


Food handling in the domestic environment: an online questionnaire study with respondents from 24 of 26 Brazilian states

Manipulação de alimentos no ambiente doméstico: um estudo realizado com emprego de questionário online respondido por habitantes de 24 dos 26 estados brasileiros

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ABSTRACT

Using an online questionnaire, this study evaluated the profile of a Brazilian population's food handling practices in the home environment. The questionnaire, containing questions about domestic behavior in terms of hygiene and food handling, was built and available through social media sites. Information about the participants' profiles, their food pre-preparation, food preparation, and food post-preparation practices, and the occurrence of foodborne diseases (FBDs) was included in the questionnaire. A total of 701 responses were obtained. The interviewees included 78.31% female participants and 21.68% male participants, with an average age of 31.2 years. Nearly all (94.3%) had a complete or incomplete higher education. In the pre-preparation stage, the participants evaluated the shelf life (97.28%) and storage temperature (44.79%) of the products while purchasing them. Regarding food handling practices, only a few participants washed the food packages before storing them (31.95%) or removed hand jewelry or other adornments when washing food (61.48%). Most participants washed their hands (91.58%) and washed vegetables (99.28%). But a group of interviewees reported washing raw meat (27.81%) before preparing it. Cutting surfaces such as plastic (50.36%) and glass (49.36%) tops were the most prevalent in the study. Most respondents did not know how long they had been using their cutting boards (67.62%) and mentioned using the same surface to handle both raw and ready-to-eat products (84.17%). As for the preparation, most interviewees declared they did not check the food temperature during preparation (86.31%), ignoring the ideal cooking temperature (88.26%). Regarding the occurrence of FBDs, 79.17% of the interviewees reported having suspicious clinical signs associated with contaminated foods and 65.59% did not seek medical help. Thus, the participants demonstrated ignorance about adequate practices for food safety in the home environment, highlighting the need to conduct health education programs within the Brazilian population.

Keywords: Food safety. Good handling practices. Food consumption. Foodborne diseases.

RESUMO

Este estudo teve como objetivo avaliar o perfil das práticas de manipulação de alimentos no ambiente domiciliar no Brasil utilizando um questionário online. Um questionário contendo perguntas sobre comportamento doméstico em nível de higiene e manipulação de alimentos foi construído e disponibilizado por redes sociais. O questionário continha informações sobre o perfil dos participantes, suas práticas de pré-preparo, preparo e pós-preparo de alimentos e a ocorrência de doenças transmitidas por alimentos (DTA). Obteve-se 701 respostas, os entrevistados foram 78,31% do sexo feminino e 21,68% do sexo masculino, com média de idade de 31,2 anos. A maioria (94,3%) possuía ensino superior completo ou incompleto. Na etapa de pré-preparo, os participantes avaliam o prazo de validade (97,28%) e a temperatura de armazenamento (44,79%) dos produtos no momento da compra. Em relação às práticas de manipulação dos alimentos, apenas alguns participantes lavavam as embalagens dos alimentos antes de armazená-los (31,95%) ou retiravam adornos ao lavar os alimentos (61,48%). A maioria dos participantes lavam as mãos (91,58%) e os vegetais (99,28%); entretanto, um grupo de entrevistados relatou lavar carne crua (27,81%) antes de prepará-la. Superfícies de corte como tábuas de plástico (50,36%) e de vidro (49,36%) foram os mais prevalentes no estudo. A maioria dos entrevistados não sabe há

quanto tempo usa as tábuas de corte (67,62%) e utilizam a mesma superfície para manusear produtos crus e prontos para o consumo (84,17%). Quanto ao preparo, a maioria dos entrevistados declarou não verificar a temperatura dos alimentos durante o preparo (86,31%), ignorando a temperatura ideal de cozimento (88,26%). Em relação à ocorrência de DVA, 79,17% dos entrevistados relataram que já apresentaram sinais clínicos suspeitos associados a alimentos contaminados e 65,59% não procuraram atendimento médico. Nesse sentido, os participantes demonstraram desconhecimento sobre as práticas adequadas para a segurança dos alimentos no ambiente domiciliar, evidenciando a necessidade de realização de programas de educação em saúde com a população brasileira.

Palavras-chave: Segurança de alimentos. Boas práticas de manipulação de alimentos no domicílio. Consumo de alimentos. Doenças transmitidas por alimentos.

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Introduction

The incidence of foodborne diseases (FBDs) has been increasing annually in recent years (Brasil, 2019; Centers for Disease Control and Prevention, 2021). According to epidemiological data from the Ministry of Health, 6,809 outbreaks of FBDs were reported between 2009 and 2018, of which 37.2% occurred in a domestic environment (Brasil, 2019). However, this number may be underreported, since the outbreaks that occur in these environments cause mild and self-limiting symptoms, resulting in the affected individuals often not seeking medical help (Hoelzer et al., 2018).

Inappropriate handling of food in the home environment can occur during the pre-preparation, preparation, and storage of food products (Rebouças et al., 2017; Andrade et al., 2020). Some factors relate to consumers, such as age, education level, type of employment, and lack of prior knowledge, which directly affect hygienic-sanitary conditions during food preparation (Luo et al., 2019; Ruby et al., 2019).

Studies have reported on the importance of the home environment in the occurrence of outbreaks and diseases in people in Brazil, the US, and Europe (European Food

Safety Authority, 2018; Brasil, 2019; Centers for Disease Control and Prevention, 2021). The data presented have led to a series of studies evaluating how these practices are directly related to the occurrence of cases or outbreaks of a home origin. Studies have shown that the main flaws during food handling are related to poor hygiene conditions in handling places, lack of personal hygiene, and cross-contamination between different surfaces (Soares et al., 2012; Rebouças et al., 2017; Dantas et al., 2018).

Thus, it is evident that hygiene education programs should be conducted to alert the population of risks and instruct them on the proper practices of food handling to reduce the occurrence of FBD (Cunha et al., 2014; Hessel et al., 2019). Several countries, such as the United States, have education programs for the home environment (Centers for Disease Control and Prevention, 2020). In Brazil, training and programs on food handling are related to service providers, such as restaurants and snack bars (Brasil, 2004). This training program aims to elucidate questions about food handling in food services, but also, as recommended by Anvisa, to be used as a guide for improving food handling at the domestic level. However, few studies support the surveillance agencies in imparting knowledge of adequate food handling practices (Rebouças et al., 2017; Hessel et al., 2019; Andrade et al., 2020; Baptista et al., 2020).

Thus, the present study objective is to evaluate a profile of the Brazilian population in terms of its food handling practices in the home environment through an online questionnaire related to hygiene in pre-preparation, preparation, and storage of food at home.

Material and Methods

An online questionnaire (Google Forms/Google Inc.) containing information regarding hygiene, handling, and food preservation practices in the domestic environment was created. The questionnaire was divided into four parts: 1) general information, 2) food pre-preparation, 3) food preparation and post-preparation, and 4) occurrence of FBD. The questions and possible responses to this form are shown in Table 1. The questionnaire was initially shared

Table 1 - Questions, possible answers, and types of responses to the form supplied to the respondents of an online questionnaire study with respondents from 24 of 26 Brazilian states about food handling in the domestic environment

Questionnaire section	Questions	Possible answers	Type of answer
General information	City and state of origin	Name of city and state of origin	Free text
	Gender	Male; Female	Simple choice
	Age	Age	Number
	Education level	Complete or incomplete high school/elementary school; complete or incomplete higher education	Simple choice
	Do you have pets?	Yes; No	Simple choice
	Do the pets have access to the kitchen?	Yes; No	Simple choice
	Type of food storage equipment you have	Top freezer refrigerator; refrigerator without a freezer; freezer	Multiple choice
Food pre-preparation	When you arrive home from the supermarket, what kind of food do you store first?	Frozen; chilled; fruits and vegetables; grocery products; cleaning products	Sequential
	Indicate where in the refrigerator the food should be stored:	Indicate the area on the refrigerator where raw meats, frozen products, fruits and vegetables, cheeses and ham, leftover food, pasteurized milk, UHT milk, and eggs must be stored	Indicate the area on a figure
	Do you sanitize packaging before storing food in the refrigerator?	Yes; No	Simple choice
	Do you remove adornments before handling food?	Yes; No	Simple choice
	What do you observe when purchasing food?	Expiration date; preparation method; storage temperature; packaging integrity; nutritional information; price; quality aspects	Multiple choice
	How often do you wash your hands before preparing food?	Always; almost always; rarely	Simple choice
	Do you wash food before preparation?	Yes; No	Simple choice
	Which food do you wash before preparing it?	Vegetables; meat	Multiple choice
	What type of cutting surface do you have?	Wood; plastic; glass; steel; ceramic	Multiple choice
	Do you know the usage time for each surface?	Yes; No	Simple choice
	Is the surface you own used for raw and ready-to-eat foods?	Yes; No	Simple choice
	If you have only one surface, which procedure sequence do you follow?	Use for vegetables; use for raw meats; wash	Sequential
	How do you clean cutting surfaces?	Cold water only; only hot water; water + detergent + scrubbing; water + detergent + scrubbing + sanitizing	Simple choice
	How do you usually defrost your food?	Room temperature; refrigerator; microwave	Multiple choice
Food preparation and post-preparation	Do you check the temperature during cooking?	Yes; No	Simple choice
	Do you know the ideal cooking temperature for each food?	Yes; No	Simple choice
	What do you do with leftover food?	Put hot food in the refrigerator; let it cool at room temperature and store in the refrigerator; store it in a container outside the refrigerator	Simple choice
Occurrence of FBD	Have you had food poisoning signs such as vomiting or diarrhea after eating some food?	Yes; No	Simple choice
	Did you look for a health clinic after displaying signs of food poisoning?	Yes; No	Simple choice
	What was the production location of the food involved?	Home environment; social event; restaurants; snack bar	Multiple choice

with a test group of 10 people to validate and check for possible errors and inconsistencies in the questions. The questions were constructed based on the recommendations from Brazilian Health Regulatory Agency (Anvisa) using the document “Cartilha de Boas práticas nos serviços de alimentação - Resolução 216/2004” (Brasil, 2004).

The size of the sample population to be interviewed was based on the total Brazilian population (approximately 207,000,000 inhabitants), according to the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística, 2016), and adopting a 99% significance level and a margin of error of 5% (StatCalc – Epi Info™ 7.1.5). This resulted in a total of 663 individuals being interviewed.

An online access link to the questionnaire was made available via email, social networking pages, and websites related to the food safety area. On the first page of the form, a brief explanation of the objectives of the study was provided and, if the respondents agreed to participate by filling out an Informed Consent Form (ICF) they would begin to fill in the questions on the questionnaire.

Completion access was available for 10 days (April 30 to May 9, 2016), after which the link was deactivated, meaning it was no longer possible to insert responses. As the form was made available via email and social networks – thus, avoiding screening – responses from non-Brazilian individuals and people under 18 years of age were considered as criteria for data exclusion. The research was approved by the Certificate of Presentation of Ethical Appreciation 42695215.7.0000.5323 and Opinion no. 1.216.314. The data obtained were tabulated and expressed as a frequency of responses according to each section of the questionnaire.

Results

The form obtained 701 responses from 166 Brazilian cities and 24 federal units in Brazil, with only the states of Acre and Tocantins not being included. Regarding the gender profile of the interviewees (Table 2), 78.31% were female and 21.68%, were male. The average age was 31.2 years, with a higher frequency of responses received from people between 21 and 30 (45.36%). Most respondents had a complete or incomplete higher education (94.3%), had pets (66.33%) with access to the food production environment (75.48%), and had top freezer refrigerators (62.48%).

Table 3 shows the results of the pre-preparation stages of the food. Respondents were asked about the correct sequence in which food and other products (for example, nonperishable and cleaning products) were stored inside their refrigeration equipment after purchase at groceries stores. It is a correct practice to store the chilled/frozen

products first and, subsequently, the remaining products. Only 44.08% of the interviewees got this sequence correct. Subsequently, the respondents were requested to indicate the correct place for storing food in the refrigerator. The correct sequence is to store frozen products in the freezers, dairy products (cheeses, butter, pasteurized milk) and meat products (salami, pâtés, etc.) in the colder parts of the fridge (usually at the top), and fruits and vegetables in the less cold parts (at the bottom), with 65.62% of respondents responding correctly. In terms of observation of the characteristics of the products during purchase, the expiration date (97.28%) and storage temperature (44.79%) were the attributes most cited by the interviewees. Only 31.95% indicated that they washed the food before putting it in the refrigerator, 61.48% removed jewelry and other adornments (rings, watches, bracelets, etc.), and 91.58% cleaned their hands every time before handling food.

Most respondents reported washing food before preparation (99.91%), with 99.28% and 27.81% washing vegetables and meat, respectively (Table 3). Regarding the cutting surfaces, plastic (50.36%) and glass (49.36%) were the most prevalent materials, followed by wood (32.67%), steel (1.57%), and ceramic (0.43%). When asked what their practices were around using these surfaces, 67.62% of respondents reported not knowing how long they had been using a particular utensil, and 84.17% said that they used the same surface for handling raw and ready-to-eat products. For the interviewees who reported having only one food

Table 2 - Profile of respondents of an online questionnaire study with respondents from 24 of 26 Brazilian states about food handling in the domestic environment

Questions	Answers (number and frequency in %)
Gender	Male 152 (21.68)
	Female 549 (78.31)
Age range (in years)	18-20 62 (8.84)
	21-30 318 (45.36)
	31-40 210 (29.96)
	41-50 72 (10.27)
	51-60 36 (5.14)
	> 61 3 (0.43)
Education levels	Complete or incomplete high school 40 (5.7)
	Complete or incomplete higher education 661 (94.3)
Do you have pets?	Yes 465 (66.33)
	No 236 (33.66)
Do the pets have access to the kitchen?	Yes 351 (75.48)
	No 114 (24.51)
Type of equipment you own	Top freezer refrigerator 438 (62.48)
	Refrigerator without freezer 275 (39.22)
	Freezer 104 (14.83)

Table 3 - Number and frequency of responses regarding the stages of pre-preparing food of an online questionnaire study with respondents from 24 of 26 Brazilian states about food handling in the domestic environment

Questions	Answers (number and frequency in %)	
The sequence of food storage after purchase	Correct sequence	309 (44.08)
	Incorrect sequence	392 (55.92)
Food storage locations in the fridge/freezer	Pick the correct locations	460 (65.62)
	Pick the wrong locations	241 (34.38)
Do you sanitize packaging before putting it in the refrigerator/freezer?	Yes	224 (31.95)
	No	477 (68.05)
Do you remove adornments before handling food?	Yes	431 (61.48)
	No	270 (38.52)
What do you observe when purchasing food?	Expiration date	682 (97.28)
	Storage temperature	314 (44.79)
	Preparation method	108 (15.40)
	Packaging integrity	46 (6.56)
	Quality aspects	36 (5.13)
	Nutritional information	33 (4.7)
	Price	14 (1.99)
Do you clean your hands before preparing food?	Every time	642 (91.58)
	Almost every time	55 (7.85)
	Rarely	4 (0.57)
Do you wash food before preparation? Which foods?	Yes	699 (99.91)
	Vegetables	696 (99.28)
	Beef	195 (27.81)
	No	2 (0.29)
What type of cutting surface do you have?	Plastic	353 (50.36)
	Glass	346 (49.36)
	Wood	229 (32.67)
	Steel	11 (1.57)
	Ceramic	3 (0.43)
Do you know the usage time for each surface?	Yes	227 (32.38)
	No	474 (67.62)
Is the surface used for raw and ready-to-eat foods?	Yes	590 (84.17)
	No	111 (15.83)
If you have only one surface, do you know the proper sequence of use?	Correct sequence	153 (25.93)
	Wrong sequence	437 (74.07)
What is the way to clean cutting surfaces?	Water/detergent/scrubbing	523 (74.61)
	Water/detergent/scrubbing/sanitizing	157 (22.4)
	Only hot water	13 (1.85)
	Cold water only	8 (1.14)
Which way of defrosting food do you use?	In refrigerator	390 (55.63)
	Room temperature	319 (45.51)
	Microwave	253 (36.09)

preparation surface, they were asked what the sequence of use was. The correct practice is to first handle the products that are ready for consumption, followed by washing one's hands before handling raw foods, and this sequence was observed in only 25.93% of the answers. The most common surface cleaning process observed in the study was the use of running water, detergents, and mechanical scrubbing (74.61%). Regarding how the interviewees defrosted food, 55.63% defrosted meat while it was under refrigeration, 45.51% did it at room temperature, and 36.09% used the microwave defrost function.

Observations on the food preparation stage are shown in Table 4. Regarding the cooking temperature of the

food, 86.31% said they did not check the temperature during preparation and when asked about the appropriate temperature for cooking the food, 88.26% said that they did not know the ideal temperature. After preparation and consumption, 52.50% said they let the food cool to room temperature before putting it in the refrigerator, 45.79% put it into the fridge after meals, and the remainder left it in containers at room temperature until the next meal (1.71%).

Regarding the occurrence of FBD, 79.17% of the interviewees declared that they had experienced suspicious clinical signs, and most participants reported not seeking medical help (65.59%) (Table 5). Snack bars and restaurants (81.44%), and the home environment (30.99%) were attributed to

Table 4 - Number and frequency of responses regarding the stages of preparation and post-preparation of food of an online questionnaire study with respondents from 24 of 26 Brazilian states about food handling in the domestic environment

Questions	Answers (number and frequency in %)	
Do you check the temperature during cooking?	Yes	96 (13.69)
	No	605 (86.31)
Do you know the cooking temperature of the food?	Yes	71 (11.74)
	No	534 (88.26)
What do you do with leftover food?	Let it cool and put it inside the refrigerator	368 (52.50)
	Put hot food inside the refrigerator	321 (45.79)
	Store in a container outside the refrigerator	12 (1.71)

Table 5 - Number and frequency of responses regarding the information on foodborne diseases of an online questionnaire study with respondents from 24 of 26 Brazilian states about food handling in the domestic environment

Questions	Answers (number and frequency in %)	
Have you ever had signs of food poisoning such as vomiting and diarrhea after eating some food?	Yes	555 (79.17)
	No	146 (20.83)
Did you look for a health clinic after displaying the signs?	Yes	191 (34.41)
	No	364 (65.59)
What was the production location of the food involved?	Diner/restaurant	452 (81.44)
	Home environment	172 (30.99)
	Social event/Party	120 (21.62)
	Nursery/School	4 (0.72)

being the locations where there was the greatest frequency of food production.

Discussion

The study's results show that consumers evaluated had a lack of knowledge about the correct handling of food, even though most of the interviewees had a good level of education. This feature was also identified by Luo et al. (2019), Madaki & Bavorova (2019), and Ruby et al. (2019), where variables such as age, education level, prior knowledge about food safety, frequency of food preparation, and personal and professional contact with the health area were identified as factors that interfere with consumer behavior regarding the correct handling of food.

Inadequate food handling practices lead to direct risks to human health in three main ways: (a) those that allow cross-contamination, (b) those that allow microbial multiplication, and (c) those that are insufficiently effective for eliminating pathogens (Doyle & Beuchat, 2013). Failures related to these three pathways were observed in this study.

Cross-contamination is defined as the transfer of pathogenic microorganisms from a contaminated surface or product to another one that is innocuous (Oliveira et al., 2010). Thus, contamination routes can be through meat products, vegetables, cutting surfaces, equipment, and food handlers (Soares et al., 2012; Dantas et al., 2018; Hessel et al., 2019; Sibanyoni & Tabit, 2019). The present research demonstrates that some of the interviewees did not properly sanitize their hands and incorrectly stored food, used adornments during food preparation, and mainly used the same cutting

surfaces for handling raw and ready-to-eat products. These are factors that make cross-contamination possible in the domestic environment, favoring the occurrence of FBD.

Cutting surfaces are known to be a source of contamination for ready-to-eat products, even when appropriate hygiene practices are followed (Sibanyoni & Tabit, 2019). Soares et al. (2012) demonstrated that hygiene procedures routinely used, such as using water, detergent, and sanitizers, were not sufficient to eliminate *Salmonella* on glass, wood, and plastic surfaces, and that the pathogen was present on tomatoes after they were placed on the sanitized surfaces. In a study by Dantas et al. (2018), *Salmonella* Enteritidis biofilm producers were recovered after washing 100% of the analyzed surfaces, with biofilm production occurring on 60% of wooden surfaces, 40% on plastic, and 10% on glass. Thus, it is evident that the use of a single surface for the handling of raw and ready-to-eat products increases the chances of cross-contamination in the domestic environment. In addition, even when using different surfaces for different foods, a constant changing of cutting boards is recommended. However, this practice was not common among the consumers evaluated in the present study, as a good number did not know how to properly use their food surfaces.

Another fact that illustrates their lack of knowledge concerns washing food. Almost all of the respondents stated that they wash vegetables before preparing them (99.28%), which is a correct practice from a hygienic-sanitary point of view. However, 27.81% replied that they washed meat before preparation, a practice that predisposes them to

cross-contaminating different surfaces and foods (Centers for Disease Control and Prevention, 2021), as also observed by Kosa et al. (2015) and Hessel et al. (2019).

Practices that promote bacterial development were also observed in the present study, such as delays in storage, defrosting, and maintenance after preparing food at room temperature. Some of the participants demonstrated the perception that the priority is for frozen food to be stored over other products due to the possibility of defrosting leading to deterioration and contamination. In our study, the time that elapses between the purchase of products and storage was not questioned. However, time is a factor that must be considered. The occurrence of food poisoning can be caused by keeping food at temperatures that allow bacterial multiplication at high rates and the production of toxins, as in the case of outbreaks associated with *Staphylococcus aureus* and *Bacillus cereus* (Fetsch et al., 2014; Tewari & Abdullah, 2015; Xaplanteri et al., 2019; Al-Nabulsi et al., 2020; Maia et al., 2020). After preparing and consuming food, it is recommended to store leftovers in clean containers for a maximum of 2 h after preparation. Likewise, defrosting and marinating must always be carried out under refrigeration or inside microwaves (Centers for Disease Control and Prevention, 2020). When reheating food, sufficient temperatures must be used to eliminate most microorganisms (Ricci et al., 2020).

Another feature of this study was that respondents showed little knowledge related to cooking food. Most consumers (88.26%) reported not knowing what an ideal cooking temperature is. Heat treatment is essential to inactivate microorganisms. The minimum cooking temperature recommended for ground beef, pork, and lamb is 72°C, for chicken, 74°C, and seafood, 63°C (Brasil, 2004; Centers for Disease Control and Prevention, 2020). If the minimum temperature is not reached, there is a risk of pathogens remaining in the meat (Brasil, 2004; Centers for Disease Control and Prevention, 2020; Choi et al., 2020; Ricci et al., 2020). Thus, a lack of knowledge about these parameters may be a risk to the health of the consumers evaluated.

Although data on notification of FBD in Brazil are growing, underreporting and failures in the subsequent investigation steps mean that many cases are not identified (Dias et al., 2011; Hoelzer et al., 2018). When a new case of FBD is reported, it is important to notify the health authorities so that data can be collected and studies conducted related to the food and the identification of the pathogen involved, thus enabling a conclusive epidemiological investigation to be carried out (Brasil, 2010). As 65.59% of the interviewees who showed classic signs of FBD reported not having gone to a health clinic highlights the underreporting that exists in the country since these possible cases are not included in the

epidemiological data of the municipality's epidemiological surveillance departments.

The Brazilian regulation, RDC no. 216 of 2004, requires the implementation of good practices and standardized procedures by food services (restaurants and snack bars), intending to ensure the safety of food produced, offered, or marketed to the population (Brasil, 2004). However, epidemiological studies have shown that food services contribute significantly to the occurrence of FBD cases. Ferreira (2017) reported, in a retrospective study carried out with data from different regions in Brazil between 2000 and 2015, that 36.6% of the investigated FBD outbreaks occurred in the home environment, with the remaining taking place in restaurants (15.1%) and schools (8.4%), at social events (4.5%), in health units (2.7%), and nursing homes (0.5%). In a survey conducted in the state of Santa Catarina, Brazil, it was reported that 47.5% of the outbreaks were related to homes and 29.5% to commercial food services (Marchi et al., 2011). A study carried out in the United States (USA) evaluating data on outbreaks and diseases between 2009 and 2015, indicated restaurants (61%), snack bars (14%), and homes (12%) as the main places incriminated (Dewey-Mattia et al., 2018). These results are confirmed in Europe, where norovirus outbreaks are related to hotels, restaurants, and cafeterias (Hofmann et al., 2020). These results corroborate the results obtained in the present study, emphasizing the importance of hygienic-sanitary practices in domestic environments, along with adequate food handling.

This work showed that many food handlers do not have adequate information about the practices that must be followed during the pre-preparation, preparation, and packaging of food in Brazilian homes. The fact that most of the interviewees had a high level of education showed that this was not a factor that conditioned handlers to develop better handling practices. Besides this, the study shows that the people evaluated were unaware of proper food safety practices in the domestic environment, highlighting the need to conduct health education programs within the population to reduce the risks of FBD in the domestic environment.

Conflict of Interest

The authors declare no conflict of interest.

Ethics Statement

This research was approved by the Ethics Committee of São Paulo State University (Unesp), School of Veterinary Medicine and Animal Science, Botucatu, by the Certificate of Presentation of Ethical Appreciation 42695215.7.0000.5323 and Opinion no. 1.216.314.

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