SİDAS MEDYA
Akademik Gıda®
ISSN Online: 2148-015X
https://dergipark.org.tr/tr/pub/akademik-gida

Akademik Gıda 19(4) (2021) 381-392, DOI: 10.24323/akademik-gida.1050759

Research Paper / Araştırma Makalesi

Food Safety Knowledge, Attitudes and Practices of Consumers Regarding Meat Consumption at Home

Çiğdem Muştu[1], Veli Ceylan[2], Mehmet Sarıışık[2]

[1]Bilecik Seyh Edebali University, Vocational School, Program of Food Quality Control and Analysis, Bilecik, Turkey
[2]Sakarya University of Applied Sciences, Faculty of Tourism, Department of Gastronomy and Culinary Arts, Sakarya, Turkey

Received (Geliş Tarihi): 15.11.2020, Accepted (Kabul Tarihi): 19.12.2021
Corresponding author (Yazışmalardan Sorumlu Yazar): cigdem.mustu@bilecik.edu.tr (Ç. Muştu)
+90 228 214 2499 +90 228 214 13 32

ABSTRACT

This study is conducted to determine the meat purchase, storage, handling or preparation, and personal hygiene practices of consumers living in Istanbul and their level of knowledge on food safety practices. A questionnaire was sent to 830 consumers, who were responsible for primary shopping and cooking in their households. Participants achieved a certain score with their responses to the statements in the questionnaire. The difference between the sociodemographic characteristics of the participants and their scores was determined by independent samples t-test and one-way ANOVA. A significant difference was observed in participants' knowledge scores about meat purchasing and carrying, storage and preparation practices and gender ($p<0.05$). In addition, participants' meat purchase and carrying practices information scores were significantly influenced by monthly income while storage and preparation information scores were significantly affected by the age of participants ($p<0.05$). An insignificant difference between the personal hygiene and socio-demographic parameters was observed ($p>0.05$). By considering these results, it is recommended to prepare questionnaires and interviews to reveal the status of applications for measuring food safety information of consumers in other regions of Turkey, and planning preventive measures to eliminate risks in future studies.

Keywords: Food safety, Red meat, Poultry meat, Knowledge, Practices, Consumer

Tüketicilerin Ev Ortamında Et Tüketimi Konusundaki Gıda Güvenliği Bilgi, Tutum ve Uygulamaları

ÖZ

Bu çalışma, İstanbul'daki tüketicilerin et satın alma ve taşıma, depolama, hazırlama ve kişisel hijyen uygulamaları ile gıda güvenliği bilgi düzeylerini belirlemek amacıyla yapılmıştır. Anket, hanelerde birincil alışveriş ve yemek yapma sorumluluğunu üstlenen 830 tüketiciye gönderilmiştir. Katılımcılar ankette yer alan ifadelere verdikleri yanıtlarla belirli bir puan almıştır. Katılımcıların gıda güvenliği bilgisindeki puan farklılıklarının sosyo-demografik parametrelerden etkilenip etkilenmediğini araştırmak için ANOVA ve t testleri kullanılmıştır. Katılımcıların et satın alma ve taşıma, depolama, hazırlama ve kişisel hijyen uygulamaları hakkındaki bilgi puanları ile cinsiyet arasında anlamlı bir fark gözlemlenmiştir ($p<0.05$). Ayrıca katılımcıların et satın alma ve taşıma uygulamaları bilgi puanları aylık gelir faktöründen; depolama ve hazırlama bilgi puanları yaş faktöründen önemli ölçüde etkilenmiştir ($p<0.05$). Kişisel hijyen ve sosyo-demografik parametreler arasında anlamlı bir farklılık bulunmamıştır ($p<0.05$). Bu sonuçlar dikkate alınarak, gelecekte yapılacak çalışmalarda Türkiye'nin diğer bölgelerindeki tüketicilerin gıda güvenliği bilgilerinin ölçülmesine yönelik uygulamaların durumunu ortaya çıkarmak ve riskleri ortadan kaldıracak önleyici tedbirlerin planlanması için anket ve görüşmelerin hazırlanması önerilmektedir.

Anahtar Kelimeler: Gıda güvenliği, Kırmızı et, Kanatlı eti, Bilgi, Uygulamalar, Tüketici

INTRODUCTION

The food supply chain refers to a chain that reaches from farm to table. In this chain, consumers are the last segment that comes into contact with food. Food safety is of great importance in terms of the health and economy of consumers and professionals in the food-service sector of all countries [1]. It is the responsibility of the regulator authorities to regulate the food-service sector on food safety, but it is the consumer's responsibility to ensure the right conditions at home [2]. From this point of view, food safety knowledge and practices have an important effect on the emergence of foodborne diseases [3, 4].

The basis of ensuring foodstuffs is suitable to the consumers' consumption, and to protect them from foodborne diseases based on good hygiene practices in purchasing, preparation, cooking and storage processes [5]. Bryan [6] determined errors in the food preparation process as; contamination of cooked foods with raw foods, insufficient heat treatment applications, reheating the cooked food, food production with poor quality raw material, and not storing food at the proper temperature. In addition, cleaning practices (handwashing, dishwashing, using dishcloths, cleaning work surfaces) are also important practices that may pose a risk in foods if not appropriately [7, 8].

With the report published by the World Health Organization (WHO), it has been reported as a global problem that, one out of every 10 people become ill because of consuming contaminated foods [9]. In addition, according to the statistics indicated in the report published by the European Food Safety Authority (EFSA) and European Center for Disease Prevention and Control (ECDC) in 2018, one-third of foodborne diseases occur in homes. According to these studies, it is stated that consumer practices in homes have an important effect on increasing the number of foodborne diseases [10, 11, 12]. According to EFSA [13], consumer applications that cause the emergence of foodborne diseases are identified as especially cross-contamination, storage time, insufficient heat treatment, and storage under unfavorable conditions. Flynn [14] reports that these diseases are mostly caused by improper applications such as insufficient heat treatment and poor hygiene.

In the report published by EFSA and ECDC [10], it is stated that 60% of foodborne diseases that could be registered (643 diseases, 12.7% of total food-borne diseases) and the causes of which can be proved, are composed of foods of animal origin. It has been observed that meat and meat products (poultry, pork, beef, sheep and other unspecified red meat and products) cause the highest rate of disease (approximately 32%) among animal origin foods. Subsequently, there are seafood (approx. 28%), eggs and products (approx. 27%), and milk and products (about 13%). It is stated that Salmonella is the most critical pathogen bacterium in disease formation due to the wrong applications of consumers regarding meat and meat products, and *Clostridium Botulinum* and fungal toxins and *Trichinella* have been reported to cause disease only in foods prepared in the home environment [8, 10, 15]. As noted in this report that since there is no enforceable regulation for notification of foodborne diseases to a specific institution in Turkey, it is thought that data on foodborne diseases is wrong [16].

The emergence of foodborne diseases causes social and economic losses on communities and health systems [17, 18]. It is reported that the economic cost of foodborne diseases in the United States can be as high as 80 billion USD [19]. It is clearly seen that investigating the causes, determining risk factors and higher risk groups has become an important requirement to prevent these adverse effects caused by foodborne diseases [20].

A lot of research has been done to determine their level of knowledge about food processing, consumption, storage, and personal hygiene practices of food processors, consumers and students, and their demographic factors (ethnicity, gender, age, income and various consumer characteristics) affecting them. In their researches, Walker et al. [21] examined those working in food businesses in the UK; Bas et al. [22], those working in the food business in Turkey; Jevšnik et al. [4], those working in food businesses in Slovenia; Tokuc et al. [23], those working in the hospital food-service in the province of Edirne in Turkey; Abdul-Mutalib et al. [24], those working in restaurants in Malaysia; Sani and Siow [25], those working in the food business at Kebangsaan University in Malaysia; Moreb et al. [26], food processors in the Republic of Ireland; and Osaili et al. [27] examined food safety information, attitudes, and practices of food-service staff in hospitals in Jordan. Badrie et al. [5] evaluated consumers in Trinidad, West Indies; Unusan [28], evaluated consumers who have primary responsibility for preparing food in Konya in Turkey; Sanlier [29] evaluated the young and adult consumers in Ankara in Turkey; Kennedy et al. [30] evaluated consumers in Dublin in Ireland; Langiano et al. [31], evaluated consumers in the Cassino region of Italy; Farahat et al. [32] evaluated Saudi female consumers; Cheng et al. [33] evaluated consumers in Beijing urban areas in China; Liu and Niyongira [34] evaluated consumers in Nanjing and Beijing in China; Odeyemi et al. [35], evaluated consumers in developing countries in Asia and Africa; Okour et al. [20] evaluated consumers in Jordan; Bolek [1] evaluated attitudes, food safety knowledge, and practices about the food safety of consumers in the province of Istanbul in Turkey. Ozilgen [36] evaluated Turkish university students; Lazou et al. [37] evaluated Greek university students; Ovca et al. [38] evaluated students in Slovenia; Hassan and Dimassi [39] evaluated Lebanese university students; and Marklinder et al. [40] evaluated the knowledge, attitudes, and practices of university students in Sweden about food safety. These studies show that although food employees, consumers and students are generally aware of their personal hygiene needs, they have lack of knowledge or no knowledge about basic food hygiene (cross-contamination, critical

temperatures of hot or cold ready-to-eat foods, storage conditions, etc.). Some studies in Turkey show that food employees and consumers have a low level of knowledge [1, 22, 23, 29]. On the contrary, although there is a high level of food safety knowledge of the participants, there are also studies where there is a general awareness and lack of knowledge in food safety practices [28]. For this reason, it is stated that there is an urgent need to increase the awareness of food safety and to provide regular training in this field to increase the food safety knowledge levels of employees and consumers and to reduce the risks of foodborne diseases [4, 22, 26, 27]. In addition, government and related organizations are recommended to use mass media such as TV or broadcast and internet to provide more information to consumers on food safety [1, 33]. In some studies, it has been determined that food employees and consumers have excellent knowledge, attitude and good practices, although they have deficiencies in food safety [24, 25]. In addition to these, although meat and meat products are deemed as the riskiest product group that may cause disease among foods prepared in the home environment; studies on this important subject are limited [15, 16, 41-44].

The purpose of this research is to examine consumers' food safety knowledge and practices which claimed responsibility for food preparation in the home environment in Turkey. According to Turkish Statistical Institute [45] data, it is thought that Istanbul represents an important part of Turkish consumers because its population is determined as 15.519.267 and it is the most populous city in the country. Meat and meat products are considered as the most important risk group that causes food diseases worldwide. Based on this, it is aimed to examine the information of consumers living in Istanbul about buying meat, storing, preparing, and personal hygiene for processing food in the home environment.

MATERIALS and METHODS

Research Design

This research was carried out to determine food safety perceptions and food processing practices of those who take responsibility for preparing food in the home environment. In the study conducted between March-April 2020, 830 randomly selected consumers living in Istanbul were interviewed. Participants were randomly selected from those who prepare meals at home at least once a day and take primary shopping responsibility for their homes.

Participants were informed about the purpose of the study and asked if they would like to take part in a questionnaire on the safety of meat products in food preparation at home. Initially, all potential participants asked through their social media accounts, "Are you the person who is responsible for shopping and cooking at home?" and a questionnaire was applied to those who gave a positive answer.

The ethical consent required to collect research data was obtained with the decision of Sakarya University of Applied Sciences ethics committee, dated 9 November 2020 and numbered 26428519/044.

Instrument

In this study, the scale used as a data collection tool is an adapted version of the scale used by Mol et al. [2] in their research on seafood safety. The questionnaire was prepared to determine the demographic characteristics of the participants (gender, age, education, income), food processing practices (red and poultry meat purchasing, carrying, storage and processing practices) and personal hygiene habits. A five-point Likert Scale was used in the questionnaire, and negative expressions were coded reciprocally, and the scoring of these expressions was done reciprocally. The knowledge level score range for food safety practices is ranged between 5 and 25 for "meat purchasing and carrying" and "storage" practices; ranged between 6 and 30 for "meat products processing" applications; ranged between 2 and 10 for "personal hygiene" practices. The internal consistency reliability test was made between the expressions of the research scale, and the Cronbach Alpha (α) value was determined as 0.802. According to the studies in the literature, its reliability was determined at an acceptable good level [46]. There were also questions to determine where the participants bought meat products, how they store them, how they are defrosted, how long they keep them in the refrigerator and freezer, and how long they wash their hands.

Statistical Analysis

All data obtained within the scope of the study (n = 830) were analyzed using SPSS software (version 22.0, SPSS Inc., Chicago, IL, USA). Frequency analysis was used to determine the response percentage of respondents in each category. To determine the analysis management to be used in the difference analysis, the normality test was conducted initially. As a result of the normality analysis, Skewness and Kurtosis values of the scale-related data were determined between -1 and +1 (Skeness-0.408 / Kurtosis 0.508). Values in this range indicate that the data is normally distributed [47]. For this reason, parametric (t-test and one-way analysis of variance) tests were applied to determine food safety information scores and socio-demographic differences. ANOVA and t test were applied. The significance level was accepted as $p<0.05$ for all statistical comparisons [48]. Tukey multiple comparison test, which is one of the Post-Hoc analyzes, was used to compare food safety information scores between groups that showed significant differences as a result of ANOVA analysis.

RESULTS and DISCUSSION

Characteristics of Respondents

Demographic characteristics of the participants according to their gender, age, educational background,

and income are given in Table 1. 70% of the interviewed consumers were women, 53.5% were between the ages of 20 and 30, 50.8% have university degrees, and 55.4% were not working. A significant number of the respondents were identified as women, and the number of non-working participants was found quite high. Because most of the respondents were housewives who not working and were responsible for the preparation of meals.

Purchase and Transportation

Ensuring food safety is an important process that begins with the purchase of raw materials for the product to be prepared [2]. Applications of consumers in purchasing meat products and transporting them to home are given in Figure 1.

Table 1. Socio-economic and demographic characteristics of the participants

Demographic characteristics	Category	Frequency (N)	Percent (%)
Gender	Female	581	70.0
	Male	249	30.0
Age group	<20	81	9.8
	20-30	444	53.5
	31-40	106	12.8
	41-50	122	14.7
	>50	77	9.3
Education	Secondary school or less	125	15
	High school	283	34.1
	University	422	50.8
Monthly income ($)	Not working	460	55.4
	≤337	76	9.2
	338-439	89	10.7
	440-586	69	8.3
	587-733	58	7.0
	734 and higher	78	9.4

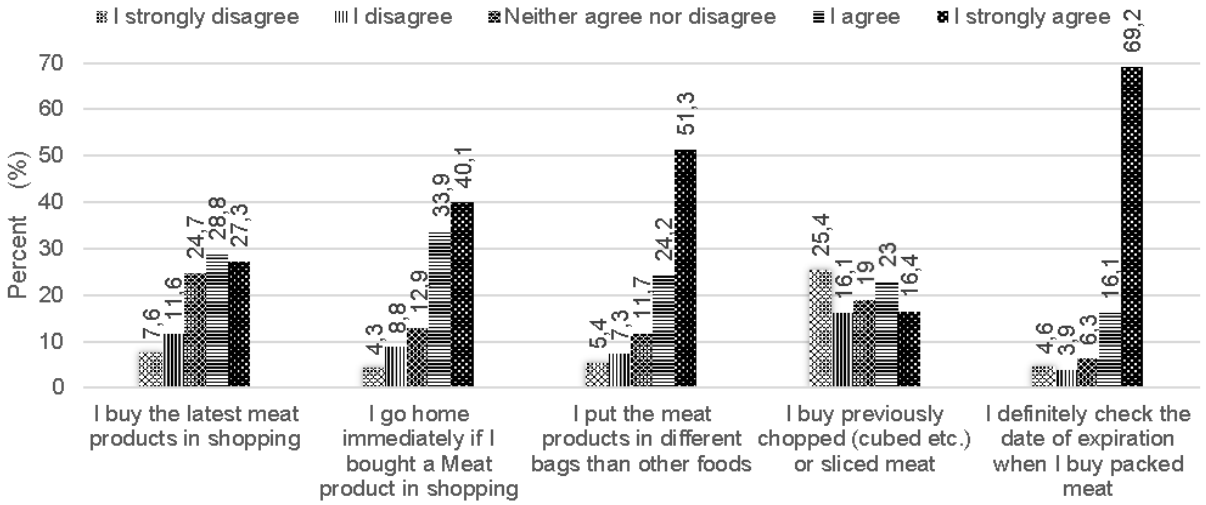

Figure 1. Practices of consumer during purchase and transportation

As a result of the longer breaks in the cold chain, pathogenic microorganisms can multiply rapidly and reach unacceptable levels, and this poses an important health risk for consumers [49]. More than half of the participants (56.1%), who are knowledgeable in this regard, stated that they bought meat products at the end of the shopping process. However, 19.2% of consumers did not find it important to buy meat products at the latest while shopping. The fact that many members of society know that meat is easily perishable, and this is one of the most important reasons for this situation. Similar findings were found in the studies performed in the literature. In their research, Moreb et al. [26] stated that 78.1% of consumers in Ireland; Gong et al. [50] 36.7% of consumers in China; Hassan and Dimassi [39] 59.7% of consumers in Lebanon; Lazou et al. [37] 55.3% of consumers purchase the products that should be kept cold at the end of the shopping process. In addition, 74% of the participants stated that when they buy meat products in shopping, they immediately go home. Likewise, Hessel et al. [51] stated that 72.3% of the participants brought chicken meat straightly home and cooled them within 30 minutes after purchasing.

The Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture recommends

that raw meat and seafood be transported in separate bags from other foods to prevent the broth from dripping into other foods during carrying [52]. Most of the participants (75.5%) do the right practice by stating that they strictly participate in the transport of meat products in separate bags from other foods. Karabudak et al. [16] stated that 4.8% of the participants use cooler bags while 15.2% use different bags for meat while carrying meat. Also, Mol et al. [2] determined that 66.1% of the participants carried it separately from other foods when they bought fish.

Since the surface area is increased by chopping and slicing the meat, microorganisms penetrate the internal tissues more easily and quickly, and show a faster logarithmic growth. Therefore, the shelf life of unedged and unsliced meat is longer [53, 54]. According to the results of the research, 41.5% of the participants stated that they disagreed with the relevant statement and did not purchase pre-chopped-sliced meat products, while 19% stated that they were uncertain about this issue. However, the percentage of respondents who stated that they purchased chopped and sliced meat is also high. Research findings show that consumers do not have sufficient knowledge on this issue.

Checking the expiration dates of foods at the time of purchase is an important practice in ensuring food safety. Thus, the risk of purchasing a product that may adversely affect the health of the consumer will be reduced. In addition, since it is not possible to taste or smell packaged products, Hall-Phillips and Shah [55] support the food quality control by checking the expiration date. A large part of the participants (85.3%) stated that they always check the expiration date when buying packaged products. This shows that the participants are trying to choose a food product whose nutritional content and freshness are preserved. Similarly, Bolek [1] stated that 62% of the participants; and Mol et al. [2] stated that 58.2% of the participants think expiration dates are important. One of the most important reasons for this finding is that controlling the expiry date is one of the most sensitive issues in Turkey.

The food safety score for meat purchasing and carrying practices was found for all participants as 19.14±4.26, for women's as 19.34±4.15 and for men's as 18.69±4.47. There is a statistically significant difference between the gender of the participants and their level of knowledge about buying and carrying meat ($p<0.05$). It is seen that women follow safer practices than men.

Furthermore, when other demographic characteristics were analyzed, it was observed that the level of knowledge of buying and carrying meat varies according to monthly income, however, it was not at a linear increase level. There was a significant difference between participants who do not work and whose income is up to $ 440, and participants with an income of more than $ 440 ($p<0.05$).

In addition to the questions in Figure 1, the participants were asked where they bought meat products most frequently. 61.1% of the participants stated that they bought meat products from the butchers in their neighborhood, 31.9% stated that they bought them from the supermarket, and 7% from any butchers. Hessel et al. [51] stated that 98.6% of the participants bought chicken products from supermarkets or butchers. Contrary to these values, Mol et al. [2] determined the 26.1% of participants buying fish from the supermarket and stated that most of the participants neglected this important detail. Consumers want to choose a retailer they can trust to reduce risk and increase safety. For this reason, they usually shop for beef, poultry and seafood from supermarkets or butcher shops [56].

Storage

Applications made by consumers to store meat products are given in Figure 2. According to the food preparation report of the Republic of South African Department of Agriculture, Forestry and Fisheries (DAFF), the cold chain should not be broken for more than 2 hours in carrying the meat [57]. While 86.6% of the participants put the meat product, they bought in the refrigerator within 2 hours, it is seen that 8.6% neglected this application. In his study, Kennedy et al. [58] indicated that it is seen that 95% of the participants cooled up to 2 hours after purchasing chicken meat. Breaking the cold chain is an important factor affecting food safety, and the fact that the food remains at a high ambient temperature for a long time during carrying causes an increase in the microorganism load [59].

According to the results of the survey, 89.7% of the participants stated that they store meat by packing them in a refrigerator or freezer. Moreb et al. [26] reported that 48% of the participants store the raw meat in a refrigerator by packing. Also, 59.9% of the participants put meat and other foods on separate shelves during storage. Murray et al. [60] stated in their research that, 91% of the participants store raw meat, poultry, and fish separately from other foods in the refrigerator, and for this purpose, 60% of the participants put the raw meat in a plastic bag. Similarly, Mol et al. [2] reported that consumers follow cross-contamination prevention practices during storage, and 69.8% of respondents store fish in a refrigerator or freezer, and 60.4% of them put it on a shelf different from other foods.

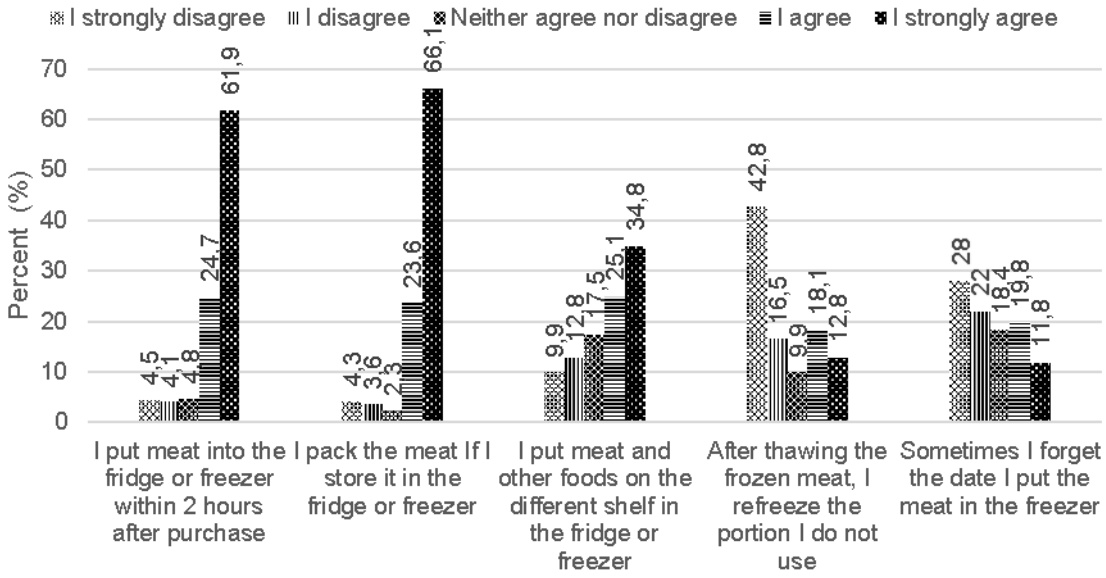

Figure 2. Consumer meat storage practices at home

Re-freezing of the thawed food not only affects its nutritional value and sensory properties, but also increases the number of microorganisms in the foodstuff [25]. While 59.3% of the participants stated that they do not freeze the thawed meat again, but on the contrary, 30.9% of them stated that they freeze the unused portion of the thawed meat. The rate of participants who re-freeze the meat was extremely high. In similar studies in the literature, the proportion of participants re-freezing thawed meat was lower than in this study. Karabudak et al. [16] stated that 89.7% of the participants; Al-Shabib et al. [61] 83% of them, Moreb et al. [26] 67.6% of them, and Tokuc et al. [23] 42% of the participants indicated that thawed meat will not be frozen for later use. However, Abdul-Mutalib et al. [24] reported that the participants had the wrong information about the re-freezing of thawed foods, and that the re-freezing process may cause dangers.

Storage is seen as an important step to ensure that food is consumed without losing its freshness. For foods with limited shelf life, the storage period of the product should be followed in both domestic and industrial applications. However, it is said that this situation is neglected in domestic applications [2]. 50% of the participants stated that they did not forget the date they put meat in the freezer. Similarly, Mol et al. [2] stated that 50.1% of the participants did not forget the date they put the fish in the freezer. In addition, storing foods at what temperature and for how long are other important factors in storage. The ideal maximum cooling time for raw meat cannot be given precisely as it will vary depending on the microbial load of the meat at the time of purchase [62]. The United States Department of Agriculture (USDA) recommends that raw poultry foods should be cooled in the refrigerator (at 4°C or lower) for a maximum of 2 days [63]. In comparison, there is the advantage of inhibiting the proliferation of both pathogenic and degrading microorganisms and longer storage time with the freezer temperature (below −10 or −12°C) [62, 64, 65]. When respondents were asked about the time to store the meat in the refrigerator, 27.6% of the participants stated that they consume the meat products within the day they purchased, and 27.1% of them consume it within 1 day after the purchase; 25.3% of them stated that they consume within 2-3 days after purchase. In addition, when they asked about the time to store the meat in the freezer, 29% of the participants declared it as 1-3 months, 20.5% as less than 1 month, and 17.6% as less than 15 days. Remarkably, 16.1% of the participants reported that they kept the meat in the refrigerator for 4-6 months. Moreb et al. [26] asked participants what the best temperature is for storing frozen food, and 7.8% of them stated as 4°C, 63.7% as -18°C or below. Katiyo et al. [44] explained that 81% of the participants stated that they store chicken meat in the refrigerator for a maximum of 2 days; 15% of the participants stated that they stored it for 2-7 days. However, since increasing storage time will cause the growth of pathogenic bacteria especially in chicken meat, it may put consumers at risk of food poisoning. Karabudak et al. [16] stated that 70% of the participants store raw meat less than 2 days in the refrigerator (5°C), and 99.1% of the participants store them less than 1 month in the freezer.

The food safety score for meat storage applications was found for all participants as 19.34±3.63, women's as 19.7±3.57, and for men's as 18.5±3.64. As with the purchasing and carrying practices, there was a statistically significant difference between the gender of the participants and their level of knowledge about meat storage ($p<0.05$). When the relationship between education and meat storage information level was examined, no significant difference was found ($p>0.05$).

In addition, when the meat storage information levels are evaluated by considering the age factor, it was observed that the age of the participants increases proportionally as the age increases. There was a significant difference between the age factor and

storage practices score ($p<0.05$). According to the Tukey test result, this difference occurred between the participants under the age of 20 and the participants between the ages of 20-30 and the participants over the age of 50.

Food Handling and Preparation Practices

Preparing and cooking meat products for consumers at home is given in Figure 3. The temperature range at which the disease-causing bacteria multiply in the fastest way is 5-60°C. For this reason, especially cold chain products should be stored at an appropriate temperature in order to ensure the microbial safety of foods [16, 59]. 30.9% of the participants stated that they leave the meat on the kitchen counter if they will cook them within the day. It is seen that these participants neglect food safety practices for meat by leaving them at room temperature.

It is known that washing hands with soap and water before preparing food as a food safety practice, reduces the risk of cross-contamination [41]. Likewise, 82.8% of the participants wash their hands after touching the raw meat and before touching another food, and this is an application that reduces the risk of cross-contamination. Badrie et al. [5] stated that 79.3% of the participants Karabudak et al. [16] stated that 69.1%, Kennedy et al. [58] stated that 64.6%; Jevšnik et al. [4] stated that 57.1% of the participants wash their hands with soap and warm water after processing raw meat, poultry, or fish during food preparation. Besides, the use of antibacterial cleaning products is important in preventing cross-contamination when cleaning kitchen surfaces. 59.2% of the participants stated that they agree with the relevant statement and added that they use antibacterial cleaning products in the kitchen. Badrie et al. [5] stated that 43.7% of the participants use bleach and 15% of the participants use commercial disinfectants in cleaning kitchen benches and other surfaces that come into contact with food.

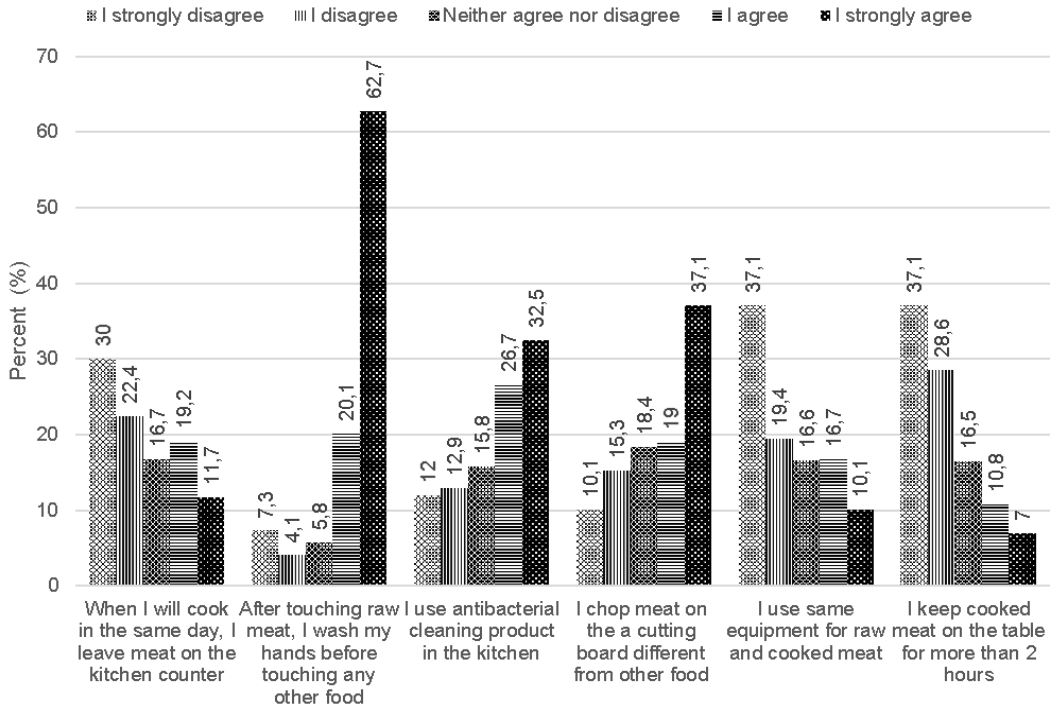

Figure 3. Food-handling and preparation practices of the consumer

Using a cutting-board different from other foods for raw meat is a highly recommended practice in domestic kitchens to prevent cross-contamination [41]. 56.1% of the participants agreed with the relevant statement and stated that they cut meat at a different cutting board from other foods. Chopping raw meats on a cutting board different from other foods is one of the most sensitive issues in food safety applications. Similar results have been obtained in the relevant studies in the literature. Hessel et al. [51] indicated that 76.5% of the participants; Moreb et al. [26] that 51.2%; Hassan and Dimassi [39] that 38.6% of the participants used different cutting boards for meat and other foods. Also, 56.5% of the participants stated that they used different equipment for raw and cooked meat to prevent cross-contamination. Burke et al. [66] explained that 97.7% of the participants; Murray et al. [60] that 88%; Sani and Siow [25] that 82.8%; Abbot et al. [67] that 63%; and Uggioni and Salay [68] that 54.8% of the participants have applied the raw meat and cooked meat correctly by using different equipment.

According to the survey results, it is seen that 65.7% of the participants did not keep the cooked meat on the table for more than 2 hours. Stein et al. [69] stated that 82% of the participants; Murray et al. [60] stated that 81% of the participants report that they have cooled the remaining meat within 2 hours after cooking. Hessel et al. [51] reported that 42.1% of the participants left

cooked chicken meat at the table less than 30 minutes; 38.8% of them wait 1 hour at the table.

The food safety score for meat handling and preparation practices was found for all participants as 22.14±4.35, for women's as 22.53±4.18 and for men's as 21.22±4.61. As in meat purchasing and carrying, and storage practices, the level of knowledge of female participants in meat handling and preparation was higher than men. Also, it is seen that consumers between the ages of 31-40 have the highest score in meat handling and preparation practices, while the consumers under 20 have the lowest score. It has been determined that there is a significant difference between the level of knowledge in meat handling and preparation practices and the age factor and this difference is due to the knowledge level scores of participants under 20 years old and participants between 31-40 years old ($p<0.05$).

In addition to the questions in Figure 3, the participants were asked how they thaw frozen meat. Thawing frozen meat at room temperature increases the growth rate of pathogen bacterias [70]. Roccato et al. [71] stated that the thawing of frozen raw chicken meat causes a significant increase in the number of *Salmonella Typhimurium* compared to refrigerator thawing on the kitchen counter. 40.6% of the participants reported that they had frozen meat on the kitchen counter, 37% in the refrigerator, 16.3% in water and 6.1% in the microwave. The rate of the participants who made the wrong application in defrosting the frozen meat is quite high. In the relevant studies in the literature, both similar and different findings were obtained from this study. In the study of Hassan and Dimassi [39], 38.5% of the participants were thawed frozen meat on the kitchen counter; 28% in the fridge; 20.2% in the microwave; and 11.3% dissolved in water. Nesbitt et al. [72] stated that 51.4% of the participants used a refrigerator, 30.6% microwave, 25.6% kitchen counter, and 7.6% water dissolution method in frozen meat thawing.

Consumer Hygiene

Hand hygiene is said to be more important in cleaning and disinfection of food contact surfaces in ensuring food safety at home [73]. Mol et al. [2] reported that short nails and not using accessories are important factors to ensure hand hygiene. Also, 50.8% of the participants stated that their nails were less than 1 cm in their study. According to the results of the survey, participants stated that 76.1% had short nails and 73.3% did not wear rings and watches while cooking (Figure 4). Similarly, Hassan and Dimassi [39] 76.3% of the participants; Al-Shabib et al. [61] reported that 75.9% of them removed their jewelry while preparing the meal. In contrast, Abdul-Mutalib et al. [24] reported that 54.7% of the participants wear jewelry while working.

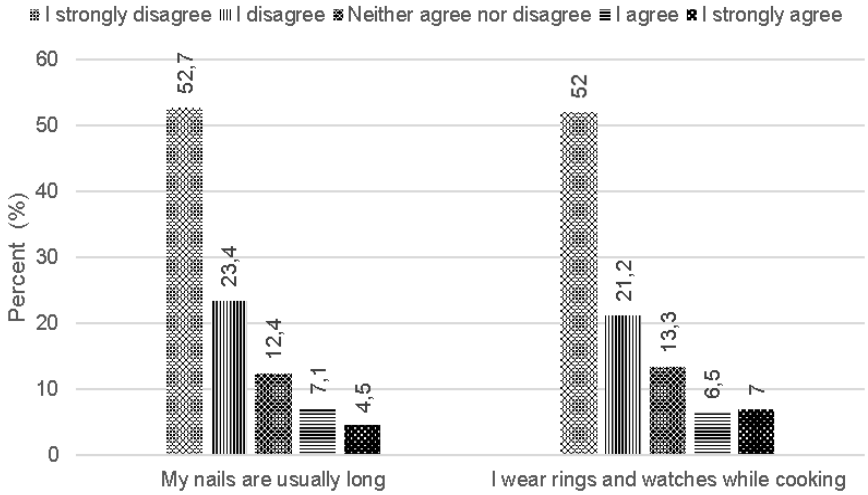

Figure 4. Consumer hygiene practices

Appropriate and sufficient duration of washing hands is an important factor in preventing contamination of food-borne microorganisms from employees [74]. In food handling applications, hygienic hand washing should be done using warm water, soap, or detergent, and by rubbing hands for at least 20 seconds [75] 46.9% of the participants stated that they washed their hands for 11-20 seconds and 39.5% for more than 20 seconds. Findings regarding the handwashing of the participants are at the desired level. In the relevant studies of the literature, it was found that the participants generally paid attention to hand hygiene. Burke et al. [66] stated that 66.4% of the participants, and Hassan and Dimassi [39] stated that 39% of the participants wash their hands for 20 seconds.

The food safety score of the participants for personal hygiene practices was found to be 8.17±1.92. For personal hygiene practices, the score of women was 8.15±1.88, while the score of men was 8.24±2.00. Although the level of knowledge of the participants about hygiene is similar, it is seen that men are higher than women. However, this was not identified as a significant difference ($p>0.05$).

In addition, when the knowledge levels of the participants regarding personal hygiene practices and other demographic features (age, education, and monthly income) were examined, no significant difference was observed in the information scores.

When the research was evaluated in general, there was a significant difference between food safety scores and gender for meat purchasing and carrying, storage, and preparation practices, and it was determined that female participants had better knowledge about food safety practices than men. This result was similar to previous studies on food safety practices [76, 77]. This may be related to the fact that 70% of the participants are women and 55.4% do not work. The fact that women in Turkey deal with food preparation at home more often than men, thus it is thought that they have more practical experience.

It is seen that age has a significant effect on food safety scores of participants for meat storage and preparation practices. Furthermore, food safety information on meat storage has been identified as a developing trend according to consumer age. Participants with the lowest level of meat storage and preparation knowledge were identified as young participants (<20 years old). In some previous studies, it has been found that young consumers generally have less information about food safety practices than older consumers [78]. This situation is evaluated because the individuals under 20 years of age have less responsibility to cook and have limited knowledge and skills. In other words, participants who are responsible for cooking, and elderly consumers with more culinary experience have more information about food safety.

When the food safety scores of the participants for meat purchasing and carrying, storage, preparation, and personal hygiene practices are analyzed according to monthly income, food safety information level differences are observed between the participants whose income level up to $440 and those with income level more than $440. Nesbitt et al. [72] determined that individuals with high-income are less concerned about food safety and made more dangerous practices in terms of food safety. On the other hand, Kwon et al. [79], reported that individuals have more appropriate food safety practices with an increase in income level. In this study, it was determined that the monthly income of the family affects food safety information scores and increases the average information score with the increase of income.

CONCLUSION

Although measures related to food safety have been increased in recent years, the increase in food-borne disease rates shows that people still practice unsafe applications in food preparation, storage, and consumption. Consumer practices, especially at home, have an important effect on the increase in the number of foodborne diseases. However, the rate of diseases caused by food preparation practices at home is not fully known due to many factors. Studies report that one-third of foodborne illnesses occur because of the production of food prepared at home.

This study shows that although the knowledge, attitude, and application levels of food processors in the home environment are satisfactory, storage and hygiene knowledge should be emphasized. Storage and hygiene practices require more theoretical knowledge, which is one of the important reasons for achieving this result. For this reason, it is necessary to provide food safety training to consumers regularly to raise the awareness of consumers. Food safety trainings will also increase the level of food safety knowledge of consumers, especially food hygiene and storage practices, by providing regular trainings to raise awareness of consumers, the information of food processors will be refreshed in areas that are deemed incomplete. For this purpose, public education programs can be planned all over the city in Istanbul due to its strategic location. In addition, retailers can contribute to increasing consumer awareness by providing food safety information on the labels or advertisements of meat products. By considering these results, it is recommended to prepare questionnaires and interviews to reveal the status of applications for measuring food safety information of consumers in other regions of Turkey, and planning preventive measures to eliminate risks, in future studies.

REFERENCES

[1] Bolek, S. (2020). Consumer knowledge, attitudes, and judgments about food safety: A consumer analysis. *Trends in Food Science & Technology,* 102, 242-248.

[2] Mol, S., Akay, K.U., Guney, G.Ç. (2018). Seafood safety at home: Knowledge and practices. *International Journal of Gastronomy and Food Science*, 13, 95-100.

[3] Clayton, D.A., Griffith, C.J., Price, P. (2003). An investigation of the factors underlying consumers' implementation of specific food safety practices. *British Food Journal*, 105(7), 434-453.

[4] Jevšnik, M., Hlebec, V., Raspor, P. (2008). Consumers' awareness of food safety from shopping to eating. *Food Control*, 19(8), 737-745.

[5] Badrie, N., Gobin, A., Dookeran, S., Duncan, R. (2006). Consumer awareness and perception to food safety hazards in Trinidad, West Indies. *Food Control*, 17(5), 370-377.

[6] Bryan, F.L. (1988). Risks of practices, procedures and processes that lead to outbreaks of foodborne diseases, *Journal of food protection*, 51(8), 663-673.

[7] Lange, M., Göranzon, H., Marklinder, I. (2014). Teaching young consumers'–food safety in home and consumer studies from a teacher's perspective. *International Journal of Consumer Studies*, 38(4), 357-366.

[8] Redmond, E., Griffith, C., Redmond, E.C. Griffith, C.J. (2006). Assessment of consumer food safety education provided by local authorities in the UK. *British Food Journal*, 108(9), 732-752.

[9] World Health Organization (WHO). (2015), Food Safety: What you should know? available at:

http://www.searo.who.int/entity/world_health_day/2015/whd-what-you-should-know/en/#targetText=Food%20safety%20is%20about%20producing,organic%20or%20locally%20produced%20food%3F (accessed 20 May 2020)

[10] European Food Safety Authority and European Centre for Disease Prevention and Control (EFSA and ECDC). (2018). The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2017. *The EFSA Journal (European food Safety Authority),* 16(12), 262.

[11] Meredith, L., Lewis, R., Haslum, M. (2001). Contributory factors to the spread of contamination in a model kitchen, *British Food Journal*, 103(1), 23-36.

[12] York, V.K., Brannon, L.A., Shanklin, C.W., Roberts, K.R., Barrett, B.B., Howells, A.D. (2009). Intervention improves restaurant employees' food safety compliance rates. *International Journal of Contemporary Hospitality Management*, 21(4), 459-478.

[13] European Food Safety Authority and European Centre for Disease Prevention and Control (EFSA and ECDC). (2016). The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2015. *The EFSA Journal (European food Safety Authority),* 14(12), 1-231.

[14] Flynn, K., Villarreal, B.P., Barranco, A., Belc, N., Björnsdóttir, B., Fusco, V., Jörundsdóttir, H.Ó. (2019). An introduction to current food safety needs. *Trends in Food Science & Technology*, 84, 1-3.

[15] Kennedy, J., Nolan, A., Gibney, S., O'Brien, S., McMahon, M.A.S., McKenzie, K., Healy, B., McDowell, D., Fanning, S., Wall, P.G. (2011). Deteminants of cross-contamination during home food preparation. *British Food Journal*, 113(2), 280-297.

[16] Karabudak, E., Bas, M., Kiziltan, G. (2008). Food safety in the home consumption of meat in Turkey. *Food Control*, 19(3), 320-327.

[17] Akhtar, S., Sarker, M.R. Hossain, A. (2014). Microbiological food safety: a dilemma of developing societies. *Critical Reviews in Microbiology,* 40(4), 348-359.

[18] Milton, A., Mullan, B. (2010). Consumer food safety education for the domestic environment: A systematic review. *British Food Journal,* 112(9), 1003-1022.

[19] Lando, A.M., Verrill, L., Liu, S., Smith, E. Branch, C.S. (2016). 2016 FDA Food Safety Survey, available at**:** https://www.fda.gov/media/101366/download (accessed 17 May 2020)

[20] Okour, A.M., Alzein, E., Saadeh, R., Alfaqih, M. (2020). Food safety knowledge among Jordanians: A national study. *Food Control*, 107216.

[21] Walker, E., Pritchard, C., Forsythe, S. (2003). Food handlers' hygiene knowledge in small food businesses. *Food Control,* 14(5), 339-343.

[22] Bas, M., Ersun, A.S., Kivanc, G. (2006). The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in food businesses in Turkey. *Food Control,* 17(4), 317-322.

[23] Tokuc, B., Ekuklu, G., Berberoglu, U., Bilge, E., Dedeler, H. (2009). Knowledge, attitudes and self-reported practices of food service staff regarding food hygiene in Edirne, Turkey. *Food Control*, 20(6), 565-568.

[24] Abdul-Mutalib, N.A., Abdul-Rashid, M.F., Mustafa, S., Amin-Nordin, S., Hamat, R.A., Osman, M. (2012). Knowledge, attitude and practices regarding food hygiene and sanitation of food handlers in Kuala Pilah, Malaysia. *Food Control*, 27(2), 289-293.

[25] Sani, N.A., Siow, O.N. (2014). Knowledge, attitudes and practices of food handlers on food safety in food service operations at the Universiti Kebangsaan Malaysia. *Food Control*, 37, 210-217.

[26] Moreb, N.A., Priyadarshini, A., Jaiswal, A.K. (2017). Knowledge of food safety and food handling practices amongst food handlers in the Republic of Ireland. *Food Control*, 80, 341-349.

[27] Osaili, T.M., Obeidat, B.A., Hajeer, W.A., Al-Nabulsi, A.A. (2017). Food safety knowledge among food service staff in hospitals in Jordan, *Food Control, 78,* 279-285.

[28] Unusan, N. (2007). Consumer food safety knowledge and practices in the home in Turkey. *Food Control*, 18(1), 45-51.

[29] Sanlıer, N. (2009). The knowledge and practice of food safety by young and adult consumers. *Food Control*, 20(6), 538-542.

[30] Kennedy, J., Gibney, S., Nolan, A., O'Brien, S., McMahon, M.A.S., McDowell, D., Fanning, S., Wall, P.G. (2011), Identification of critical points during domestic food preparation: an observational study. *British Food Journal*, 113(6), 766-783.

[31] Langiano, E., Ferrara, M., Lanni, L., Viscardi, V., Abbatecola, A.M., De Vito, E. (2012). Food safety at home: knowledge and practices of consumers, *Journal of Public Health*, 20(1), 47-57.

[32] Farahat, M.F., El-Shafie, M.M., Waly, M.I. (2015). Food safety knowledge and practices among Saudi women. *Food Control,* 47, 427-435.

[33] Cheng, L., Jiang, S., Zhang, S., You, H., Zhang, J., Zhou, Z., Xiao, Y., Liu, X., Du, Y., Li, J., Wang, X., Xin, Y., Zheng, Y., Shang, K. (2016). Consumers' behaviors and concerns on fresh vegetable purchase and safety in Beijing urban areas, China. *Food Control*, 16, 101-109.

[34] Liu, A., Niyongira, R. (2017). Chinese consumers food purchasing behaviors and awareness of food safety. *Food Control*, 79, 185-191.

[35] Odeyemi, O.A., Sani, N.A., Obadina, A.O., Saba, C.K.S., Bamidele, F.A., Abughoush, M., Aberoumand, A. (2019). Food safety knowledge, attitudes and practices among consumers in developing countries: An international survey. *Food Research International,* 16, 1386-1390.

[36] Ozilgen, S. (2011). Food safety education makes the difference: food safety perceptions, knowledge, attitudes and practices among Turkish university students. *Journal für Verbraucherschutz und Lebensmittelsicherheit,* 6(11), 25-34.

[37] Lazou, T., Georgiadis, M., Pentieva, K., McKevitt, A., Iossifidou, E. (2012). Food safety knowledge and food-handling practices of Greek university students: A questionnaire-based survey. *Food Control,* 28(2), 400-411.
[38] Ovca, A., Jevšnik, M., Raspor, P. (2014). Food safety awareness, knowledge and practices among students in Slovenia, *Food Control, 42,* 144-151.
[39] Hassan, H.F., Dimassi, H. (2014). Food safety and handling knowledge and practices of Lebanese university students. *Food Control*, 40, 127-133.
[40] Marklinder, I., Ahlgren, R., Blücher, A., Börjesson, S.M.E., Hellkvist, F., Moazzami, M., Schelin, J., Zetterström, E., Eskhult, G., Tham Danielsson, M.L. (2020). Food safety knowledge, sources thereof and self-reported behaviour among university students in Sweden. *Food Control*, 113, 107130.
[41] Altekruse, S.F., Street, D.A., Fein, S.B., Levy, A.S. (1996). Consumer knowledge of foodborne microbial hazards and food-handling practices. *Journal of Food Protection*, 59(3), 287-294.
[42] Donelan, A.K., Chambers, D.H., Chambers, E., Godwin, S.L., Cates, S.C. (2016). Consumer poultry handling behavior in the grocery store and in-home storage. *Journal of Food Protection*, 79(4), 582-588.
[43] Hallman, W.K., Senger-Mersich, A. Godwin, S.L. (2015). Online purveyors of raw meat, poultry, and seafood products: delivery policies and available consumer food safety information. *Food Protection Trends*, 35, 80-88.
[44] Katiyo, W., de Kock, H.L., Coorey, R., Buys, E.M. (2019). Assessment of safety risks associated with handling chicken as based on practices and knowledge of a group of South African consumers. *Food Control*, 101, 104-111.
[45] Turkish Statistical Institute (2019). Address Based Population Registration System (ABPRS), available at: https://biruni.tuik.gov.tr/medas/?kn=95&locale=tr (accessed 20 May 2020)
[46] Bhatnagar, R., Kim, J., Many, J.E. (2014). Candidate surveys on program evaluation: Examining instrument reliability, validity and program effectiveness. *American Journal of Educational Research,* 2(8), 683-690.
[47] Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R.L. (2013). Multivariate Data Analysis. Pearson Education, London.
[48] Acikel, C.H., Kilic, K. (2004). Method selection for medical researches. *Turkish Armed Forces Preventive Medicine Bulletin,* 3(7), 162-163.
[49] Alonso-Herhanndo, A., Alonso Calleja, C., Capita, R. (2013). Effectiveness of several chemical decontamination treatments against Gram-negative bacteria on poultry during storage under different simulated cold chain disruptions. *Food Control,* 34(2), 574-580.
[50] Gong, S., Wang, X., Yang, Y., Bai, L. (2016). Knowledge of food safety and handling in households: A survey of food handlers in Mainland China. *Food Control*, 64, 45-53.
[51] Hessel, C.T., de Oliveira Elias, S., Pessoa, J.P., Zanin, L.M., Stedefeldt, E. Tondo, E. C. (2019). Food safety behavior and handling practices during purchase, preparation, storage and consumption of chicken meat and eggs. *Food Research International,* 125, 108631.
[52] FSIS (US Food Safety and Inspection Service). (2013). Be smart. Keep foods apart. Don't cross-contaminate, available at: https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/safe-food-handling/be-smart-keep-foods-apart/ct_index (accessed 20 May 2020)
[53] Limbo, S., Torri, L., Sinelli, N., Franzetti, L., Casiraghi, E. (2010). Evaluation and predictive modeling of shelf life of minced beef stored in high-oxygen modified atmosphere packaging at different temperatures. *Meat Science*, 84(1), 129-136.
[54] Jaberi, R., Kaban, G., Kaya, M. (2019). Effects of vacuum and high-oxygen modified atmosphere packaging on physico-chemical and microbiological properties of minced water buffalo meat. *Asian-Australasian Journal of Animal Sciences*, 32(3), 421.
[55] Hall-Phillips, A., Shah, P. (2017). Unclarity confusion and expiration date labels in the United States: A consumer perspective. *Journal of Retailing and Consumer Services,* 35, 118-126.
[56] Behrens, J.H., Barcellos, M. N., Frewer, L.J., Nunes, T.P., Franco, B.D., Destro, M.T., Landgraf, M. (2010). Consumer purchase habits and views on food safety: A Brazilian study. *Food control*, 21(7), 963-969.
[57] DAFF (2020). Food preparation and home food safety (2002), available at**:** http://www.daff.gov.za/docs/Infopaks/FoodPrep.pdf (accessed 20 May 2020)
[58] Kennedy, J., Jackson, V., Blair, I.S., McDowell, D.A., Cowan, C., Bolton, D.J. (2005). Food safety knowledge of consumers and the microbiological and temperature status of their refrigerators. *Journal of Food Protection*, 68(7), 1421-1430.
[59] Paster, T. (2007). The HACCP Food Safety Training Manual. John Wiley & Sons, New Jersey.
[60] Murray, R., Glass-Kaastra, S., Gardhouse, C., Marshall, B., Ciampa, N., Franklin, K., Nesbitt, A. (2017). Canadian consumer food safety practices and knowledge: Foodbook study. *Journal of Food Protection*, 80(1), 1711-1718.
[61] Al-Shabib, N.A., Mosilhey, S.H., Husain, F.M. (2016). Cross-sectional study on food safety knowledge, attitude and practices of male food handlers employed in restaurants of King Saud University. Saudi Arabia, *Food Control*, 59, 212-217.
[62] Coorey, R., Ng, D.S.H., Jayamanne, V.S., Buys, E.M., Munyard, S., Mousley, C.J., Dykes, G.A. (2018). The impact of cooling rate on the safety of food products as affected by food containers. *Comprehensive Reviews in Food Science and Food Safety,* 17(4), 827-840.
[63] USDA-FSIS (2014), Chicken from farm to table, available at: https://www.fsis.usda.gov/wps/wcm/connect/ad74bb8d-1dab-49c1-b05e-390a74ba7471/Chicken_from_Farm_to_Table.pdf?MOD=AJPERES (accessed 15 May 2020)

[64] Koutsoumanis, K., Taoukis, P. S. (2005). Meat safety refrigerated storage and transport: modeling and management. In Improving the Safety of Fresh Meat, Edited by J.N. Sofos Woodhead Publishing, Cambridge, 503-561p.
[65] Tuncer, B., Sireli, U.T. (2008). Microbial growth on broiler carcasses stored at different temperatures after air-or water-chilling. *Poultry Science,* 87(4), 793-799.
[66] Burke, T., Young, I., Papadopoulos, A. (2016). Assessing food safety knowledge and preferred information sources among 19–29-year-olds. *Food Control*, 69, 83-89.
[67] Abbot, J.M., Byrd-Bredbenner, C., Schaffner, D., Bruhn, C.M., Blalock, L. (2009) Comparison of food safety cognitions and self-reported food-handling behaviors with observed food safety behaviors of young adults. *European Journal of Clinical Nutrition,* 63(4), 572-579.
[68] Uggioni, P.L., Salay, E. (2012). Consumer knowledge concerning safe handling practices to prevent microbiological contamination in commercial restaurants and socio-demographic characteristics, Campinas/SP/Brazil. *Food Control*, 26(2), 331-336.
[69] Stein, S.E., Dirks, B.P., Quinlan, J.J. (2010). Assessing and addressing safe food handling knowledge, attitudes, and behaviors of college undergraduates. *Journal of Food Science Education*, 9(2), 47-52.
[70] Medeiros, L.C., Hillers, V.N., Kendall, P.A., Mason, A. (2001). Food safety education: what should we be teaching to consumers? *Journal of Nutrition Education,* 33(2), 108-113.
[71] Roccato, A., Uyttendaele, M., Cibin, V., Barrucci, F., Cappa, V., Zavagnin, P., Ricci, A. (2015). Effects of domestic storage and thawing practices on Salmonella in poultry-based meat preparations. *Journal of Food Protection,* 78(12), 2117-2125.
[72] Nesbitt, A., Majowicz, S., Finley, R., Marshall, B., Pollari, F., Sargeant, J. Sittler, N. (2009). High-risk food consumption and food safety practices in a Canadian community. *Journal of Food Protection*, 72(12), 2575-2586.
[73] Todd, E.C., Greig, J.D., Bartleson, C.A. Michaels, B.S. (2007). Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 2. Description of outbreaks by size, severity, and settings. *Journal of Food Protection*, 70(8), 1975-1993.
[74] Montville, R., Chen, Y., Schaffner, D.W. (2001). Glove barriers to bacterial cross-contamination between hands to food. *Journal of Food Protection,* 64(6), 845-849.
[75] Jay, L.S., Comar, D., Govenlock, L.D. (1999). A national Australian food safety telephone survey. *Journal of Food Protection*, 62(8), 921-928.
[76] Byrd-Bredbenner, C., Berning, J., Martin-Biggers, J., Quick, V. (2013). Food safety in home kitchens: a synthesis of the literature. *International Journal of Environmental Research and Public Health*, 10(9), 4060-4085.
[77] Johannesson, J., Rothenberg, E., Dahlin Ivanoff, S., Slinde, F. (2016). Gender differences in practice: knowledge and attitudes regarding food habits and meal patterns among community dwelling older adults. *Journal of Aging Research & Clinical Practice*, 5(4), 220-228.
[78] Alqurashi, N.A., Priyadarshini, A., Jaiswal, A.K. (2019). Evaluating Food Safety Knowledge Practices among Foodservice Staff in Al Madinah Hospitals, Saudi Arabia. *Safety*, 5(1), 9.
[79] Kwon, J., Wilson, A.N., Bednar, C., Kennon, L. (2008). Food safety knowledge and behaviors of women, infant, and children (WIC) program participants in the United States. *Journal of Food Protection*, 71(8), 1651-1658.