Chapter 4

Food Safety, Food Adulteration and Fraud

Eda Elgin Kılıç[1]

Songül Kesen[2]

Abstract

Food health and food safety are vital for ensuring both health and economic sustainability in the food sector. Implementing food safety standards and raising consumer awareness underpin policies and strategies in these areas. Food safety is the totality of systems established to ensure that food products reach the consumer in a safe, healthy and high quality manner. Food security is an important concept that defines people's access to sufficient, safe and nutritious food. Food health covers all practices to ensure that food is consumed without adverse health effects. Food security is critical for meeting basic food needs, ensuring food security and adequate nutrition. Systems that function throughout the process from food production to consumption are vital for the existence of a healthy society. Food security and health are critical for individuals to lead a healthy life. Not only physiological needs need to be met, but also psychological and social needs need to be taken into account. Therefore, not only food production, but also the healthy processing, storage and distribution of this food is essential. Food security ensures the growth of healthy individuals and the protection of public health, while healthy food is the basis of this security.

Introduction

Food health and food assurance refers to the totality of the systems that a business establishes to ensure the safety, health and quality of food products. While food health includes the measures to be taken to ensure that the foods offered to consumers are not harmful to health and are of good quality, food assurance guarantees the reliability and conformity of these products

1 Lecturer Dr., Gaziantep University, Naci Topcuoglu Vocational School, edakilic@gantep.edu.tr, ORCID ID: 0000-0002-9887-8377

2 Assoc. Prof. Dr. ., Gaziantep University, Naci Topcuoglu Vocational School, kesen@gantep.edu.tr, ORCHID ID: 0000-0003-0587-1721

https://doi.org/10.58830/ozgur.pub722.c3037

to expectations (Eren et al., 2017, Akın & Akın, 2020). Food health aims to minimize health risks that may arise from the consumption of food. In this context, it is of great importance to comply with hygiene standards throughout the food production process. Food processors' compliance with hygiene rules such as hand hygiene and mask use is essential to protect the health of both employees and consumers (Dalyan et al., 2023). Food safety, on the other hand, has a broader meaning; it covers standardization and inspection in the production, processing, storage and distribution stages of food. Food safety has a critical role in increasing consumer confidence in food sources (Eren et al., 2017). Food safety is often supported by various standards and certifications. These standards ensure that products are safe for health, prepared with proper processing methods and meet consumer expectations. Some international standards used to ensure the safety of food products include Hazard Analysis Critical Control Point (HACCP), ISO 22000 and British Retail Consortium (BRC). These standards, combined with food safety management systems, contribute to the provision of quality and reliable products (Delesa, 2017; Ren et al., 2016). Furthermore, consumer information and traceability of products are important components of food safety. Food products that consumers trust are often supported by elements such as labeling, certification and transparency. This process reduces consumers' concerns about food safety and quality, giving them confidence in products (Benni et al., 2019; Wu et al., 2021). To meet consumer demands, cooperation between food producers and retailers has become important, which increases the effectiveness of food assurance (Marucheck et al., 2011). The success of the food safety system also depends on the compliance of producers and retailers with legal regulations on food safety and quality. To this end, governments and inspection bodies ensure that the implementation of food safety standards is monitored and audited. Thus, both consumer safety is enhanced and the overall quality of food products is improved (Kotsanopoulos a& Arvanitoyannis, 2017)

1.1 Food Safety in the World

Food safety in the world is an important issue that directly affects people's health and quality of life. Food safety plays a critical role in ensuring healthy and safe food at every stage of food production. In this context, food safety is a complex issue in both developed and developing countries (Nagyová et al., 2019). Food safety is particularly critical for preventing health problems such as foodborne diseases and contamination. The World Health Organization (WHO) has developed various strategies to mitigate food crises by making food safety a public health priority (Shrivastava

et al., 2015). Food safety involves not only healthy food production but also supply chain management. Therefore, it is important to increase the quality control of agricultural practices and food processing stages to ensure the traceability and safety of food products (Vallée & Charlebois, 2015). There are some strategic approaches that should be followed to improve food security worldwide. These include adopting good agricultural practices (GAPs), establishing food traceability systems and developing the necessary inspection mechanisms for healthy food production (Li et al., 2023). In addition, raising public awareness and expanding education are considered among the most important elements of food safety (Ayyad et al., 2022). The COVID-19 pandemic has also revealed its impacts on food systems. Disruptions in food supply chains during the pandemic have created serious risks that threaten food safety. Accordingly, it has become inevitable to develop safe and sustainable food systems to cope with the challenges posed by the pandemic (Cable et al., 2020). In short, food security across the globe remains an area that needs to continuously evolve to ensure both the health of individuals and the sustainability of societies. Food safety is a global challenge and international cooperation, legal regulations and public awareness should be increased to overcome this problem. Countries should use scientific and social knowledge to strengthen their food safety strategies and take effective measures to minimize risks. Ongoing challenges to food safety include food bans, adulteration and market imbalances. It is inevitable to establish an effective inspection mechanism to ensure food safety at every stage, from production to distribution. In addition, increasing public awareness will strengthen consumers' demand for safe food and reinforce the trust relationship between producers and consumers (Niyaz & Inan, 2016).

1.1 Food Fraud

Food fraud is defined as the deliberate alteration of the quality and safety of food products and includes various fraudulent activities carried out for economic gain. Types of food fraud include misrepresentation of additives, violations of hygiene standards, and false food labeling Spink et al. (2019). Food fraud both increases risks to consumers' health and has a negative impact on overall food safety. The harms of food fraud are multifaceted. First, it can create health problems. Counterfeit foodstuffs or products containing debilitating substances can jeopardize the health of consumers. Especially nutritionally vulnerable groups (children, the elderly, the chronically ill) are more vulnerable to such fraud (Soon et al., 2023). Fraudulent foods can cause foodborne illnesses, allergic reactions or long-

term health problems. Second, food fraud can lead to economic losses. The food industry can suffer serious economic losses due to the distrust created by fraudulent products. When consumers' trust is shaken, brands and producers can suffer from loss of revenue and reputational damage (Dasenaki & Thomaidis, 2019). In particular, major food scandals have resulted in significant declines in sales, which can lead to market instability in the long run (Agnoli et al., 2016). The consequence of food fraud is the need to tighten food safety regulations and inspections. Although these regulations are intended to raise food safety standards, the implementation of strict inspections can be economically burdensome for businesses (Creydt & Fischer, 2018). Food safety gaps also strain government resources in this area. Food fraud can create a general climate of mistrust in society, which creates obstacles to the provision of a satisfactory food system. Consumers who are concerned about the quality and safety of their food purchases are therefore more likely to seek out trustworthy products (Chang et al., 2022). It is important to ensure a healthy flow of information on food safety and to increase trust between consumers and producers. The harms of food fraud have serious consequences for both individual health and the economy. Therefore, effective inspection mechanisms, training programs and consumer information studies are inevitable to ensure food safety.

1.2 Food Adulteration

Food adulteration refers to the deliberate alteration of the content of a particular food product, exceeding quality and safety standards, or the addition of misleading substances in order to obtain additional costs or other advantages. Food adulteration is an important problem that threatens consumer health and jeopardizes food safety. In this article, the causes, types and effects of adulteration in foods and the measures to be taken in this area will be discussed.

Causes of Adulteration

The most common reason for food adulteration is economic considerations. It is common practice for manufacturers to use low-quality ingredients or dilute products to reduce costs and increase profits. Adulteration can often occur at any stage of the supply chain of foodstuffs, which can be caused by a lack of strict inspection and certification (Spink et al. (2019; Soon et al., 2023).

Types of Adulteration

Food adulteration can be expressed in several types:

1. Physical Adulteration: These are the processes used to change the appearance of food products. For example, mixing a low quality oil with a high quality product.

2. Chemical Adulteration: The addition of harmful substances to the components of food. For example, adding water to frozen fish or dairy products.

3. Illegal Adulteration: Misleading information on food labels can lead consumers to misunderstand food ingredients. Such practices are a violation of food safety laws (Dasenaki & Thomaidis, 2019; Agnoli et al., 2016).

The health effects of food adulteration can be quite serious. The presence of counterfeit or harmful ingredients in foods can lead to foodborne illnesses. Individuals with weak immune systems, children and the elderly are particularly susceptible to such fraud (Creydt & Fischer, 2018). Adulteration can also adversely affect the taste, nutritional value and overall quality of a food.

Economic and Social Impacts

Food fraud can cause economic losses for both consumers and producers. Adulteration leads consumers to purchase unsafe products and undermines brand safety in the food industry (Chang et al., 2022). Adulteration incidents can increase costs for food businesses as recalls and quality control processes may become mandatory.

Solution Suggestions

An effective fight is needed to reduce food adulteration: Strengthening Regulatory Framework: Food safety laws need to be updated and enforced more effectively. Food businesses should be encouraged through continuous inspection and training.

Consumer Awareness: Education programs should inform consumers about food safety. Thus, consumers can better identify fraudulent products.

Transparency: Increasing transparency in food production and distribution is a key step towards rebuilding consumer trust. Food adulteration refers to the fraudulent alteration of food products or the addition of deceptive substances, and this action is usually carried out for economic gain.

Adulterated Foods and Adulteration Detection Methods

Adulteration in Olive Oils

Olive oil is an important food product known for its high nutritional value and health benefits. However, olive oil is frequently subjected to adulteration

due to its high costs and market-provided qualities. Adulteration can occur in the form of adulteration of olive oil with various low-quality vegetable oils, such as soybean oil, sunflower oil or pea oil (Varnasseri et al., 2021).

Causes of Adulteration

The main reasons for adulteration in olive oil are economic concerns. Producers may resort to such fraudulent methods in order to reduce their costs and increase their profits by mixing cheaper oils instead of the more expensive real olive oil. This situation threatens both the quality and safety of the products offered to consumers (Ok, 2017).

Types of Adulteration

There are several types of adulteration in olive oil:

1. Blending with Low Quality Oils: This is the adulteration of real olive oil with sunflower oil, soybean oil or other low-quality vegetable oils. This trick can be done without changing the appearance and taste of olive oil.

2. Chemical Adulteration: Adding preservatives or harmful chemicals to olive oil. For example, the use of unspecified additives in olive oil that can harm health.

3. Mislabeling: Misleading product labeling can lead consumers to obtain false information about the quality of the product they are purchasing (Varnasseri et al., 2021).

Adulteration Detection Methods

Various analytical methods have been developed for the detection of adulteration in olive oil:

NMR Spectroscopy: Fauhl et al. analyzed blends of olive oil and hazelnut oil using nuclear magnetic resonance (NMR) spectroscopy and were able to detect suspected cases of adulteration with the addition of 25% or more hazelnut oil (Parker et al., 2014).

HPLC and GC: Jabeur and colleagues detected adulteration of olive oil with various vegetable oils using gas chromatography (GC) and liquid chromatography (HPLC) (Jabeur et al., 2014).

Fluorescence and FTIR Spectroscopy: Zhang et al. studied the detection of olive oil adulteration by fluorescence spectroscopy (Zhang et al., 2024).

Consumer Health Impact

Adulteration of olive oil poses serious health risks. Consumption of low-quality oils can cause both loss of nutritional value and health problems such

as allergic reactions. Furthermore, consumption of adulterated products can lead to serious social and economic problems by reducing consumer confidence in olive oil in general (İlem-Özdemir & Öztürk, 2020; Nanou et al., 2023).

Adulteration in dairy products

Adulteration in dairy products is an important problem in terms of food safety. Adulteration refers to the deliberate addition of low-quality or unhealthy ingredients to milk and dairy products or the misrepresentation of their true value. Dairy products are widely consumed worldwide due to their high nutritional value, making them a target for counterfeiting and adulteration (Montgomery et al., 2020, Tibola et al., 2018).

Types of Adulteration

1. Mixing Animal Species

One of the most common types of adulteration in dairy products is the mixing of cow, sheep or goat milk. In particular, the addition of cow milk into sheep and goat milk is a common fraud. Biçer et al. addressed this situation and emphasized the negative effects of adulteration on milk quality (Biçer et al., 2023).

2. Adding Additives

Illegal additives can be added to dairy products to increase their nutritional value or to reduce costs. For example, glucose, protein powders or other harmful substances are added to dairy products, altering the actual nutritional value (Grassi et al., 2022).

3. Mislabeling

Misleading information on food labels leads to consumer deception. The substitution of genuine dairy products for lower quality or counterfeit products sold as "real" dairy products is one of the most common forms of adulteration (Montgomery et al., 2020).

Health Effects of Adulteration

Adulteration of dairy products can pose serious risks to consumers' health. For example, the addition of harmful chemicals such as melamine or formalin can lead to allergic reactions or other health problems in consumers (Grassi et al., 2022). Consumption of such fraudulent products can lead to an increase in foodborne diseases and pave the way for the development of health problems in the long term.

Detection Methods

Various methods have been developed to prevent and detect adulteration in dairy products. Genetic analysis methods can be used effectively to identify animal species in milk samples. In the study of Biçer and colleagues, TaqMan Real-Time PCR method was used to determine which animal species belonged to which animal species in milk (Biçer et al., 2023). Chemical analysis and various spectroscopy techniques are also used to detect adulteration (Mafra et al., 2022).

Economic Impacts

Adulteration in dairy products can cause economic losses to both consumers and producers. The loss of consumer confidence leads to increased legal and financial liabilities in the market. Adulteration, which is economically motivated, both damages the reputation of food businesses and creates serious problems in healthy food consumption (Tibola et al., 2018; Mafra et al., 2022)

Cheese is an important foodstuff in many cultures with its nutritional properties and flavor. However, adulteration incidents are frequently experienced in cheese production due to economic motivations. Cheese adulteration generally means adding low-quality or unhealthy substances or using imitation products instead of real cheese. This text details the types of adulteration in cheeses, their effects on health and the precautions to be taken.

Types of Adulteration

1. Mixing with Low-Quality Ingredients

A common type of adulteration is the use of vegetable oils or low-quality milk powders instead of milk in cheese production. The health risks of toxic compounds formed by the use of low-quality oils in imitation mozzarella cheese were emphasized in the study by Han and Csallany (2012). While real milk has different nutritional values, imitation cheeses usually offer less nutritional value.

2. False Labeling and Adulteration

Providing misleading information on cheese labels prevents consumers from knowing the real content of the products they buy. The sale of imitation cheeses as "real cheese" is one of the most common such frauds. Studies on this subject are based on information provided on mislabeling, but there is no definitive source here (Liu et al., 2017; Saraco & Blaxland, 2020). Mislabeling can harm consumers' health and is a phenomenon that threatens food safety.

3. Use of Hyaluronic Acid and By-Products

It has been reported that fertilizers derived from microbes are used in some imitation cheeses and these affect product quality; more evidence is needed on this issue. In the study by Padhiyar et al (2017), the effects of different protein sources and costumes used for cheese analogues on cheese quality were examined

Health Effects

The health effects of adulteration in cheeses are extremely serious. Consumption of imitation cheeses can cause allergic reactions, foodborne poisoning and other health problems (Xie et al., 2021). In addition, the addition of illegal chemicals to milk ingredients can pose serious health threats, especially in individuals with weak immune defenses.

Control and Detection Methods

There are various methods that can be used to detect adulteration in cheese:

-Chemical Analyses: Methods such as gas chromatography and liquid chromatography can be effective in determining the fat quality and content in cheese. In a study conducted by El-Bakry and colleagues, the content of imitation cheese was examined by chemical analyses (Mehfooz et al., 2021).

Spectroscopic Methods: Methods such as NMR (Nuclear Magnetic Resonance) spectrum analysis can also be used to detect imitation cheese. Thus, it is possible to understand whether the ingredients in cheese are natural or not (Katidi et al., 2023).

Economic Impacts

Adulteration not only results in health problems, but also in undermining consumer confidence. This situation creates the need to strengthen quality control systems in the cheese sector. The prevalence of adulteration leads to higher cheese prices and market imbalances, which may cause consumers to turn to less safe products (El-Bakry et al., 2010).

Raising Consumer Awareness Against Fraud and Adulteration

Fraud and adulteration in food create significant problems both in terms of health and socio-

Fraud and adulteration in food create significant problems both in terms of health and socio-economic aspects. Especially products like cheese, milk, and olive oil are frequently subjected to fraudulent practices. Raising consumer awareness on these issues, making healthy food choices, and

preventing such frauds are of critical importance. Below are important topics related to raising consumer awareness against fraud and adulteration.

Definition of Fraud and Adulteration Fraud and adulteration mean the deliberate alteration of the content, quality, and safety of food products. It is important for consumers to understand what types of fraud can be committed in food products in order to raise awareness on this issue (Biçer et al., 2023).

Education and Information Increasing the education levels of consumers will raise their awareness of food safety. Education enables them to be knowledgeable about the properties of foods, label reading skills, and food safety standards. Especially the inclusion of food safety education in school curricula can help young people become more conscious individuals in this field (Bozkurt, 2024).

Labeling and Transparency The accuracy of the information specified on food product labels is of critical importance to the consumer. It is necessary to provide training so that consumers can choose between correctly labeled products and counterfeit ones. To raise consumer awareness, information should be provided on how to read correct labels and which signs increase reliability (Araç et al., 2022).

Social Media and Digital Platforms Social media and digital platforms can be an effective informational tool regarding food safety. Sharing information related to food safety will enable consumers to become more knowledgeable about fraud and adulteration. Social media campaigns can be used to raise awareness on this issue (Duran, 2023).

Collaboration with the Community Local governments, non-governmental organizations, and the ready-to-eat food industry should cooperate in combating fraudulent food products. Public information campaigns are an effective method for raising citizens' awareness levels regarding food safety. Consumer complaints and feedback can be an important resource for improving food safety practices (Biçer et al., 2023).

Strengthening Legal Regulations The government needs to strengthen food safety laws and enhance inspection mechanisms. Effective legal measures need to be developed to protect consumers from counterfeit and adulterated products. In addition, establishing systems that will enhance the traceability of products can help in the quicker detection of adulteration and fraud cases (Çil, 2017)

References

Agnoli, L., Capitello, R., Salvo, M. D., Longo, A., & Boeri, M. (2016). Food fraud and consumers' choices in the wake of the horsemeat scandal. *British Food Journal*, 118(8), 1898-1913. https://doi.org/10.1108/bfj-04-2016-0176

Agnoli, L., Capitello, R., Salvo, M. D., Longo, A., & Boeri, M. (2016). Food fraud and consumers' choices in the wake of the horsemeat scandal. British Food Journal, 118(8), 1898-1913. https://doi.org/10.1108/bfj-04-2016-0176

Akın, M. and Akın, M. (2020). Gida güvenliği ve covid-19. *Harran Üniversitesi Mühendislik Dergisi*, 5(3), 268-277. https://doi.org/10.46578/humder.727194

Araç, D., Dıraman, H., & GÜNER, S. (2022). Some chromatographic methods used for species determination in meat and meat products. *Helal Ve Etik Araştırmalar Dergisi*, 4(1), 62-70. https://doi.org/10.51973/head.1118666

Arvanitoyannis, I. S., Kotsanopoulos, K. V., & Savva, A. G. (2017). Use of ultrasounds in the food industry–Methods and effects on quality, safety, and organoleptic characteristics of foods: A review. *Critical reviews in food science and nutrition*, *57*(1), 109-128.

Ayad, A. A., Abdulsalam, N. M., Khateeb, N. A., Hijazi, M. A., & Williams, L. L. (2022). Saudi Arabia household awareness and knowledge of food safety. *Foods*, *11*(7), 935.

Benni, N. E., Stolz, H., Home, R., Kendall, H., Kuznesof, S., Clark, B., … & Stolze, M. (2019). Product attributes and consumer attitudes affecting the preferences for infant milk formula in china – a latent class approach. *Food Quality and Preference*, 71, 25-33. https://doi.org/10.1016/j.foodqual.2018.05.006

Biçer, Y., Sönmez, G., Turkal, G., Yılmaz, T., ÇULHA, M. H., & Uçar, G. (2023). Koyun ve keçi sütlerinde inek sütünün taqman real-time pcr ile tespit edilmesi. *Veteriner Hekimler Derneği Dergisi*, 94(1), 50-58. https://doi.org/10.33188/vetheder.1183990

Biçer, Y., Sönmez, G., Turkal, G., Yılmaz, T., ÇULHA, M. H., & Uçar, G. (2023). Koyun ve keçi sütlerinde inek sütünün taqman real-time pcr ile tespit edilmesi. *Veteriner Hekimler Derneği Dergisi*, 94(1), 50-58. https://doi.org/10.33188/vetheder.1183990

Bozkurt, İ. (2024). Pazarlama iletişiminde bilinçli farkindalik: nöropazarlama araştirmalarina sistemsel bir bakiş. P*amukkale Üniversitesi İletişim Bilimleri Dergisi*. https://doi.org/10.70559/pauibd.1602382

Cable J, Jaykus LA, Hoelzer K, Newton J, Torero M. The impact ofCOVID-19 on food systems, safety, and security-a symposium report. Ann N Y Acad Sci. 2021;1484(1):3-8. doi: 10.1111/nyas.14482

Chang, A., Schulz, P. J., Jiao, W., Yu, G., & Yang, Y. (2022). Media source characteristics regarding food fraud misinformation according to the health information national trends survey (hints) in china: comparative study. *JMIR Formative Research*, 6(3), e32302. https://doi.org/10.2196/32302

Creydt, M. and Fischer, M. (2018). Omics approaches for food authentication. *Electrophoresis,* 39(13), 1569-1581. https://doi.org/10.1002/elps.201800004

Çil, K. E. İ. (2017). Identification of meat species in different types of meat products by pcr. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*, 64(4), 261-266. https://doi.org/10.1501/vetfak_0000002808

Dalyan, O., Canpolat, E., Öztürk, Ö., & Pişkin, M. (2023). Gıda sektöründe çalışanların salgın hastalık farkındalıkları: çanakkale ili örneği. *Journal of Advanced Research in Natural and Applied Sciences*, 9(4), 952-963. https://doi.org/10.28979/jarnas.1246775

Dasenaki, M. E. and homaidis, N. S. (2019). Quality and authenticity control of fruit juices-a review. *Molecules,* 24(6), 1014. https://doi.org/10.3390/molecules24061014

Delesa, D. A. (2017). Standards related foods and food products. *International Journal of Advanced Research in Biological Sciences (IJARBS)*, 4(12), 201-206. https://doi.org/10.22192/ijarbs.2017.04.12.020

Duran, O. (2023). Taraflarin ifa yeri anlaşmasi yaparak hukuk muhakemeleri kanunu'nun yetki sözleşmesine ilişkin hükümlerini dolanmalari. *Ankara Hacı Bayram Veli Üniversitesi Hukuk Fakültesi Dergisi,* 27(1), 37-68. https://doi.org/10.34246/ahbvuhfd.1202508

El-Bakry, M., Duggan, E., O'Riordan, D., & O'Sullivan, M. (2010). Small scale imitation cheese manufacture using a farinograph. *LWT - Food Science and Technology*, 43(7), 1079-1087. https://doi.org/10.1016/j.lwt.2010.02.013

Eren, R., Nebioğlu, O., & Şık, A. (2017). Knowledge levels on food safety of employees working in hotel enterprises' kitchen: the example of alanya. *Journal of Multidisciplinary Academic Tourism,* 2(1), 47-64. https://doi.org/10.31822/jomat.350175

Grassi, S., Tarapoulouzi, M., D'Alessandro, A., Agriopoulou, S., Strani, L., & Varzakas, T. (2022). How chemometrics can fight milk adulteration. *Foods,* 12(1), 139. https://doi.org/10.3390/foods12010139

Han, I. and Csallany, A. S. (2012). The toxic aldehyde, 4-hydroxy-2-trans-nonenal (hne) formation in natural and imitation mozzarella cheeses: heat

treatment effects. *Journal of the American Oil Chemists' Society,* 89(10), 1801-1805. https://doi.org/10.1007/s11746-012-2084-0

İlem-Özdemir, D. and Öztürk, B. (2020). Near infrared spectroscopic determination of olive oil adulteration with sunflower and corn oil. *Journal of Food and Drug Analysis*, 15(1). https://doi.org/10.38212/2224-6614.2447

Jabeur, H., Zribi, A., Makni, J., Rebaï, A., Abdelhèdi, R., & Bouaziz, (2014). Detection of chemlali extra-virgin olive oil adulteration mixed with soybean oil, corn oil, and sunflower oil by using gc and hplc. *Journal of Agricultural and Food Chemistry*, 62(21), 4893-4904. https://doi.org/10.1021/jf500571n

Katidi, A., Xypolitaki, K., Vlassopoulos, A., & Kapsokefalou, M. (2023). Nutritional quality of plant-based meat and dairy imitation products and comparison with animal-based counterparts. *Nutrients,* 15(2), 401. https://doi.org/10.3390/nu15020401

Kotsanopoulos, K. V., & Arvanitoyannis, I. S. (2017). Audit results of UK meat companies–critical analysis. *British Food Journal*, 119(12), 2684-2697.

Le Vallée, J. C., & Charlebois, S. (2015). Benchmarking global food safety performances: the era of risk intelligence. *Journal of food protection*, 78(10), 1896-1913.

Li, X., Du, J., Li, W., & Shahzad, F. (2023). Green ambitions: A comprehensive model for enhanced traceability in agricultural product supply chain to ensure quality and safety. *Journal of Cleaner Production*, *420*, 138397.

Liu, L., Zhang, H., Li, X., Han, X., Qu, X., Chen, P., … & Wang, L. (2017). Effect of waxy rice starch on textural and microstructural properties of microwave-puffed cheese chips. International *Journal of Dairy Technology*, 71(2), 501-511. https://doi.org/10.1111/1471-0307.12437

Mafra, I., Honrado, M., & Amaral, J. S. (2022). Animal species authentication in dairy products. *Foods*, 11(8), 1124. https://doi.org/10.3390/foods11081124

Marucheck, A. S., Greis, N. P., Mena, C., & Cai, L. (2011). Product safety and security in the global supply chain: issues, challenges and research opportunities. Journal of Operations Management, 29(7-8), 707-720. https://doi.org/10.1016/j.jom.2011.06.007

Mehfooz, T., Ali, T. M., Ahsan, M., Abdullah, S., & Hasnain, A. (2021). Use of hydroxypropylated barley starch as partial casein replacer in imitation mozzarella cheese. *Journal of Food Processing and Preservation*, 45(12). https://doi.org/10.1111/jfpp.16094

Montgomery, H., Haughey, S. A., & Elliott, C. T. (2020). Recent food safety and fraud issues within the dairy supply chain (2015–2019). *Global Food Security*, 26, 100447. https://doi.org/10.1016/j.gfs.2020.100447

Montgomery, H., Haughey, S. A., & Elliott, C. T. (2020). Recent food safety and fraud issues within the dairy supply chain (2015–2019). Global Food Security, 26, 100447. https://doi.org/10.1016/j.gfs.2020.100447

Nagyová, S., & Tölgyessy, P. (2019). Validation including uncertainty estimation of a GC–MS/MS method for determination of selected halogenated priority substances in fish using rapid and efficient lipid removing sample preparation. Foods, 8(3), 101.

Nanou, E., Pliatsika, N., & Couris, S. (2023). Rapid authentication and detection of olive oil adulteration using laser-induced breakdown spectroscopy. *Molecules*, 28(24), 7960. https://doi.org/10.3390/molecules28247960

Niyaz, Ö. C., & İnan, İ. H. (2016). Türkiye'de gıda güvencesinin mevcut durumunun değerlendirilmesi. *Adnan Menderes Üniversitesi Ziraat Fakültesi Dergisi*, *13*(2), 1-7.

Ok, S. (2017). Detection of olive oil adulteration by low-field nmr relaxometry and uv-vis spectroscopy upon mixing olive oil with various edible oils. *Grasas Y Aceites*, 68(1), e173. https://doi.org/10.3989/gya.0678161

Padhiyar, D., Jana, A., Modha, H., & Aparnathi, K. (2017). Influence of using a blend of rennet casein and whey protein concentrate as protein source on the quality of mozzarella cheese analogue. *Journal of Food Science and Technology*, 54(3), 822-831. https://doi.org/10.1007/s13197-017-2528-5

Parker, T. W., Limer, E., Watson, A. D., Defernez, M., Williamson, D., & Kemsley, E. K. (2014). 60mhz 1h nmr spectroscopy for the analysis of edible oils. *TrAC Trends in Analytical Chemistry*, 57, 147-158. https://doi.org/10.1016/j.trac.2014.02.006

Ren, Y., He, Z., & Luning, P. A. (2016). A systematic assessment of quality assurance-based food safety management system of chinese edible oil manufacturer in view of context characteristics. *Total Quality Management &Amp; Business Excellence*, 1-15. https://doi.org/10.1080/14783363.2016.1187995

Saraco, M. N. and Blaxland, J. (2020). Dairy-free imitation cheese: is further development required?. *British Food Journal*, 122(12), 3727-3740. https://doi.org/10.1108/bfj-11-2019-0825

Soon, J. M., Imathiu, S., Obadina, A. O., Dongmo, F. F. D., Tchuenchieu, A., Moholisa, E., … & Kussaga, J. B. (2023). How worried are you about food fraud? a preliminary multi-country study among consumers in selected sub-saharan african countries. *Foods,* 12(19), 3627. https://doi.org/10.3390/foods12193627

Spink, J., Bedard, B., Keogh, J. G., Moyer, D. C., Scimeca, J., & Vasan, A. (2019). International survey of food fraud and related terminology: preliminary results and discussion. *Journal of Food Science*, 84(10), 2705-2718. https://doi.org/10.1111/1750-3841.14705

Srivastava, V., Ismail, S. A., Singh, P., & Singh, R. P. (2015). Urban solid waste management in the developing world with emphasis on India: challenges and opportunities. *Reviews in Environmental Science and Bio/Technology,* 14, 317-337.

Tibola, C. S., Silva, S. A. d., Dossa, Á. A., & Patrício, D. (2018). Economically motivated food fraud and adulteration in brazil: incidents and alternatives to minimize occurrence. *Journal of Food Science*, 83(8), 2028-2038. https://doi.org/10.1111/1750-3841.14279

Varnasseri, M., Muhamadali, H., Xu, Y., Richardson, P. I. C., Byrd, N., Ellis, D. I., … & Goodacre, R. (2021). Portable through bottle sors for the authentication of extra virgin olive oil. *Applied Sciences*, 11(18), 8347. https://doi.org/10.3390/app11188347

Wu, W., Zhang, A., Klinken, R. D. v., Schrobback, P., & Muller, J. (2021). Consumer trust in food and the food system: a critical review. *Foods,* 10(10), 2490. https://doi.org/10.3390/foods10102490

Xie, D., Yun-sheng, G., Du, L., Shen, Y., Xie, J., & Wei, D. (2021). Effect of flavorzyme-modified soy protein on the functional properties, texture and microstructure of mozzarella cheese analogue. *Journal of Food Processing and Preservation*, 45(11). https://doi.org/10.1111/jfpp.15963

Zhang, L., Nuo, C., Huang, X., Xinmin, F., Juanjuan, G., Jin, G., … & Wang, C. (2024). Adulteration detection and quantification in olive oil using excitation-emission matrix fluorescence spectroscopy and chemometrics. *Journal of Fluorescence*. https://doi.org/10.1007/s10895-024-03613-zAgnoli, L., Capitello, R., Salvo, M. D., Longo, A., & Boeri, M. (2016). Food fraud and consumers' choices in the wake of the horsemeat scandal. British Food Journal, 118(8), 1898-1913. https://doi.org/10.1108/bfj-04-2016-0176