

Domestic Refrigeration Practices with Emphasis on Hygiene: Analysis of a Survey and Consumer Recommendations

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ABSTRACT

A Web-enabled survey was conducted to improve knowledge of home refrigeration practices of French consumers ($n = 809$), with an emphasis on hygiene, and this information was used to establish recommendations. The survey targeted a convenience sample of working people. Analysis of the survey responses revealed that efforts should be directed toward improvement of microbiological control measures. Only 37% of respondents made sure the temperature in their refrigerator was 4°C or below. Only 37% of respondents reported that they systematically wrapped food. Sponges, known to be frequently highly contaminated, were used by 89% of the respondents to clean their refrigerator, which indicates the need to recommend disinfection of sponges before they are used for cleaning. Twenty-seven percent of respondents used sodium hypochlorite (bleach), but it was applied without previous cleaning (21% of the users) or in the commercial concentrated form (7% of the users). The permanent presence of water condensation on the shelves was noted by 2% of respondents, suggesting imperfect closure of the door, with a consequence of higher energy consumption and water available for microbial circulation and growth. Thus, an important recommendation is to check the door gaskets and to ensure the tight closure of the door. Seventy percent of the respondents declared that they never put warm or hot food in the refrigerator. However, many people, when orally questioned, acknowledged that they leave dishes at ambient temperature overnight before putting them in the refrigerator. It therefore is essential to recommend that perishable food not be left for more than 2 h at ambient temperature.

The microbiological quality of food is the business of everyone involved, from production to consumption. The last place most food passes through before it is consumed is the domestic kitchen. In France, between 2001 and 2003 32% of declared food poisoning outbreaks occurred in the family home, about 200 outbreaks per year (5). The healthfulness and safety of food partly depends on preserving the cold chain, from the producer through to the consumer. However, a survey on domestic refrigerators in France (12) revealed that in one in four households, the average temperature of the refrigerator was above 8°C. Only 11% of refrigerators were at temperatures of 4°C or less, yet the ideal temperature for food conservation is between 0°C and 4°C (8). Sixty percent of respondents to the French National Survey on Individual Food Consumption (INCA) were unaware of the ideal temperature for safe food storage (27). Another cause for concern is the level of cleanliness in refrigerators (20).

We conducted a survey to evaluate consumer behavior with regard to refrigeration practices with an emphasis on refrigerator cleanliness. The information gathered may shed light on refrigerator cleaning practices and ideas and could be useful for designing hygiene recommendations for consumers.

MATERIALS AND METHODS

The electronic form to be filled in was designed using the Nvu software package (3) and was turned into a dynamic file using Hypertext PreProcessor language (PhP). We used access provider Free and its "Pages Perso" personal Web pages to set up a MySQL database and post the questionnaire online. We also created controls to make sure the questionnaire was properly filled in: the respondent was alerted if they failed to answer a question, and it was not possible to fill in and submit the questionnaire more than once from the same computer. The questions covered four topics: (i) the respondent, (ii) general information about their refrigerator such as the type of refrigerator, the type of refrigeration system, and the defrosting method, (iii) the state of wear of the refrigerator, and (iv) the user's habits with regard to refrigerator cleaning. There are three types of refrigeration systems: the classic static refrigeration (without ventilation) and two ventilation types. For the type in which air is forced by a fan, the cold surface of the evaporator is inside the refrigerator compartment and the air of the refrigerator's cavity is moved by a fan. In the type called "no-frost," the evaporator is located outside the refrigerated compartment and the cold air is forced into the refrigerator's compartment by a fan. There are three types of defrosting systems: (i) manual, in which the defrost is turned off and on again manually, (ii) semiautomatic, in which the defrost is turned off manually but restarted automatically, and (iii) automatic, in which defrost is turned off and on automatically. Most questions were multiple choice. In finalizing the questionnaire, we took into account the comments and comprehension difficulties of several people, some who were involved in the project and others who were not. Explanations to help the respondents could be easily accessed by

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following hypertext links to photographs of each of the six refrigerator types, descriptions of the three defrosting systems and three refrigeration systems, and an explanation of nondiluted bleach.

The survey was distributed by the 14 research groups involved in the project: nine public research institutes, four manufacturers of refrigeration equipment, and one private research institute. An e-mail message was sent to the 25 key persons in the project on 25 April 2006 inviting them to complete and return the questionnaire and to encourage people in their personal and professional networks to do likewise, using distribution lists. Accordingly, the sample was a convenience sample rather than a random sample. To approximate the desired number of 1,000 respondents, staff at the AFSSA (French Food Safety Agency) were contacted twice. Collection of completed surveys was stopped on 13 July 2006. This data collection protocol is the least costly and has the advantages of reaching a large number of people and not requiring personnel to administer the questionnaire. The anonymity that the Internet provides allows collection of responses that match reality closely, but because we did not solicit socioprofessional and geographical information, the survey results are not necessarily representative of the French population as a whole.

This opt-in quantitative survey produced 809 responses. The survey data were exported from the database to Excel (Microsoft, Redmond, Wash.) and then to Statgraphics Centurion XV version 15.2.00 (Sigmaplus, Levallois-Perret, France), which was used to perform all statistical tests. Cross-classifications and chi-square independence tests were used with all the data to investigate associations between two variables, for example, the association between the establishment to which the respondent belonged and a variable assessing food safety knowledge. Two-proportions comparisons tests were performed with all the data or on subsamples to compare cleaning methods of men and women respondents. The significance threshold was set at $P = 0.05$.

RESULTS

A summary of the main questions and their respective answers is presented in Table 1. The data from this survey are available on the Web site of the AFSSA (<http://www.afssa.fr/Documents/LABO-Ft-DonneesRefrigerateur.xls>).

Survey respondents. Of the 101 institutions and private companies with respondents who completed the survey, AFSSA had the highest participation, with 313 responses. There was no significant difference between AFSSA employees and other people either in the proportion who checked the temperature of their refrigerator ($P = 0.36$) or in refrigerator cleaning frequency ($P = 0.53$).

To determine whether there was an establishment effect, we considered the eight establishments that had produced the most responses (10 to 313 responses) and put the others in one group. In almost every group, the proportion of people who checked the temperature of their refrigerators was lower than the proportion who did not. The only exception was Bosch & Siemens Home (BSH; a European manufacturer of domestic refrigerators, which was a partner in the project). Of the 54 respondents at BSH, 28 monitored their refrigerator temperature. We therefore excluded the responses from BSH to ensure that there was no significant difference on this vigilance criterion according to the establishment involved ($P = 0.68$). The proportion of people who monitored the temperature of their refrigerator was

36% (this figure increases to only 37% when BSH respondents are included).

In all nine establishment groups, the proportion of people who said they had not read the instruction booklet for their refrigerator was lower than the proportion who said they had. The proportions do not significantly differ according to the establishment concerned ($P = 0.39$). Forty percent of respondents had not read their refrigerator's user manual, and 27% had read only part of it.

Of the 807 respondents who answered the gender question, 67% were women. In only three establishments was the number of women respondents smaller than (two establishments with 10 and 99 respondents) or equal to (one establishment with 28 respondents) the number of men respondents. In the AFSSA, the proportion of women respondents (75%) was significantly higher than the proportion of women calculated on the whole sample ($P < 0.001$).

Refrigerator attributes. Of the five types of refrigerator, three (American style, table top, and freezerless) were represented in our sample in proportions similar to those in French households in 2005 as identified by TNS Sofres (Montrouge, France; a French company specialized in market studies and opinion polls) for the French Association of Household Appliance Manufacturers (GIFAM, Paris, France) (Table 2). However, the proportion of bottom-freezer refrigerators was higher in our survey (36.6%) than that found in French households by TNS Sofres (21.5%) and the proportion of top-freezer refrigerators was lower (26.3% in our survey and 39.4% in the TNS Sofres survey). The most often quoted refrigerator age group was between 2 and 5 years; 52% of the respondents had a refrigerator that was 5 years old or newer, and 10% of respondents had refrigerators that were 10 to 15 years old.

The most common defrosting system was an automatic system (56%). Among respondents who had a refrigerator with a nonautomatic defrosting system, 61% defrosted the refrigerator more than once per year. The static system was the most common refrigeration system (51%).

Fifty-three percent of respondents did not know whether the inside walls of their refrigerator contained an antimicrobial, and only 8% knew that the walls did contain an antimicrobial.

Condition and use of the refrigerator. Thirty-nine percent of respondents said they had water condensation in the refrigerator, on the shelves and/or in the vegetable compartment. Regarding the water condensation on the shelves, 8% of all respondents said it was frequent and 2% said it was permanent. Sixteen percent said they had traces of food in their refrigerator, and 10% said there was visible mold.

Regarding outer packaging of foods (cardboard around yogurt containers or plastic around bottles of milk), 82% of respondents said they removed the outer packaging. Fifty-five percent of respondents usually wrapped any partly consumed foods, and 37% always did so. Seventy percent of respondents never put food in the refrigerator while the food was still warm or hot.

TABLE 1. Summary of the main survey questions, their respective answers, and number (n) and percentage of respondents

Question/answer	n	%
Are you a woman or a man?		
Woman	541	67
Man	266	33
Do you monitor the temperature of your refrigerator?		
Yes	299	37
No	510	63
How old is your refrigerator?		
<2 yr	157	19
Between 2 and 5 yr	260	32
Between 5 and 10 yr	232	29
Between 10 and 15 yr	84	10
>15 yr	50	6
Unsure	26	3
What type of defrosting system does your refrigerator have?		
Automatic	454	56
Manual	278	34
Semiautomatic	77	10
If manual or semiautomatic, what is the frequency of defrosting?		
More than once per mo	8	2
Once per mo	44	12
Every 3 mo	82	23
Two times per yr	85	24
One time per yr	98	28
Less than one time per yr	38	11
What type of refrigeration system does your refrigerator have?		
Static	416	51
No-frost	142	18
Air forced by a fan	45	6
Unsure	206	25
Do the inside walls of your refrigerator contain an antimicrobial?		
Yes	64	8
No	313	39
Unsure	432	53
Have you read the user manual of your refrigerator?		
Yes	263	33
No	325	40
Partly	221	27
Have you had some water condensation in your refrigerator?		
Yes	316	39
No	445	55
Unsure	48	6
If yes, where does the water condensation appear?		
On the shelves only	114	36
In the vegetable compartment only	94	30
On both	108	34
How often do you have water condensation on the shelves?		
Seldom	139	63
Often	66	30
Always	17	8

TABLE 1. Continued

Question/answer	n	%
How often do you have water condensation in the vegetable compartment?		
Seldom	112	55
Often	74	37
Always	16	8
Do you have some traces of food in your refrigerator?		
Yes	130	16
No	679	84
Do you have some visible mold in your refrigerator?		
Yes	77	10
No	732	90
Do you remove the outer packaging of your foods (cardboard or plastic)?		
Yes	662	82
No	147	18
Do you wrap your partly consumed foods?		
All of them	300	37
Most of them	443	55
Few of them	66	8
Do you put warm or hot foods in your refrigerator?		
Never	566	70
Seldom	228	28
Often	15	2
How often do you clean your refrigerator?		
More than once per mo	66	8
Once per mo	191	24
Every 3 mo	263	33
Two times per yr	172	21
One time per yr	82	10
Less than one time per yr	35	4
Do you sometimes clean your refrigerator partially?		
Yes	701	87
No	108	13
What kind of product do you use for cleaning your refrigerator?		
Washing-up liquid	354	44
Multipurpose detergent	344	43
Sodium hypochlorite	220	27
Impregnated wipes	117	14
White vinegar	40	5
Other: water, lemon juice, etc.	32	4
Does the washing-up liquid contain an antimicrobial?		
Yes	131	37
No	112	32
Unsure	111	31
Does the multipurpose detergent contain an antimicrobial?		
Yes	204	59
No	44	13
Unsure	96	28
What type of impregnated wipes do you use?		
Antimicrobial cleaning wipes	92	79
Cleaning wipes	17	15
Unsure	8	7

TABLE 1. Continued

Question/answer	n	%
What form of bleach do you use?		
Diluted form	205	93
Concentrated form	15	7
What kind of instrument do you use for cleaning your refrigerator?		
Soft sponge	718	89
Abrasive sponge	146	18
Cloth	128	16
Dishwasher	22	3
Brush	17	2
Disposable paper	11	1
Dishcloth	3	0.4
Do you rinse the surface after applying washing-up liquid, detergent, sodium hypochlorite, or impregnated wipes?		
Yes, washing-up liquid	317	90
Yes, multipurpose detergent	275	80
Yes, sodium hypochlorite	172	78
Yes, impregnated wipes	25	21
Yes, other product	38	53
Do you wipe the inside of your refrigerator after cleaning?		
Yes	606	75
No	203	25
If yes, what kind of instrument do you use to wipe?		
Cloth	327	54
Disposable paper	279	46

Cleaning the refrigerator. Quarterly cleaning was reported by 33% of the respondents (Fig. 1), 32% declared that they cleaned the refrigerator once per month, or more and 31% declared they cleaned it one or two times per year. The products most commonly used were washing-up liquid and multipurpose detergent. The impregnated wipes, multipurpose detergents, and washing-up liquids used contained antimicrobials as reported by 79, 59, and 37% of the respondents, respectively. Twenty-seven percent of respondents used sodium hypochlorite disinfectant (commonly known as bleach). Of these, 7% used bleach in its commercial concentrated form (a 2.7% solution) and 21% used it directly on the surface without prior cleaning.

The proportions of respondents who rinsed refrigerator surfaces after using washing-up liquid, detergent, bleach, or impregnated wipes were 90, 80, 78, and 21%, respectively.

Most respondents (89%) used a soft sponge to clean the refrigerator, 18% used an abrasive sponge, and 12% used a cloth. Six percent of all respondents declared that an abrasive sponge was the only cleaning instrument. After cleaning the inside of the refrigerator, 75% of respondents wiped the cleaned surfaces with a paper kitchen towel (46% of those who wiped) or a cloth (54% of those who wiped).

Although only 33% of responses were sent in by men, the cleaning frequencies reported by men were significantly different from those reported by women ($P = 0.005$) (Fig. 1a). The percentage of men who said they cleaned the refrigerator frequently was lower than that for women, and

TABLE 2. Refrigerator types in French households according to our survey and the TNS Sofres survey

Type of refrigerator	% of refrigerator types	
	Our survey (n = 809) ^a	TNS Sofres survey (n = 1,483) ^b
Double-door top freezer	26.3	39.4
Double-door bottom freezer	36.6	21.5
One door	24.7	24.0
Table top	10.6	13.5
American style	1.61	1.7
Others	0.12	

^a Conducted in 2006 with a convenience sample.

^b Conducted in 2005 (by a French company that specializes in market studies and opinion polls) with a sample representative of all French households (23).

for infrequent refrigerator cleaning the balance was reversed. Most of the answers regarding cleaning methods were similar for men and women respondents. For example, when bleach was used, 94% of women and 91% of men used it diluted, and 75% of women and 74% of men wiped the surfaces dry after cleaning. Only a few answers suggested that men did not clean the refrigerator with the same care as did women. However, only one significant difference was found with a two-proportions comparisons test (which can be performed only when the sample size is at least 100 in each group): women used bleach more often than did men (29% versus 22%, $P = 0.03$).

People who regularly checked the temperature in the refrigerator also cleaned it more frequently ($P < 0.0001$)

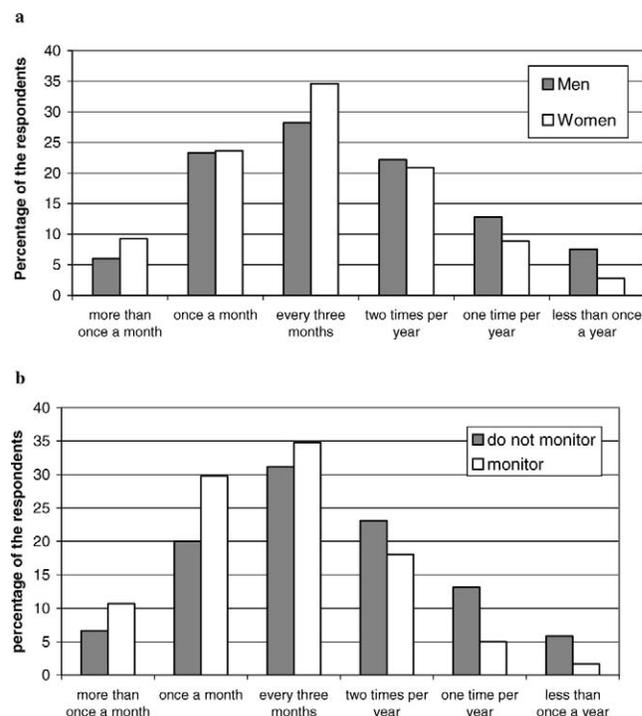


FIGURE 1. Frequency with which 809 survey respondents cleaned the inside of the refrigerator as correlated with (a) gender of the respondent and (b) whether the respondent monitored the temperature of the refrigerator.

(Fig. 1b). But there was no correlation between type of refrigerator and cleaning frequency ($P = 0.18$).

For refrigerators designed for manual or semiautomatic defrosting, 7% of respondents said that the refrigerator was defrosted more often than it was cleaned, 50% reported that it was cleaned more often than it was defrosted. Thus, refrigerators are not always cleaned after defrosting and may be cleaned without being defrosted.

DISCUSSION

The heavy representation by staff members of AFSSA, a specialist food hygiene institution, could be considered a serious bias in a survey about hygiene awareness, making the sample nonrepresentative of the French population as a whole. However, the responses from AFSSA staff on questions of whether they check the temperature of the refrigerator and how often they clean the refrigerator were not significantly different from those of other respondents. Only the staff of BSH, who made up only 6% of respondents, appeared to be more vigilant, but only in regard monitoring refrigerator temperature. Because double-door bottom-freezer refrigerators are generally more costly than double-door top-freezer refrigerators, the slight overrepresentation in our sample for double-door bottom-freezer refrigerators compared with those with the freezer at the top may be due to the fact that the survey targeted working people who probably had a higher standard of living than the national average. The percentages of the other types of refrigerators were close to those in French households as determined by TNS Sofres for the GIFAM (23) (Table 2).

The ages of the refrigerators in our sample and those reported by Derens et al. (12) also are similar. In that study, 51% of the refrigerators were less than 4 years old, and in our study 52% were less than 5 years old, and 11% were between 10 and 15 years old compared with 10% in our study.

Women accounted for a higher percentage of respondents in our study (67%) than in the French population (51%). The proportion of working women in AFSSA (63%) does not entirely explain this overrepresentation. A more likely explanation is that women are more involved in taking care of the domestic refrigerator. In support of this hypothesis, several male respondents specified that they had submitted their answers after asking their wives.

The low percentage of men in our survey probably reflects reality and should be taken as information revealed by the survey rather than a weakness in our sample. Only one aspect of our sample might lead to conclusions different from those that would be obtained with a sample fully representative of the French population; the balance of socioprofessional classes differed slightly from that suggested by TNS Sofres (Table 2).

Some respondents reported the presence of visible condensation on the shelves in their refrigerators, which is a food safety concern. Water in the form of condensation or trickles enables microorganisms to grow and circulate in a refrigerator. When a refrigerator is defrosted manually, water accumulates inside. Therefore, surfaces should be cleaned or at least wiped after defrosting. Similarly, the

surface should be wiped dry after cleaning as recommended in instruction booklets for refrigerators (1). However, if the wiping is done with a cloth that has already been used, the surface can be recontaminated (13). The permanent presence of visible condensation in 2% of respondents' refrigerators is particularly alarming and probably reflects the fact that the refrigerator doors did not close properly. A poorly sealed refrigerator door allows warm air to enter continually, and the water in the air will then condense in the refrigerator. One of the first recommendations consumers should be given is to make sure the door of the refrigerator closes tightly.

The survey revealed that a majority of respondents did comply with the recommendation of refrigerators manufacturers (as written in instruction booklets) not to put warm or hot food in the refrigerator (1). Putting warm food in the refrigerator increases energy consumption (because the refrigerator has to produce more cold air to compensate for the rise in temperature caused by the warm food) and causes condensation inside the refrigerator. However, the food cools more quickly this way, thus limiting microbial growth. Currently, the World Health Organization (WHO) (6) and AFSSA (8) recommend that perishable foods should not be left for more than 2 h at ambient temperature and that when a large quantity of a dish has been prepared, it should be divided into smaller portions so it can cool more quickly. This quick cooling reduces or eliminates the germination of spores that have resisted the heat of cooking, specifically spores of the pathogenic bacterium *Clostridium perfringens*, for which cooked meats (mainly beef but also chicken) are the main vehicle of transmission (16, 24). The major factor in food poisoning by this pathogen is temperature abuse after cooking (16). Although the issue was not raised in our questionnaire, many people when questioned orally acknowledged that they were in the habit of leaving dishes at ambient temperature overnight before putting them in the refrigerator. Therefore, it is essential to substitute the usual recommendation to avoid putting warm or hot food in the refrigerator with the above WHO recommendation.

Only 37% of respondents systematically wrapped food, even though wrapping food or putting it in boxes prevents dehydration and reduces the risk of food-to-food or refrigerator-to-food contamination; Evans et al. (15) found less microbial contamination in cold stores where the stored food was wrapped. However, 82% of respondents followed the advice to remove outer packaging from food. Outer packaging is exposed during handling, storage, and transport and is therefore considered a ready vehicle for molds and bacteria (14). The purpose of removing it is to prevent microorganisms from contaminating the food and the refrigerator and to allow more circulation of cold air around the food.

The cleaning frequencies in our survey are close to those from the INCA of 1999 (27). In that survey, 56% of respondents stated that they cleaned the refrigerators at least once every 3 months; in our survey this figure was 64%. The percentage of people who check the temperature of the refrigerator also was similar in these two surveys: 33% in

the INCA and 37% in our survey. In a telephone survey of 500 women (21), “the average frequency for cleaning the inside of the refrigerator was once every three weeks, while 40% of respondents cleaned theirs once a month and 18% once every three months.” In a recent nationally representative Web-enabled survey conducted in United States, about half of the 2,060 respondents had cleaned the refrigerator in the month before the survey (20). In a nationally representative survey conducted in France in 2007 in which respondents were asked about the frequency of a complete cleaning of the inside of the refrigerator, Debucquet and Merdji (11) reported that “once a year” was the most frequent response. There may be several reasons for such discrepancies. In a telephone survey conducted by Marrakchi et al. (21), the women interviewed were in direct contact with the interviewer, which may have influenced their responses. For the North American survey conducted via the Internet, the difference could be explained by differences in national habits, but the six possible responses to the question about when the refrigerator was last cleaned ranged from “less than a week ago” to “more than 8 weeks ago,” with an extra option of “do not clean inside of refrigerator.” Most of the possible answers consisted of a short time since the last cleaning, which may have led respondents to select a shorter interval than the real one. In the INCA, respondents were asked for the date of a “complete” cleaning, suggesting that the higher cleaning frequencies given in the other studies took into account partial cleaning of the refrigerator.

The respondents’ answers indicate a lack of understanding of the proper use of bleach as a disinfectant. Sometimes, they used it in the commercial concentrated form (a 2.7% solution), which may damage the surface and cause cracks into which microorganisms can more easily settle. More often, the bleach was applied directly onto the surface to be cleaned, where it could be at least partially inactivated by proteins present, making it either less effective or ineffective (26). Overuse of sodium hypochlorite can be harmful to the environment and dangerous to health, particularly if it comes in contact with an acid, which causes a release of toxic chlorine gas (4). Respondents did not systematically rinse the surfaces after cleaning, although rinsing is often specified in the instructions for use printed on the labels of household detergents.

To eliminate a maximum number of microorganisms, it is best to clean with a detergent, eliminating most of the dirt on the surface, and then disinfect (25). However, this procedure has a short-lived effect. To keep the microbial density on a surface low, cleaning and disinfection should be carried out regularly, as they are (daily or weekly) in food processing premises. However, there are two reasons for not recommending frequent cleaning and disinfection. First, cleaning frequency is not a priority compared with the other recommendations put forward here, because if the food is wrapped there is little risk of contamination in the refrigerator. Second, because people do not seem to be inclined to follow advice on cleaning the refrigerator frequently and thoroughly (11), it is likely that such a recommendation would not be followed. Nonetheless, com-

mon sense suggests that a surface should be cleaned as soon as it becomes visibly soiled. In our recent study (unpublished data) of 23 domestic refrigerators, we found that the microbial load (aerobic mesophilic bacteria) from surfaces was significantly greater when soil was visible. A principal component analysis of those data suggested a positive correlation between bacterial load from surfaces and cleaning frequency.

A sponge is the cleaning instrument most frequently used. According to Marrakchi et al. (21), most women change their washing-up sponge (which is likely to be the one used to clean the refrigerator) every 2 or 3 weeks on average, and 47% change it once a month. Most women (69%) disinfect their kitchen sponges. “They did this once every three days on average, and once a week in 41% of cases” (21). An effective way to disinfect a sponge is to impregnate it with water and put it in the microwave oven for 2 min (17). Such practices are recommended because using the same sponge to wash the dishes and to clean the refrigerator and other surfaces encourages the circulation of microorganisms in the kitchen (7, 17). Because a sponge is wet nearly all the time, it carries a heavy load of microorganisms (13, 18) and can contaminate the refrigerator (22). The abrasive side of the sponge should not be used; it is aggressive to surfaces and can cause scratches that foster the retention of dirt and microorganisms.

An inside refrigerator temperature of less than 4°C stops the growth of most pathogens such as *Salmonella enterica* (10) and considerably slows the growth of microorganisms such as the seriously dangerous *Listeria monocytogenes* (9). The temperature in the coldest part of the refrigerator can be checked in two ways: with a thermometer in a container of water or with a patch that indicates whether the zone is at a temperature below 4°C. Since 2002, it has been compulsory in France for manufacturers to fit home refrigerators with this type of device (2). However, the 2002 regulation appears to have had an impact only on manufacturers’ employees (in our study, half of these employees monitored the refrigerator temperature) based on the only slight difference between the percentage of respondents who monitored temperature in 1999 (33%) (27) and the percentage found in our study (37%). These percentages are both greater than that reported in 2005 (23%) from an Irish survey (19), suggesting differences in national habits.

The results of the survey indicate that there is room for improvement with regard to proper use of the domestic refrigerator. Five priority recommendations for improving the control of microbial hazards were identified. The refrigerator temperature should be 4°C or below; in our survey only 37% of respondents did so. Food should be wrapped; in our survey only 37% of respondents did so systematically. The door of the refrigerator must close tightly, to avoid the constant presence of condensation and trickling water, which was reported by 2% of our respondents. After cooking, perishables should not be left for more than 2 h at ambient temperature. And, last, all sponges (the most common cleaning instrument) should be correctly disinfected before being used to clean the refrigerator.

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