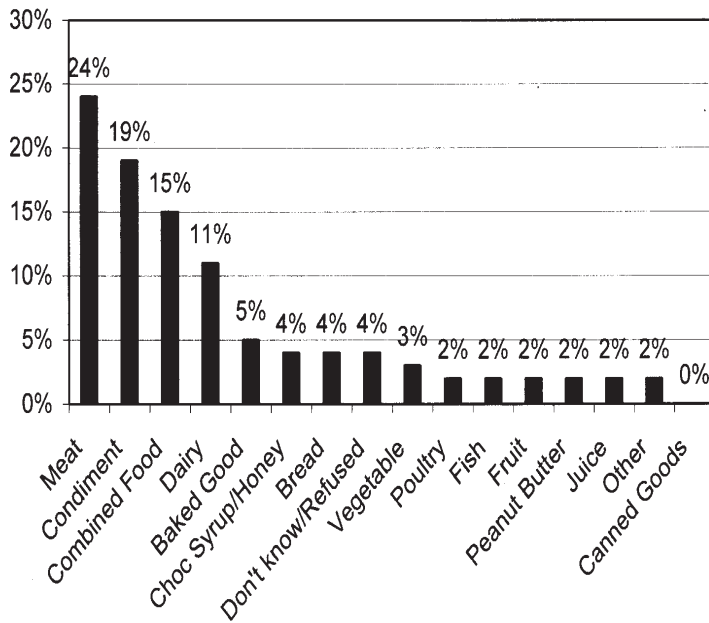
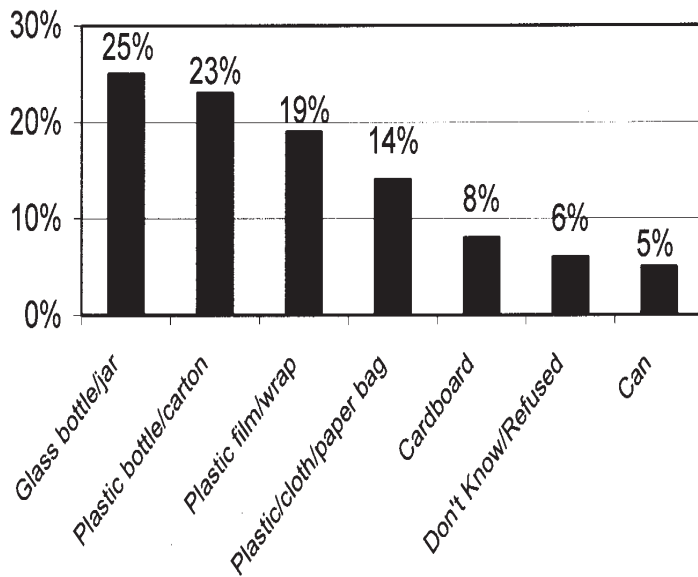


FIGURE 2. Distribution of packaging types for foods that caused refrigeration uncertainty in consumers (N=237)



Data analysis

The storage response distributions and cross tabulations were analyzed to describe the respondents' demographic characteristics, the types of products that are most problematic, and how the respondents decide where to store food.

Logistic regression was conducted to characterize demographic, risk sensitivity, and cooking experience variables associated with respondent uncertainty. All analyses were conducted with weighted data and all were performed in SAS for Windows V8 (10).

RESULTS

Descriptive statistics

Of the 2,001 participants in the survey, 11% reported having trouble deciding whether to refrigerate a product in the past three months. Table 1 lists the percent of each demographic group that had trouble with storage decisions. Particularly likely to have trouble were those aged 26 to 60, the more highly educated, and females. Race appears not to be a factor.

Meat (including bacon and cured sausage), condiments (such as catsup, and pickles), combined foods (such as soup, salad dressing, and dip), and dairy products were the foods that caused the most difficulty for consumers. No other category constituted more than 5% of the total number of problematic foods (Fig. 1). Over 50% of the problematic products were bought in either a plastic bottle or carton or in a glass bottle or jar (Fig. 2).

It is possible to determine how food product packaging causes respondent uncertainty by looking jointly at the type of food and how the food was packaged when purchased. The top six categories, accounting for 47% of all cases, were: meat in plastic wrap or film (13%), condiment in glass bottle or jar (10%), condiment in plastic bottle or carton (7%), meat in plastic, cloth or paper bag (6%), combined food in glass bottle or jar (6%), and dairy products in plastic bottle or carton (5%) (data not shown). Although it is impossible to identify specific products that are the most problematic, it seems that some categories of meats most commonly cause consumers indecision regarding storage.

Two factors are important for identifying a correct or incorrect storage decision: when respondents had trouble deciding to refrigerate a product and where the product was found at the store. The majority of the time, respondents had trouble deciding how to store food after opening it when the product was found on a shelf, rather than refrigerated, at the store (Fig. 3). When only the instances with these characteristics were considered, the most common type of products were combined foods (soup, stew, salad dressing, dip) and condiments found in plastic or glass bottles, jars, or cartons.

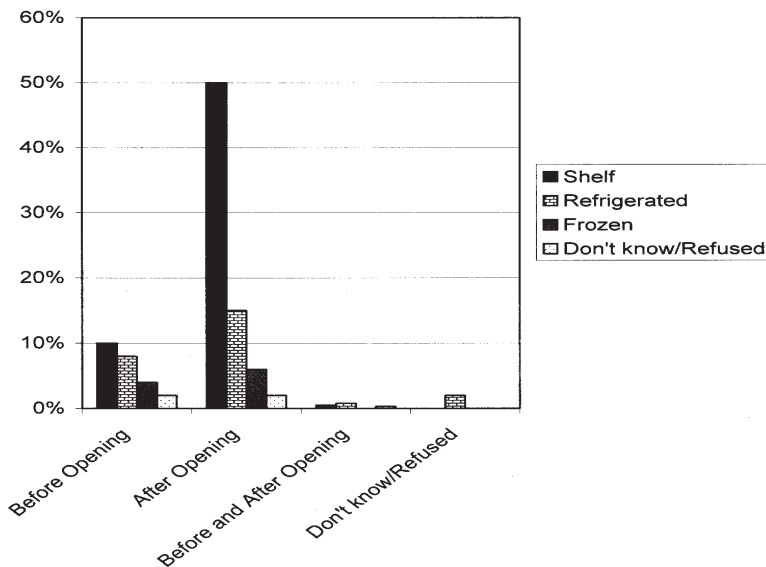
About 25% of the products that caused uncertainty for respondents were

TABLE 2. Education and label use: Percent of respondents who reported using the label and considering the type of food in deciding where to store a food product

How decided	Education Level					
	Total Sample %	Less than HS %	HS %	Some college %	College grad %	
Had trouble (n=237)						
Used label	19	7	18	14	29	$\chi^2_{df=2}=7.1 P < .05^a$
Consider type of food	49	70	43	53	42	$\chi^2_{df=2}=5.5 P < .07$
No trouble (n=1,764)						
Used label	55	44	52	61	62	$\chi^2_{df=2}=31.9 P < .0001$
Consider type of food	37	39	37	36	34	$\chi^2_{df=3}=1.7 P = .65$

^a Because multiple responses were allowed, a separate Chi Square test had to be conducted for the dichotomies “used label versus not used label” and “considered the type of food versus not considered the type of food.”

FIGURE 3. Association between how foods were stored at purchase and time when consumers had difficulty deciding to refrigerate the product (N=237)



refrigerated at the store when purchased. This result is noteworthy because the three cases of botulism caused by improper refrigeration were from products that were bought refrigerated but appeared to be shelf stable and hence were improperly stored at home (11). The most common of these products was meat found in plastic film or wrap, making up 20% of the products found refrigerated.

When respondents had trouble deciding whether to refrigerate a product,

most of them decided to refrigerate, freeze, or eat the product immediately, or throw it away, rather than storing it without refrigeration. Only 34 respondents out of the 237 who reported uncertainty did not refrigerate the product. It is impossible to know which of these cases represent a true failure, because we lack specific information about the food product. We estimated whether the storage decision was probably safe by cross tabulating the type of food product, when the respon-

dents had trouble deciding (before or after opening), and where it was found when purchased. Most of these instances (24 of the 34) seem to have been unsafe decisions to not refrigerate products that should have been refrigerated.

Most often, respondents who had trouble deciding whether to refrigerate a product decided how to store it by reading the label or considering the type of food. We compared these figures with responses from respondents who did not have trouble deciding whether to refrigerate packaged products (n = 1764). The most common answers for this group were also to read the label and to consider the type of food (Table 2). People who had no trouble deciding how to store food were more likely to use the label in making storage decisions than those who did have trouble.

Because reading labels requires both literacy and motivation to engage in information seeking, we analyzed these questions by education. Education was positively related to reading the label among both those who did and those who did not have trouble deciding how to store a product. Respondents with less than a high school education were less likely to use the label and more likely to use “common sense” to determine where to store a product than those with a high-school education or higher (Table 2).

TABLE 3. Likelihood of difficulty deciding where to store a packaged food by demographic characteristics, risk sensitivity, and food-related behaviors

Variable	Adjusted Odds Ratio
Gender	
Female	1.3
Male	1.0 (ref) ^a
Race	
White	1.0 (ref)
Black	1.2
Other	1.3
Age	
18–25	1.1
26–39	1.6*
40–60	1.5
> 60	1.0 (ref)
Education ^b	1.2**
Information sources ^c	1.1*
Home Risk ^d	1.7**
Had foodborne illness ^e	2.1**
Eat raw ^f	1.5**
Practice-specific risk ^g	1.1
Cook main meal ^h	1.0
Cross-contamination ⁱ	1.0

Model fit: Likelihood Ratio $\chi^2_{df=14} = 77.7$ $P < .001$; percent correctly classified = 67%

*Significantly associated with storage indecision at $P < .10$

**Significantly associated with storage indecision at $P < .05$

^aReference category

^bA continuous variable for level of education

^cNumber of sources of food safety information and quantity per source (range 0 to 10)

^dBelieves that it is very common for people to get sick by food prepared at home

^eBelieves that someone in the household had gotten foodborne illness in the past year

^fHas consumed at least one raw food from animals in the past year

^gPersonal belief of how likely it is to get sick from four specific food handling errors

^hCooks the main meal at least some of the time

ⁱCross-contamination prevention practices (washing hands and cutting board). This variable is a combination of washing hands before cooking, after cracking raw eggs, and after touching raw meat or chicken and raw fish, and washing cutting boards after cutting raw meat or chicken and raw fish. The variable ranges in value from -6 to +6. Each variable was scored as safe (+1) or unsafe (-1). Those who did not engage in the behavior were given a score of safe. Those who engaged in the behavior but answered “don’t know” or “refused” were scored as unsafe

Logistic regression results

The logistic regression, which adjusted each variable for all others in the equation, showed that people who were more likely to be uncertain about storage had these characteristics: age 26 to 39 years, higher levels of education, receive food safety information from more sources, think that it is very common to get a foodborne illness as the result of the way food is prepared at home, report that they or a household member had a foodborne illness in the past year, and eat raw foods from animals (Table 3).

DISCUSSION

The results show that respondents rarely have trouble deciding where to store packaged products. When they do have trouble, it is likely that the products either are new to them or need to be stored in an unexpected way. The latter seems to have been the case for the three aforementioned cases of food botulism. Even though these foods were refrigerated at purchase, the victims did not refrigerate them at home (11). Food storage labels may be particularly important for such products. Storage statements on food labels are also important when the same person who does the shopping does not put away the food after it is brought home. Even if the food had been refrigerated at purchase, this information may not be communicated to the person putting the food away.

When respondents reported having trouble deciding where to store a product, most chose a safe option — store in the refrigerator, freeze, eat immediately, or throw away — but some (14% of those who reported having trouble deciding) make decisions not to refrigerate products that probably are unsafe to store at room temperature. This estimate of the percent of uncertain respondents who make unsafe decisions may serve as an approximate estimate for the total population. Those who were uncertain about storage are the more highly educated and the most sensitive to food safety information; for example, they used more sources for food safety information, believed that illness from home prepared food was more common, and were more likely to believe that a family member had recently been sick from food. These highly sensitized people

may be more aware of the consequences of unsafe foods and thus more likely to think about refrigeration decisions. Those who do not report having trouble with storage decisions are probably a diverse group that includes both those who always know what to do (and who store food safely) and those who do not realize that proper food storage is an important issue. The latter in particular may make critical mistakes when storing a product.

The food label, which gives product-specific information, is one of the two most important sources of storage information for both those who do and those who do not have trouble deciding how to store a particular food. Label use, however, is reported nearly three times as often by those who do not have trouble deciding on storage. The other frequently used source is common sense, which works only if the consumer is familiar with the storage requirements of the specific food in the specific type of package. We found a positive association between education level and label use. It is possible that those with a very low education are unable to read the storage information on the label or that finding such information is more burdensome for them.

These results highlight the importance of the presence on food labels of storage statements that can be easily found and understood by consumers. Storage statements for foods that need to be refrigerated for safety are intended to prevent the user from consuming an unsafe product and being harmed. In this sense, storage statements for safety serve some of the same purposes as warning labels. Some characteristics of a good warning label include: standardized placement, size, color, and wording of the statements, wording that is clear and understandable, and inclusion of a signal word that indicates that a warning is to follow (13). Sometimes symbols can be useful to signify a warning, such as the need to refrigerate a product for safety. Unlike words, symbols can often be interpreted by people with limited language proficiency or non-native speakers. Also, symbols can be easily recognized and easier to use than words (6). For a symbol to be effective, however, it must be easily identified and understood by consumers. Additional consumer research would be needed to determine the effectiveness of any proposed symbol that might accompany a storage statement.

The Food and Drug Administration (FDA) has provided guidance on refrigeration labeling. The Agency grouped foods into three categories depending on whether the food needs to be refrigerated for safety or for quality and whether the product needs to be refrigerated before or only after it is opened. The first groups of foods are those that need to be refrigerated at all times for safety reasons. The Agency recommends that these foods display the label:

IMPORTANT Must Be Kept Refrigerated To Maintain Safety

The second group of foods must be refrigerated after opening to maintain safety and should have the label:

IMPORTANT Must Be Refrigerated After Opening To Maintain Safety

Finally, the third group of foods needs refrigeration to maintain quality and should be labeled as “Refrigerate for Quality” (4).

To help with ease of reading, FDA suggested that for foods in the first two groups the statement be set off by hairline marks and have these type characteristics: (1) Be on a contrasting background; (2) utilize a single, easy-to-read style and size; (3) have at least one point leading (space between two lines of text); and (4) ensure that letters never touch.

The food industry has issued slightly different recommendations about how foods that need refrigeration should be labeled. They recommend the use of two categories. Group A consists of “Highly perishable, packaged, processed foods that must be refrigerated for safety reasons” and Group B of “Products intended to be refrigerated that do not pose a safety hazard if temperature abused” (7). Industry recommends that Group A foods have the label, “* IMPORTANT * MUST BE KEPT REFRIGERATED” in a box on the food package and that Group B foods have the label, “Keep Refrigerated.”

Data from the Food Label and Package Survey (FLAPS) conducted by FDA in 1999 shows that although some type of storage information is often found on the label, the format is not the same for all products, even those in a single category. In addition, the 1999 results show that none of the products that FDA classified

in the first group (needing refrigeration for safety before and after opening) and only one of the products in the second group used the exact language prescribed in the FDA Guidance (1). Combining the results of both the Food Safety Survey and FLAPS, we conclude that the current storage information available on packaged products is not meeting the needs of all consumers.

ACKNOWLEDGMENT

The authors thank Carol Spease for conducting an early analysis of the FLAPS data for the first draft of this paper.

REFERENCES

1. Bender Brandt, M., C. J. Spease, G. June, and A. Brown. 2003. Prevalence of food safety, quality, and other consumer statements on labels of processed, packaged foods. *Food Prot. Trends*. 23:870–881.
2. Bureau of Transportation Statistics. Omnibus survey—household survey results—general methodology August 2000–March 2001. Accessed May 11, 2006 at http://www.bts.gov/programs/omnibus_surveys/household_survey/all_months.html.
3. Byran, F. L. 1988. Risks of practices, procedures and processes that lead to outbreaks of foodborne diseases. *J. Food Prot.* 51:663–673.
4. Guidance on labeling of foods that need refrigeration by consumers. 1997. 62 Federal Register 8248–8252.
5. Marth, E. H. 1998. Extended shelf life refrigerated foods: microbiological quality and safety. *Food Tech.* 52: 57–62.
6. McDougall, S. J., M. B. Curry, and O. De Bruijn. 1999. Measuring symbol and icon characteristics: norms for concreteness, complexity, meaningfulness, familiarity, and semantic distance for 239 symbols. *Behavior Research Methods, Instruments, & Computers.* 31:487–519.
7. National Food Processors Association. 1989. NFPA Bulletin 24-L, Guidelines for the development, production, distribution & handling of refrigerated foods. Washington, D.C.
8. Redmond, E. C., and C. J. Griffith. 2003. Consumer food handling in the home: a review of food safety studies. *J. Food Prot.* 66:130–161.

9. Rhodes, M. E. 1991. Educating professionals and consumers about extended-shelf-life refrigerated foods. *Food Tech.* 45:162,164.
10. SAS Institute Inc. 1999–2001. SAS System for Windows, Version 8.02. Cary, NC.
11. Sobel J., N. Tucker, A. Sulka, J. McLaughlin, and S. Maslanka. 2004. Foodborne botulism in the United States, 1990–2000. *Emerging Infectious Diseases*. 10:1606–1611.
12. U.S. Food and Drug Administration. 2003. The unwelcome dinner guest: preventing foodborne illness. *FDA Consumer Magazine*. Available at www.fda.gov/fdac/reprints/dinguest.html. Accessed on June 11, 2006.
13. Wogalter, M. S., M. J. Kalsher, and R. Rashid. 1999. Effect of signal word and source attribution on judgments of warning credibility and compliance likelihood. *Internat. J. of Industrial Ergonomics*. 24:185–192.