



An Assessment Study on Consumer Knowledge and Purchasing Behavior Regarding Food Safety

Sengul ULUDAG ^a and Nermin BAHSI ^{a*}

^a *Osmaniye Korkut Ata University, Osmaniye, Turkey.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/acri/2024/v24i11968>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/126468>

Original Research Article

Received: 06/09/2024

Accepted: 09/11/2024

Published: 13/11/2024

ABSTRACT

Economic and technological developments affect consumers' purchasing behaviors along with their lifestyles. Understanding consumer characteristics and purchasing behaviors is of great importance for companies in determining target markets and preparing marketing programs. The aim of this study is to determine consumers' level of knowledge about food safety and their purchasing behavior regarding food products. For this purpose, a face-to-face survey was conducted with 400 consumers selected using the Simple Random Probability Sampling method. About 76% of the consumers participating in the study have heard of the concept of food safety. It was found that consumers primarily consider health safety, the expiry date, and the cleanliness of the place of purchase when buying food products. They prefer the products they consume to be fresh and mostly shop at supermarkets and hypermarkets. It was also determined that 53.8% of consumers pay partial attention to human health conditions in the places where food is produced, and 69% are willing to pay more for packaged foods. The level of food

*Corresponding author: Email: nerminbahsi@osmaniye.edu.tr;

safety knowledge among consumers will provide important feedback for food producers and policymakers, guiding the creation of more effective and safer food systems that address consumer needs.

Keywords: Food safety; purchasing behaviour; level of knowledge; packaged food.

1. INTRODUCTION

In order for living beings to continue their lives, the need for nutrition, which is among the compulsory needs, must be met. People can maintain good health with adequate and balanced nutrition throughout their lives. However, for people to maintain their health, it is not enough to have adequate and balanced nutrition; the foods consumed must also be safe and should not pose a threat to human health (Özkaya & Akbulut, 2016). At this point, the issue of people's access to healthy and safe food arises. Food security is defined as the right to always have access to physically and economically necessary food for humans to sustain their existence and healthy lives (Söğüt et al., 2020). Safe food can be defined as food that has been made suitable for consumption by eliminating all spoilage and contamination factors (Yüksel & Karagözlü, 2022). Food legislation defines foods that are harmless to health and carry an acceptable level of risk as 'safe food' (Madenci et al., 2019).

The growing global population, international trade, and industrialization have introduced various risks into the production and distribution processes of food products. These risks include those that may adversely impact human health, such as infectious diseases, chemical contamination, improper storage and transportation, hygiene deficiencies, food fraud, and the use of antibiotics and hormones. Additionally, risks such as climate change can negatively influence agricultural productivity and food production yields, consequently affecting food supply. Effective management and mitigation of these risks are essential to ensure food safety.

Ensuring food safety is vital for the consumption of food without endangering human health. According to the World Health Organization, food safety refers to the conditions and measures required to ensure that food is safe, healthy, and suitable for human consumption during all stages of production, processing, storage, distribution, and preparation (Çelik & Çelik, 2020). The Food and Agriculture Organization of the United

Nations (FAO) defines food security as the physical, social, and economic access of all individuals to sufficient, healthy, and safe food that meets their nutritional needs for an active and healthy life (Kırmacı & Özçelik, 2021). To prevent food safety issues and minimize economic losses, various international initiatives related to food safety have been implemented. These initiatives include quality assurance systems such as HACCP, GMP, GHP, ISO 9000:2000, ISO 22000, IFC, BRC, and EUREPGAP (Onurlubaş and Gürler, 2016; Çelik and Çelik, 2020). Quality assurance systems are predominantly adopted in developed countries, and in recent years, there has been an increase in participation from developing countries as well (Dölekoğlu, 2003; Onurlubaş & Gürler, 2016).

Consumption of food that does not meet safety standards can lead to various foodborne diseases, impacting societies not only in terms of health but also economically, socially, and politically (Çelik and Çelik, 2020). Preventing foodborne illnesses, maintaining food quality, and establishing sustainable food systems are central goals of food safety. Furthermore, food safety is intrinsically linked to economic stability, agricultural sustainability, and environmental conservation. Therefore, ensuring food security for individuals and communities is vital not only for maintaining health but also for fostering social and economic development. Recognizing the significance of food security, raising awareness, and implementing necessary measures are crucial responsibilities for our future.

Numerous studies have been conducted to assess individuals' knowledge and perceptions of food safety. These include research focused on consumer awareness and knowledge levels across various provinces in Turkey (Gülse Bal et al., 2006; Uzunöz et al., 2008; Yılmaz, 2008; Gözener et al., 2009; Şanlıer, 2009; Güven, 2010; Ocak and Önder, 2014; Onurlubaş, 2015; Onurlubaş and Gürler, 2016; Özkaya and Akbulut, 2016; Gürer and Akyol, 2018; İncedal-Sonkaya et al., 2018; Durmaz Dayılar, 2018; Açıkalın, 2019; Çelik and Çelik, 2020; Bolek, 2020; Palamutoğlu et al., 2021; Kırmacı and Özçelik, 2021; Yanğıç Yüksel and Karagözlü,

2022). There are also studies exploring consumer attitudes and behaviors related to food safety (Mutlu and Yurdakul, 2008; Bekar, 2013; Yüzbaşıoğlu et al., 2018; Söğüt et al., 2020; Aydın Eryılmaz and Kılıç, 2020) and studies investigating food safety perceptions (Kılıçalp, 2011; Zorba and Kaptan, 2011; Taşdan et al., 2014; Niyaz and Demirbaş, 2018; Madenci et al., 2019; Ayaz and Türkmen, 2019; Okat, 2019; Can, 2020; Çelik, 2021; Aytıp et al., 2021; Kayacan and Demirbaş, 2021; Kayacan and Demirbaş, 2023; Aykaç and Doğan, 2023; Künili et al., 2024; Koç and Yıldırım, 2024). Arıkan and Tozkoparan (2022) conducted research on food security in Turkey in the context of globalization. Koç and Uzmay (2015) carried out a conceptual study on food safety. Moreover, Tayar (2020) and Akın and Akın (2020) examined the impact of COVID-19 on food safety. Angulo et al. (2005) explored food safety and the willingness to pay for labeled products, while Kılıç and Eryılmaz (2015), Gündüz and Aydoğan (2015), and Başer et al. (2022) investigated food safety awareness levels.

Understanding consumer knowledge regarding food safety is crucial for several reasons. Firstly, consumer awareness significantly contributes to the prevention of foodborne illnesses; informed individuals are more likely to adopt appropriate practices in food storage, preparation, and consumption, thereby safeguarding their health. Additionally, consumer knowledge serves as valuable feedback for food producers and policymakers, enabling the development of more effective and safer food systems that align with consumer needs. Moreover, raising consumer awareness about food safety promotes healthier dietary habits across the broader society.

The aim of this study is to assess consumers' knowledge of food safety as well as their purchasing behavior concerning food products.

2. MATERIAL AND METHODS

In this study, which aims to assess consumers' knowledge regarding food safety, primary data collected from individuals through questionnaires serve as the main source of information. To achieve this, face-to-face surveys were conducted with individuals residing in areas with diverse economic and sociocultural backgrounds across the provinces of Adana, Adıyaman, Ankara, Aydın, Çanakkale, Diyarbakır, Kahramanmaraş, Muğla, and Osmaniye. The survey questions were designed considering the research objectives, the subject matter, and the

characteristics of the target population. Additionally, similar studies from the literature were referenced during the development of the survey. The sample size was determined using the Simple Random Probability Sampling method, with the following formula.

$$n = z^2 \left(\frac{p \cdot q}{d^2} \right)$$

n: sample volume

z: 1.96 (standard z value corresponding to 95% confidence level)

p: Probability that the sample is representative of the main population

q: (1-p) Proportion of the main population that does not have the relevant characteristic

d: Accepted error tolerance level (assumed to be ±5%).

The sample size was calculated as 384, and a survey was conducted with 400 consumers to account for potentially faulty or incomplete questionnaires. The survey data were analyzed using statistical software and presented as frequency distributions and percentages. Various comparisons were made in comparative tables based on demographic characteristics and provinces.

3. RESULT AND DISCUSSION

Identifying the demographic characteristics of consumers facilitates an understanding of their purchasing behavior. These characteristics significantly influence product markets and are utilized by businesses to determine target markets. Consequently, production planning in businesses is conducted by considering consumers' demographic attributes, with efforts focused on identifying their age, gender, income, occupation, education level, and marital status (Onurlubaş, 2015).

In this study, the demographic characteristics of the participants were initially analyzed (Table 1). Among the participants, 55% were female and 45% were male. The majority of participants were between the ages of 18 and 31, and most were high school graduates. Furthermore, 56% of the participants were married, while 44% were single. The average family size was found to be 4 members. The highest level of participation was observed among individuals residing in Aydın.

An analysis of the individuals responsible for food shopping within the family revealed that

40.5% of respondents shop independently, 20.7% shop together with their parents and children, 18.8% shop with their parents, 14.5% shop with their mothers, and 5.5% shop with their fathers. When analyzed by province, it was observed that food shopping is primarily conducted by the individual respondents in provinces other than Kahramanmaraş and Muğla. In Kahramanmaraş, joint shopping by parents was the most common (40%), whereas in Muğla, 70% of the food shopping was conducted by parents and children together. Söğüt et al. (2020) reported that 31.1% of families surveyed typically shop together, 28.4% do so as an entire family, 20.6% are represented by the father, 14.4% by adult children, and 5.4% by the mother.

When consumers were asked about the frequency of their food shopping, 39% reported shopping once per week, 36% reported shopping 2-3 times per week, 14% shopped monthly, and 11% shopped daily. It was observed that larger families tend to shop for food more frequently.

The locations where consumers conducted their food shopping are presented in Table 2. While grocery stores are occasionally chosen for food shopping, neighborhood markets were found to be the most frequently preferred option. Conversely, mobile vendors were largely avoided by the majority of participants. Meanwhile, super- and hypermarkets emerged as the most commonly preferred locations for food shopping.

The characteristics that consumers prioritize when shopping for food are presented in Table 3. The most important attributes include health safety, expiry date, freshness, cleanliness of the place of purchase, and content, whereas brand, packaging, and price are considered less important. It is notable that health is the foremost concern for consumers when shopping for food, and price is only considered after other factors. It has been found that the attributes considered during food shopping do not vary according to the consumers' education level.

Table 1. Demographic characteristics of the participants in the study

Gender	f	%	Provincial	f	%
Female	220	55	Aydın	120	30
Male	180	45	Ankara	68	17
Total	400		Osmaniye	56	14
Age	f	%	Çanakkale	44	11
18-24	116	29	Adana	28	7
25-31	98	24,5	Diyarbakır	28	7
32-38	77,2	19,3	Kahramanmaraş	24	6
39-45	60	15	Adıyaman	20	5
46-52	28	7	Muğla	12	3
53 and above	21,2	5,3	Total	400	100
Total	400	100	Marital status	f	%
Education	f	%	Married	224	56
Primary education	72	18	Single	176	44
High school	150	37,5	Total	400	
Associate degree	79	19,75	Number of family members	f	%
Licence	92	23	1-3 people	131,2	32,8
Postgraduate	7	1,75	4-6 people	248,4	62,1
Total	400	100	7 and above	21,2	5,3
			Total	400	100

Table 2. Place of food shopping

Food Shopping Centre	Always		Occasionally		Never		Total	
	f	%	f	%	f	%	f	%
Grocery Store	82	20,5	261	65,25	57	14,25	400	100
Neighbourhood market	197	49,25	171	42,75	32	8	400	100
Manav	99	24,75	146	36,5	155	38,75	400	100
Peddler	18	4,5	103	25,75	279	69,75	400	100
Super-hypermarket	248	62	132	33	20	5	400	100

Gözener et al. (2009) indicated that the most important factor for students when purchasing food is the ability to trust the product from a health perspective, followed by factors such as brand, price, flavor, durability, and the availability of promotions. Özkaya and Akbulut (2016) found that the characteristics that gastronomy students pay attention to when purchasing food include expiry date (83.1%), brand (53.4%), price (44.3%), ingredients (42.5%), TSE mark (42.0%), packaging strength (38.8%), ministry approval (16%), production method (6.4%), product weight/program (5.0%), recycling symbol on the packaging (3.7%), and place of production (1.8%). Madenci et al. (2019) listed the most important concerns in terms of food safety when purchasing food products as environmental impact, absence of additives, origin, compliance with cooking instructions, low price, hygiene of the production site, non-harmful packaging, health, and packaging strength. Söğüt et al. (2020) determined that consumers consider factors such as price, appearance, traditional production, and expert recommendations important when purchasing food, whereas factors such as brand, quality, health, and freshness are considered very important.

Consumers were asked to evaluate changes in food products over time in terms of price, quality, freshness, taste, and reliability. Regarding price, 74.25% of consumers stated that prices were better in the past, 13% indicated no change, and 12.75% stated that they are better now. In terms of quality, 61.75% believed it was better in the

past, while 28.25% thought it is better now. Regarding freshness, 55% of respondents indicated that it was better in the past, whereas 30% stated that it is better now. Concerning taste, 70.5% reported that it was better in the past, while 19.75% indicated that it is better now. When considering reliability, 63.75% of consumers believed that food products were more reliable in the past, while 25.5% thought they are more reliable now, and 10.75% indicated no difference.

Furthermore, 89% of consumers preferred fresh products, while 4% preferred dried, 4% canned, and 3% frozen foods. A provincial comparison revealed that fresh food consumption was the predominant choice across all provinces. However, in Diyarbakır, 25% of consumers preferred dried foods, and in Çanakkale, 15% preferred canned products, which is higher than in other provinces.

Regarding unpackaged products, 53% of consumers stated that they are harmful to health, 43.3% considered them partially healthy, and 3.7% considered them healthy. Additionally, 69% of consumers expressed willingness to pay more for packaged products, whereas 31% were unwilling to pay extra. The reasons for the willingness to pay more for packaged foods are illustrated in Fig. 1. The primary reasons for paying more for packaged products were their perceived health benefits, reliability, and the availability of ingredient information.

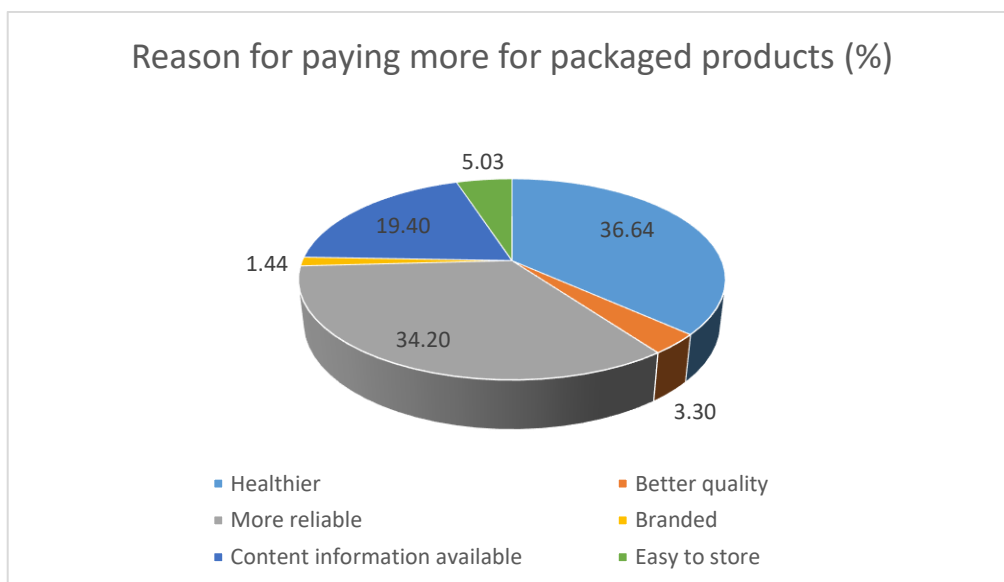


Fig. 1. Reason for paying more for packaged products

Table 3. Factors that are important when shopping for food

Factors	Not at all important		Partly important		Very important		Total		Mean
	f	%	f	%	f	%	f	%	
Price	58	14,5	155	38,75	187	46,75	400	100	2,32
Freshness	5	1,25	25	6,25	370	92,5	400	100	2,91
Brand	42	10,5	134	33,5	224	56	400	100	2,46
Content	7	1,75	64	16	329	82,25	400	100	2,81
Packaging	68	17	106	26,5	226	56,5	400	100	2,40
Expiry date	6	1,5	17	4,25	377	94,25	400	100	2,93
Reliable in terms of health	5	1,25	14	3,5	381	95,25	400	100	2,94
Cleanliness of the place of purchase	5	1,25	27	6,75	368	92	400	100	2,91

While 76% of consumers reported having knowledge of the concept of food safety, 24% stated that they had never heard about it. Awareness of food safety did not significantly differ based on educational level, although it was observed that those unaware of food safety were predominantly primary school graduates. Consumers in Ankara and Kahramanmaraş appeared to be more aware of the concept, while the majority of those unaware resided in Diyarbakır. Onurlubaş and Gürler (2016) found that 68.6% of consumers had heard of the concept of food safety, while 31.4% had not. Similarly, Taşdan et al. (2014) reported that 80% of consumers in the central districts of Ankara were familiar with the concept of food safety.

Consumers' definitions of food safety are presented in Fig. 2. When asked about food safety, consumers predominantly defined it as the production of products in a controlled, healthy, and health-promoting manner. Onurlubaş and Gürler (2016) stated that 68.7% of those who had heard of food safety provided a correct definition, whereas 31.3% defined it incorrectly. Additionally, Kırmacı and Özçelik (2021) reported that 65.8% of participants correctly defined food safety, while 7.3% used the phrase 'It is to ensure that consumers have access to enough food' as their definition of food safety.

The information sources for consumers regarding food safety are as follows: 56.3% obtained information from radio and television programs, 12% from subject matter experts, 11.8% from other sources (public education centers and the internet), 8.8% from scientific articles and books, 7.5% from newspapers and magazines, and 3.8% from friends, spouses, and acquaintances. Onurlubaş and Gürler (2016) indicated that study participants followed information on food safety primarily from radio and television (78.9%), followed by newspapers and magazines (33.2%), recommendations from friends, spouses, and acquaintances (29.9%), subject experts (28.7%), and scientific articles (18.7%). Kırmacı and Özçelik (2021) found that 32.1% of participants identified the 'internet' and 28.7% identified 'radio and TV programs' as their main sources of information on food safety. Uzunöz et al. (2008) reported that the majority of rural women use television as their primary source, while Gözener et al. (2009) noted that 58.47% of agricultural faculty students used newspapers and television as sources of food safety information. Madenci et al. (2019) found that 33% of consumers obtained

information from television advertisements, 26% from internet advertisements, and 17% from friends, relatives, and neighbors.

Only 15% of consumers believe that the foods they consume are healthy (Fig. 3). When asked about the reasons why foods are considered unhealthy, 25.65% of respondents indicated the presence of chemicals, 2.12% mentioned microbiological contamination, 37.06% cited the use of hormones, 31.18% stated the presence of additives, and 21.65% pointed to the presence of GMOs. Madenci et al. (2019) found that 43% of consumers perceive food as moderately safe in Turkey, 37% believe that food is unsafe, and 18% believe that food safety is ensured in Turkish products. In the study conducted by Çelik and Çelik (2020), 45.77% of respondents stated that 'containing food additives' is important, 63.68% stated that 'containing disease-causing microbial contamination' is very important, 53.23% considered 'containing GMO origin' as very important, and 36.82% had no opinion on the matter. Moreover, 36.82% mentioned that 'irradiation has been applied,' and 82% had no idea about it. Regarding other factors, 44.03% indicated that 'the breaking of the cold chain for frozen products' is important, 38.31% considered 'cholesterol level' to be important, and 26.87% regarded 'the possibility of drug residues' as important.

Consumers believe that the Ministry of Agriculture and Forestry (69%), business owners (14%), municipalities (10%), and consumers themselves (7%) play the most significant roles in ensuring food safety. According to a study conducted by Madenci et al. (2019), consumer opinions on food safety regulation in Turkey indicate that 72% of consumers believe that food safety oversight is carried out by the government.

The proportion of consumers who believe that adequate attention is given to human health at food production sites is 7.5%, while 53.8% believe that partial attention is given, and 38.8% believe that no attention is given at all. Furthermore, 61.3% of consumers perceive food inspections as inadequate, while only a small group (5.5%) considers them sufficient. The remaining 33.3% view food inspections as partially adequate. Gözener et al. (2009) reported that only 14.42% of students agreed that 'companies producing food for the market are adequately monitored by regulatory bodies such as the Ministry of Agriculture, the Ministry of Health, and municipalities,' whereas 85.58% disagreed with this statement.

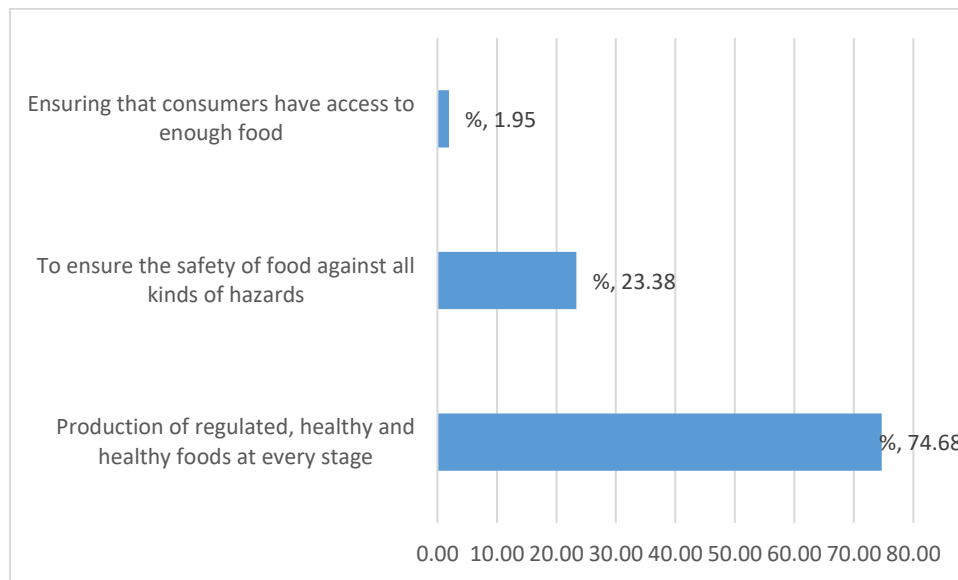


Fig. 2. Definition of food safety concept

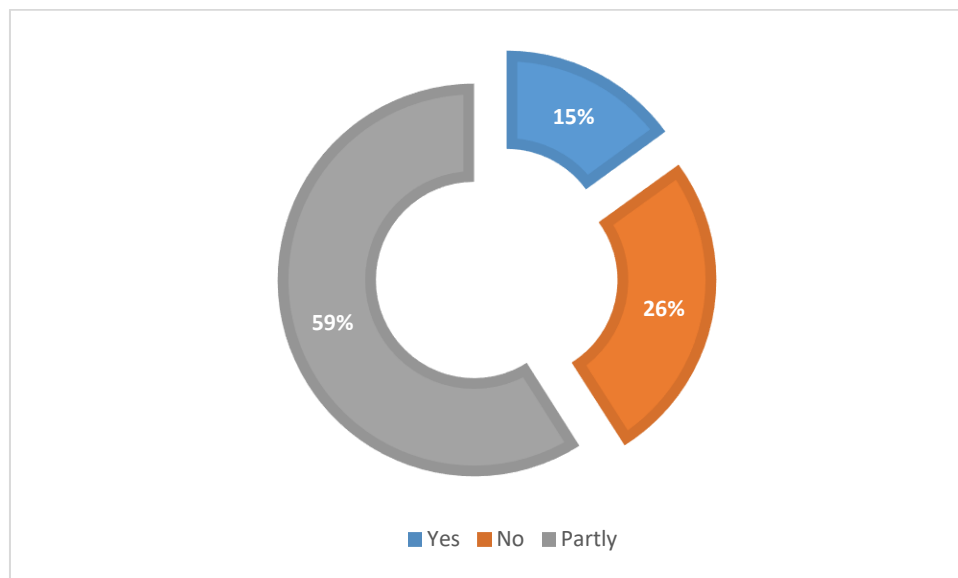


Fig. 3. Consumers' opinions on whether the foods they buy are healthy or not

While 49.8% of consumers are aware of the Alo 174 Food Hotline, 50.2% are not. It was found that those who were unaware were predominantly primary school graduates (75%). In contrast, individuals at higher education levels were generally aware of the Alo 174 Food Hotline. Yanğıç Yüksel and Karagözlü (2022) reported that only 18.18% of participants in Etimesgut, Ankara, knew the telephone number for the Alo Food Line, and 20.21% of those who knew it had called the Alo Food Line at least once. Kırmacı and Özçelik (2021) stated that 24% of participants were not aware of the existence of this hotline.

Among those who are aware of the hotline, 97.54% stated that it is used for evaluating all types of consumer complaints and requests related to food, 0.99% believed it to be a resource for consumers seeking information on the quality of food products, and 1.58% indicated that it is a line used to determine which food brand is better. Kırmacı and Özçelik (2021) also reported that 61.3% of participants defined the ALO 174 Food Hotline as 'a service for the evaluation of all kinds of consumer complaints and requests regarding food,' while 5.9% described it as 'a line used to find out which food brands are superior.'

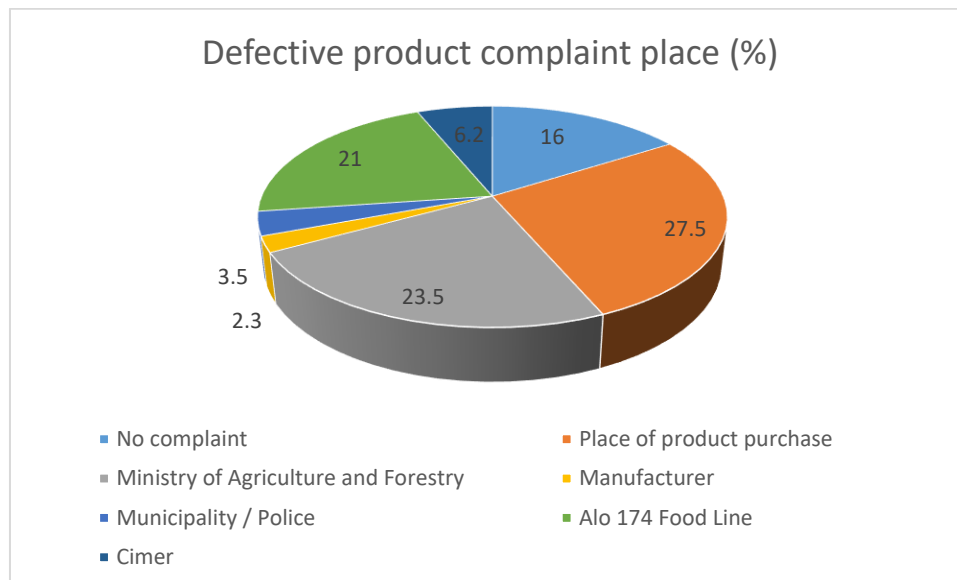


Fig. 4. Places to complain about non-compliant food products and production

The most preferred channels for consumers to report unsuitable food products are the point of purchase, the Ministry of Agriculture and Forestry, and the Alo 174 Food Line (Fig. 4). However, 16% of consumers do not report non-compliant food products or production practices.

The consumers participating in the study provided several suggestions to enhance their knowledge of safe food consumption and food safety, as well as to ensure adequate consumer confidence. These suggestions are summarized as follows: 'consumption of packaged products should be encouraged, penalties should have enforceable consequences, adequate inspections should be conducted, genetically modified raw materials should not be used, reliable seeds should be prioritized, human health should be prioritized, public awareness should be raised, additives should be minimized or eliminated if possible, cleanliness should be ensured, domestically produced items should be prioritized over imports, organic products should be promoted, and products should be approved by the Ministry of Agriculture.' These consumer suggestions should be considered in the production and marketing of food products, and appropriate sanctions should be applied in cases of non-compliance.

4. CONCLUSIONS AND RECOMMENDATIONS

The research indicates that consumers prioritize factors such as health safety, expiry date, and

freshness when purchasing food. Consumers' historical assessments of food products indicate a decline over time regarding price, quality, freshness, taste, and reliability. This trend has heightened concerns about food safety, prompting consumers to seek healthier, more reliable, and higher-quality food options.

A substantial proportion of consumers perceive packaged products as more reliable in terms of health, which contributes to their willingness to pay a premium for such products. Nevertheless, significant concerns about unpackaged products remain prevalent. It is promising that 76% of respondents are aware of the concept of food safety. However, when considering the impact of educational attainment, it becomes evident that primary school graduates exhibit a greater need for information. To enhance awareness of food safety, educational programs should be implemented, particularly at the primary education level, and awareness campaigns should be targeted toward all segments of society. To promote the consumption of packaged products, campaigns emphasizing the health and safety benefits of such products should be conducted. Improving the food safety knowledge of consumers will provide crucial feedback for food producers and policymakers, facilitating the development of more effective and safer food systems that align with consumer needs.

The findings of the study indicate that the Ministry of Agriculture and Forestry bears the

primary responsibility for ensuring food safety, while business owners and municipalities should also play significant roles. The perception that current food inspections are insufficient highlights the need to strengthen the existing system. Inspections should be conducted more frequently and with greater efficacy, and their transparency should be enhanced. Additionally, the outcomes of inspection processes should be disclosed to the public. An effective complaint mechanism should be established to facilitate consumers in communicating their concerns about food products, supported by feedback and recommendations for resolution. To enhance food safety, regulations limiting the use of genetically modified organisms (GMOs) and harmful additives should be introduced. Domestic production should be encouraged over imports, and organic and sustainable agricultural practices should be prioritized. Programs should also be developed to raise public awareness regarding healthy food consumption, fostering healthier dietary habits. Implementing these recommendations is essential for enhancing food safety and safeguarding consumer health. Ensuring access to healthy food is critical to improving public health outcomes.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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