

National Regulations and Management Systems for Implementation and Monitoring of Food Safety in Iran: A Narrative Review of Literature

Zahra Esfandiari¹, Samar Mansouripour², Farzaneh Vaseghi Baba³, Yadolah Fakhri⁴, Mohammadreza Rostami^{5,6}, Antoni Szumny⁷

¹Nutrition and Food Security Research Center, Department of Food Science and Technology, School of Nutrition and Food Science, Isfahan University of Medical Sciences, Isfahan, Iran, ²Department of Food Science and Technology, Faculty of Pharmacy, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran, ³Department of Food Hygiene Quality Control, School of Nutrition and Food Sciences, Shiraz University of Medical Sciences, Shiraz, Iran, ⁴Food Health Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran, ⁵Department of Nutrition, School of Allied Medical Sciences, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran, ⁶Food Science and Nutrition Group (FSAN), Universal Scientific Education and Research Network, Tehran, Iran, ⁷Department of Food Chemistry and Biocatalysis, Wrocław University of Environmental and Life Sciences, Wrocław, Poland

Abstract

The countries establish and enforce food safety regulations to safeguard the health and well-being of their citizens worldwide. Iran has enacted a new regulation on food safety for expansion a national food safety control system and diminishing the national and international concerns. However, a rapid understanding of the management system is lacking in Iran. This study aimed to discuss the components of the food safety management system (FSMS) in Iran and present the weakness and strengths of the Iranian food monitoring structure. For this purpose, it was conducted a narrative review of articles referenced in PubMed, Scopus, Web of Science, IranDoc, and the Iranian Scientific Information Database until February 1, 2024. Furthermore, it was included websites and review papers in Persian and English that describe strategies of national and international FSMS and protocols in different countries. It was concluded that there is a gap in the integrated tracking system throughout the food chain and a single organization responsible for monitoring the food chain to prevent parallelism. This study provides comprehensive suggestions and recommendations to improve the structure of the legislative organization to ensure safe and qualified foods to consumers in Iran.

Keywords: Food safety management system, Iran, regulation, strategy

INTRODUCTION

Food safety is a top priority issue for all governments in the world.^[1-5] It is necessary to apply adequate control measures throughout the food chain regarding with the exposure to food safety hazards at every level of the food safety supply chain.^[6] Accessibility to qualified and safe food should be guaranteed through the collective efforts of all parties involved in the food industry.^[7] Furthermore, it is the duty of governments to establish and enforce a robust national food safety framework.^[8] To achieve this, a holistic approach is needed, combining regulatory measures with preventive strategies to guarantee food safety throughout the entire food chain, from production to consumption.^[9] Operative national food control systems are vital not only to safeguard the safety of domestically consumed food and protect public health but also

to verify the quality and safety of international trade, thereby maintaining trust in imported and exported food products.^[10]

With increasing foodborne diseases, governments are strengthening further severe and particular food safety control systems.^[11] There are different reports of deaths and poisoning of thousands of people

Address for correspondence: Dr. Zahra Esfandiari, Nutrition and Food Security Research Center, Department of Food Science and Technology, School of Nutrition and Food Science, Isfahan University of Medical Sciences, Isfahan, Iran. E-mail: zefandiary24@yahoo.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

Quick Response Code:



Website:
<https://journals.lww.com/IJEH>

DOI:
10.4103/ijehe.ijehe_39_24

How to cite this article: Esfandiari Z, Mansouripour S, Baba FV, Fakhri Y, Rostami M, Szumny A. National regulations and management systems for implementation and monitoring of food safety in Iran: A narrative review of literature. *Int J Env Health Eng* 2025;14:2.

Received: 01-09-2024,

Revised: 01-11-2024,

Accepted: 05-02-2025,

Published: 31-03-2025

in the history of food outbreaks in developed and developing countries.^[12,13] The lack of a suitable control procedure leads to microbiological and chemical contamination and foodborne diseases.^[14-16] However, the shortage and poor quality of food are the biggest problems in developing countries.^[6-8]

Another issue is the worldwide trade for food. Unfortunately, exporting or importing unsafe food on international scales can cause global problems.^[10] Notable examples include the European Union's ban on animal-derived imports from China in 2002 due to veterinary drug residues, the German *E. coli* O104:H4 outbreak linked to contaminated fenugreek seeds from Egypt in 2009, and the incident of dioxin-tainted animal feed from Germany, which led to the contamination of meat, eggs, and egg products exported to China in 2011.^[12,17]

Recently, it was reported some food incidents for unsafe food in developing countries. In Iran, there are limited reports on this issue. In just one Iranian report published by the Ministry of Health and Medical Education (MOHME) between 2006 and 2011, a total of 2,250 outbreaks were registered. The increasing rate of food incidents was 0.07/100000 in 2006–1.38/100000 in 2011. Among the 684 human samples analyzed, *E. coli*, *Shigella*, *Hepatitis A*, and *Vibrio cholera* were major etiologic factor, respectively.^[13]

With the improvement of the economic, the role of global market increases in each country. Therefore, concerns about Iranian food safety can affect both the health of consumers within and outside of Iran.^[18] For this purpose, a food safety management system (FSMS) has been created in which the most attention has been paid to standardizing the conditions of production and making them safe so that the possibility of producing unhealthy products can be minimized.^[19]

The Iranian regulation aimed to establish a contemporary food safety framework that aligns with global standards, thereby providing confidence in the safety of Iranian food products and enhancing their competitiveness in the international market. Iran has emerged as a significant contributor to the international food supply chain. According to the Food and Agriculture Organization (FAO) data, Iran ranks as the world's third-largest producers of dates, honey, pistachios, and walnuts. Notably, Iranian farmers produce 1.28 million tons of dates each year, securing the country's position as the third-largest date producer globally, following Egypt.^[20]

In Iran, MOHME has determined the requirements for food safety management in trade within the food chain at the national level, in line with the global trend for food processing plants. In addition, one of the main functions of this organization is to supervise and monitor the requirements defined in FSMS in food processing plants.^[21]

To the best of our knowledge, a rapid understanding of the management system is not published in Iran. For this purpose, this article provides an introductory examination of the food regulatory framework in Iran. The key components of the implementation of FSMS are good manufacturing practices (GMP), good

hygiene practices (GHP), good laboratory practices (GLP), and Hazard analytical critical control point (HACCP) in Iran. Moreover, this article assesses the organizational structure and legislative framework of Iran, highlighting both its strengths and weaknesses. For facilitate future harmonization, this article offers comprehensive recommendations for improvement of Iran's food safety regulations.

MATERIALS AND METHODS

Eligibility criteria

We defined the eligible criteria for any law or regulation or legislation related to food established on national or international scales with the aim of enabling accessibility to articles with the content of FSMS. It was included a strategy when the focus of the article was food law/regulation/legislation or if the authors itemized that a general strategy had been executed to enable achieving the FSMS. In addition, it was conducted a scan for the most important organization and legal acts as well as strengths and weaknesses of food safety regulations in Iran and other countries.

Inclusion and exclusion criteria

The eligible studies were full-text available in English or Persian from 1966 with the description of food regulation, law, or legislation or FSMS implementation in different countries. Review articles and websites were included in our study. In addition, thesis, book chapters, books, correspondence, letters to editors, and conferences were included.

Search strategy

This study seeks for FSMS implemented in Iran and presents its strengths and weakness. The literature was searched until February 1, 2024, using PubMed, Web of Science, Scopus, Irandoc, and the Iranian Scientific Information database as well as the websites of important national and international organizations related to food regulations. The search strategy consisted of combinations of terms including "Iran," "food safety management system," "food safety," "regulation," "legislation," and "law." The reference list of papers was assessed to retrieve missing papers. The search strategy for PICOT assignments is presented in Table 1.

Study selection

After removing duplicates, five reviewers (ZE, SM, FVB, YF and MRR) separately selected abstracts and titles for relevance. The

Table 1: Inclusion and exclusion items for problem, intervention, outcome, comparison, and time of the current study

| Items | Focus |
|--------------|-------------------------------|
| Problem | Food safety management system |
| Intervention | Regulation |
| Outcome | Implementation/monitoring |
| Comparison | - |
| Time | 1966–2024 |

PICOT: Problem, intervention, outcome, comparison, and time

full-text articles were carefully chosen by five reviewers (ZE, SM, FVB, YF, and MRR). Two reviewers (FVB and YF) extracted data from selected studies in a data extraction checklist. The extracted data were country, major regulatory authorities and duties, key food law and regulation and legislation, implementation of FSMS and inspection procedure. The selected studies were then transferred to four reviewers (ZE, SM, FVB, and AS) for cross-evaluation of the extracted data. The extracted data were analyzed in discussing groups. A reviewer (ZE) initially created framework by classifying the extracted food law and regulation based on how they were aimed at implementing the principles of food safety. The results were developed from the process of the extracted data by adding relevant subtypes, until fullness was reached when no more results were recognized. Subsequently, the summary of the results was finalized through discussing among researchers (ZE, SM, FVB, YF, MRR, and AS).

RESULTS

In the current study, it was identified 15988 articles, of which 188 were included [Figure 1]. A total of 96 articles related to food regulations were identified on continents including the United States, Europe, Australia, New Zealand, and Africa. For Asia, the regulations of China and Iran were included in 39 and 9 articles. There were 44 studies that described the implementation of the food safety system in the aforementioned continents and countries. Three main topics and themes were about regulations related to FSMS. Strategies were organized in the following categories and discussed afterward:

1. Basic food law and policymaking included to discuss a history of food laws, responsible organizations in the area of legislation, food safety inspection, supervision, and monitoring in Iran
2. Finding the weaknesses and strengths of FSMS in Iran and other countries involved in food regulations, as well

as continents including the USA, Europe, Africa, Asia, Australia, and New Zealand

3. Suggestion for improving FSMS in Iran for future harmonization.

An important set of content in this paper come from leading Iranian constitution and their developments in food safety.

DISCUSSION

Food safety law and regulation in Iran

In Iran, the food legislative framework encompasses a comprehensive set of authorized laws, protocols, and standards that establish guiding principles for food control, governing all aspects of the food supply chain, from production and storage to distribution, marketing, and trade. Specially, Act 13 of the Iranian constitution emphasizes the importance of ensuring the safe delivery of food to consumers, protecting them from adulterated and unhealthy products. The MOHME is responsible for policymaking and planning regarding the management and monitoring of the safety and health of food products in Iran.^[22] The legislation in the field of food is carried out in the Iranian Food and Drug Administration (IFDA) as one of the main and central departments of the MOHME.^[21] IFDA operates in the capital of the country (Tehran), and 64 deputies of the food and drug departments follow and implement the laws issued by this organization in the whole country. Notification of the implementation of laws in food processing plants and supervision of the implementation of laws is based on the annual supervision (twice every year) by the executive experts of the deputy of food and drug departments at the level of province, cities, and counties.

Companies related to the production and distribution of animal and plant raw materials and food processing plants are primarily responsible for establishing food safety and

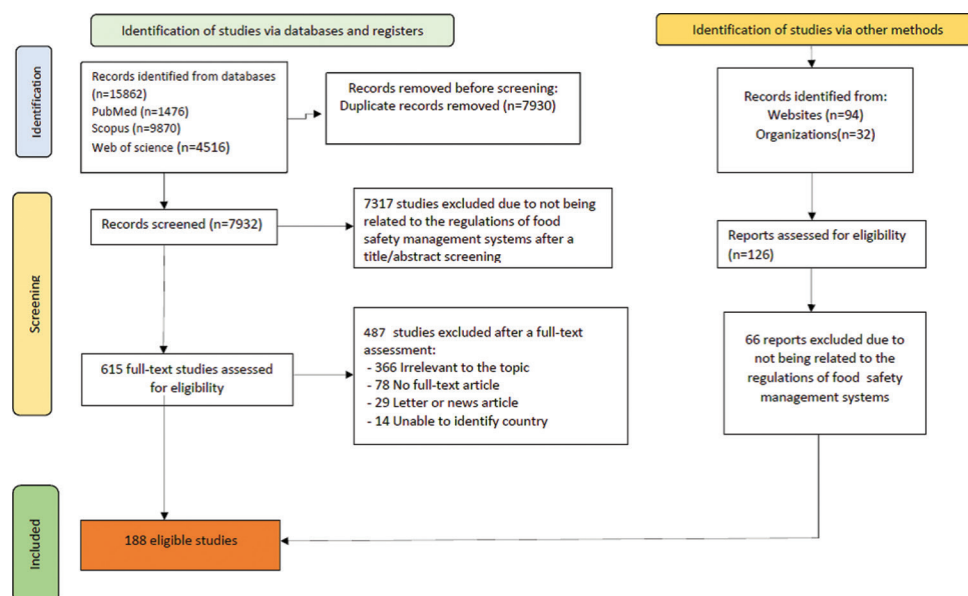


Figure 1: Review flowchart with details for included articles

health. In fact, it was clarified that food producers have the main responsibility for food safety. The laws, supervision, inspection, and monitoring of the government sector are powerful external forces to progress the quality of food through food manufacturers in Iran. All relevant legal requirements, whether direct or indirect, should be consolidated and integrated at the national level to fall under the purview of food legislation, ensuring a comprehensive and cohesive framework for food regulation. Based on this category, food safety laws are for labeling, consumer protection or fraud deterrence laws, safety claims, laws on weights and measures, import and export rules, laws on pesticides and controlling fertilizers, among many others. In addition, it has been emphasized on commercial contracts and laws, distribution networks, agricultural laws, personal injury, and international trade laws. According to the food laws in Iran, quality must meet the consumer's expectations and not be presented in a way that misleads consumers. No substance should be added or removed from food that is harmful to the health of consumers.^[23]

Iran's foundational food legislation was first introduced in 1967, with the National Parliament Congress, the country's highest legislative body, approving the core laws. Since then, these laws have undergone numerous revisions and updates. Subsequent regulations and bylaws have been enacted to govern various aspects of the food industry, including quality and safety standards, food labeling, and the use of food additives, all aimed at providing a comprehensive framework for the regulation of food-related activities.^[21]

Many revisions have been applied to food laws in the field of fraud, sale, and supply of adulterated food, the expiration date for food, and noncompliance with the approved formulation. Among the other revised cases mentioned in the food law, it is the decision regarding the legal authority that examines the request for a license to establish a small and large scale of food production. In addition, the requirements for the certification of the technical manager to work in food enterprises or factories as supervisors of food production and quality are mentioned in food and beverage laws. The fundamental amendments in the food laws are related to personal hygiene, equipment, descriptions of the duties of food technical managers and food inspectors, qualitative grading of food processing plants, and construction conditions of food preparation, distribution, storage, and sales centers. One of the significant revisions is related to the modernization of the laws for the establishment of the food safety system. In this regard, the auditing of ISO 22000 and HACCP to implement FSMS in Iran began in 2018. In 2022, executive instructions have been issued for the protocols of evaluating and auditing food processing plants based on food safety management standards.^[21]

One of the important activities in the food law is the assessment of the criteria and requirements of the prerequisite programs (PRPs) to establish the food processing plants and ensuring the availability of technical and sanitary conditions for the production of safe food. Based on the Iranian food

laws, the main responsibility of manufacturing safe food is the duty of food processing plants. The relevant punishments for noncompliance with the implementation instructions have been clearly set for the offenders.^[21] The trend of the creation and modification of food law in Iran for establishment of FSMS is shown in Figure 2.

In the food chain from farm to fork, various government regulatory bodies monitor the compliance of companies and their performance as well as the quality of raw material transferring to the Iranian food industry. The quality and safety of material with plant basis have been formulated by the Ministry of Agriculture-Jahad (MAJ). The related law describes the quality and safety standards for agriculture, producing zones, production, packaging, marks, and authorized duties. In this regard, agriculture laws give the authority to develop the quality of agriculture products in specific for pesticides, and quality standards systems, as well as presenting quality inspection and supervision systems.^[24]

The Iranian National Standards Organization (INSO) plays a crucial role in developing and disseminating guidelines, standard operating procedures, and recommended codes of practice for food manufacturers, which are made available free of charge. Furthermore, this organization is responsible for establishing standardization laws that cover all industrial products, including food, outlining the legal obligations for the formulation of food products and their qualitative characteristics, thereby ensuring consistency and quality across the industry.^[25]

The supervision and control of material with animal basis is the responsibility of the Iranian Veterinary Organization (IVO). However, the control of processed foods has been managed by the IFDA.^[26] The definition of the limits of pesticide and veterinary drug residues in food and the related testing methods will be made cooperatively by INSO, IFDA, MAJ, and the IVO. Furthermore, Fisheries Organization, Ministry of Industry, Mining and Trade, and Primary Health Care Organization which respectively functions with respect to quality control of raw seafood products, consumer protection, and assuring the safety of distributed food [Figure 3].^[27-29]

The "Supreme Council of Health and Food Security" of the country is formed to expand coordination and interdepartmental cooperation. The approvals and acts of this council are in force after the agreement of the board ministers as well as are followed by the provincial committees managed by the governor of the various provinces. At the level of local government, the Supreme Council for Health and Food Security directives the departments of health, agriculture, quality control, industrial and commercial, and food and drug to harmonize with each other to perform and execute the law. Furthermore, it was provided the inspection services at the county level. The authority and finances are national, but technical supervision in how to implement the principles of food safety is related to the local level.^[29]

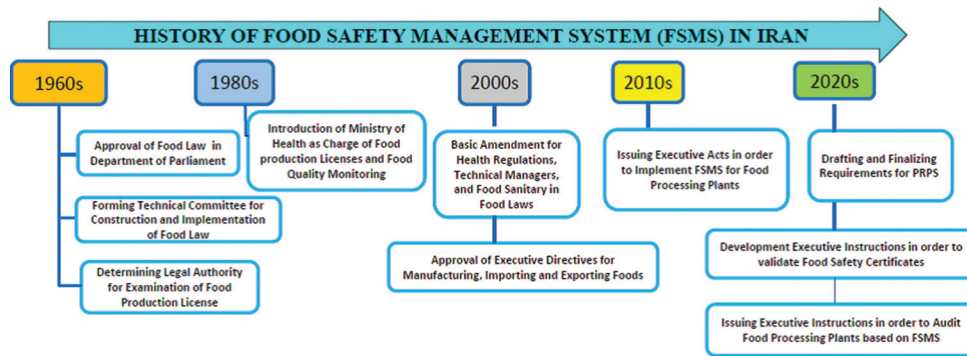


Figure 2: Evolutionary process of food regulations and laws in Iran

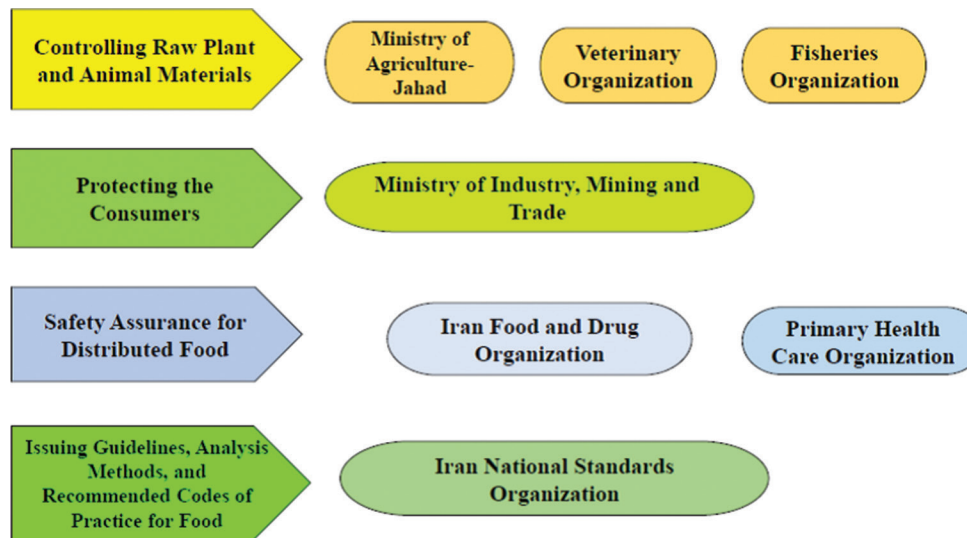


Figure 3: Different organizations responsible for delivering safe and healthy food in the chain of farm to fork in Iran

The food safety management and control system are the key factors for delivering safe food. In fact, the coordination between legislation and operation has a determinative role for the effectiveness of FSMS. In every organization related to food, it is necessary to update, create, document, implement, and maintain an effective FSMS.^[18,30] By establishing FSMS, every organization can ensure that food risks are evaluated and controlled to deliver safe food to consumers. At the same time, the necessary information regarding the safety aspects of the products is exchanged throughout the food chain.^[31]

The establishment of HACCP and ISO 22000 systems is the first step of FSMS practicalization. For this purpose, it should design and implement PRPs. The PRPs consist of various components and emphasize the policy-making, implementation, recording, archiving, and monitoring of food safety in food processing plants.^[32] It is required that food producers implement the PRPs to prove their ability in controlling and preventing food safety risks in a food production unit.^[18] Totally, PRPs are defined based on the following principles: (1) determining the scope of activity of organizations related to food; (2) defining the production process and its different steps including raw materials,

formulation, equipment, preparation, processing, packaging and distribution at an acceptable quality level; (3) evaluation of physical, chemical, and biological factors threatening the safety of food by performing the necessary tests and comparing with national and international standards; (4) communicating and documenting the effective factors in the cycle of food production and distribution; (5) continuous monitoring and updating the system for better execution of activities; and (6) controlling and documenting the process and products inside and outside the organization. In Iran, PRPs have been formed based on the requirements defined to establish GMP, GHP, and GLP.^[32-34]

Food safety law and regulation in other countries

Canada

In line with the Canadian government's policy, consumer trust and food safety are top priorities for the food industry. To achieve this, strict safety protocols are enforced throughout the entire food supply chain from production to export. Canada boasts an impressive food safety record, with key federal laws and regulation in place, including the Food and Drug Act, Food and Drug Regulations, Safe Food for Canadians Acts, and Safe Food for Canadians Regulations (SFCR).^[35] Canadian Food

Inspection Agency (CFIA) plays a vital role as a proactive and innovative regulator, overseeing the nation's food safety.^[36,37] CFIA introduced an SFCR licensing system, which took effect in 2019. Since then, a SFCR license has been mandatory for certain food business activities. The main objectives of the SFCR are to: (1) track and identify food producers and suppliers in Canada, (2) create a flexible licensing framework that accommodates diverse food businesses, (3) align Canada's food safety standards with international norms, and (4) demonstrate CFIA's commitment to modernization and improved service.^[38]

The consolidation of 14 sets of the previous food regulations occurred in SFCR to develop the harmonization between all the sections involved in food businesses. The SFCR formed based on the risk management, education, practical training, and precise measurement. Furthermore, preventive control plan shows how risks of food are recognized and controlled in food chain in Canada. In fact, traceability across the supply chain is important from immediate customers to initial providers.^[35]

CFIA has a robust inspection and enforcement program to ensure compliance with food safety organizations. This agency works with scientific basis and risk-based approach as well as it has closely activity with other government agencies, industry stakeholders, and international partners to ensure a coordinated approach to food safety.^[39]

USA

In the United States, federal agencies such as the Food and Drug Administration (FDA), the United States Department of Agriculture (USDA), Centers for Disease Control and Prevention (CDC), and Environmental Protection Agency (EPA) share the responsibility of ensuring food safety. Each agency has its own scope, with the FDA regulating human food (excluding meat, poultry, and egg products),^[40,41] the USDA overseeing meat, poultry, egg products, organic foods, and animal welfare,^[42-45] the CDC collaborating on outbreak investigations and providing food safety guidance,^[46] and the EPA managing pesticide residues and water quality.^[47] In addition to federal regulations, states and local jurisdictions may have their own food safety laws and regulations, such as state food safety codes (regulating food handling, preparation, and storage practices) and local health codes (regulating food service establishments, such as restaurants and food trucks).^[48]

Federal laws governing food safety include: (1) The Federal Food, Drug, and Cosmetic Act (FD and C Act, 1983), which tasks the FDA with safety regulation.^[49] (2) The Food Safety Modernization Act (FSMA, 2011) which prioritizes preventing foodborne illnesses by introducing mandatory controls for manufacturers and bolstering inspections and enforcement.^[50] FSMA marked a shift toward proactive, preventive measures and grants the FDA authority to regulate all food aspects, from cultivation to harvest.^[50-52] (3) Meat, poultry, and Egg inspection laws (such as the Meat Inspection Act), under the purview of the USDA, dictate inspections and guidelines for meat, poultry, and egg products.^[53]

Europe

In Europe, food safety is regulated by a comprehensive set of laws, regulations, and guidelines that prioritize human health and consumer protection.^[54] The European Parliament creates food safety laws through directives and regulations, which are then incorporated into national legislation by individual countries.^[55] The EU's food safety framework is built on four key principles: Risk analysis, precautionary principle, transparency, and cooperation.^[56] Key European food safety legislation includes: (1) General Food Law Regulation (EC) No 178/2002, which sets out general principles for food law, including the requirement for food businesses to ensure product safety,^[57] (2) Food Hygiene Regulation (EC) No 852/2004, which establishes general hygiene requirements for all food businesses,^[58] (3) Official Controls Regulation (EU) 2017/625, which defines rules for official controls on food and feed, including inspection, sampling, and enforcement.^[59] While the EU framework provides general principles and rules, each EU country has its own national laws and regulations. For example, German, France, and the United Kingdom have their own food safety authorities. The "Federal Ministry of Food and Agriculture," "French Agency for Food, Environmental and Occupational Health Safety (ANSES)" and "Food Standards Agency (FSA)" are responsible for food safety in Germany, France, and the United Kingdom, respectively.^[60] European Food Safety Authority (EFSA) is an independent agency that provides scientific advice on food safety issues to the European Commission of the European Parliament. EFSA's main tasks include conducting the scientist risk assessment, providing scientific opinions, and collecting and analyzing data on food safety issues. EFSA plays a crucial role in supporting the EU's food safety framework and ensuring that food safety decisions are based on scientific evidence.^[61-63]

China

The Chinese government has demonstrated its commitment to improving food safety by implementing more regulations and establishing additional regulatory agencies over time. For instance, the number of national food standards nearly doubled between 2012 and 2015.^[64,65] However, despite these efforts, regulatory capacity has been hindered by complexity, diversity, and coordination challenges. Two major coordination issues have arisen: (1) central-local government coordination: There were difficulties in coordinating efforts between the central government and local governments, leading to inconsistencies in food safety enforcement. (2) Institutional fragmentation: The structure of food safety supervision has led to a fragmented system, with multiple agencies responsible for different aspects of food safety. This has resulted in gaps in oversight and enforcement. In China, the MOH oversaw national food hygiene, but this has led to practical problems being left unaddressed. As a case of problem, there was a lack of clear authority for food safety inspection agencies to punish violators. Furthermore, industrial ministries controlled key segment of food chain, which can lead to conflicting priorities and undermine food safety efforts.^[66] Overall, while

the Chinese government has made efforts to improve food safety, it still faced significant challenges in coordinating its regulatory efforts and addressing the complexities of the food safety system. To address the challenges in China's food safety regulatory structure, a new framework was established in the 1990s, bringing together key agencies such as the MOH, Ministry of Agriculture, the General Administration of Quality Supervision, Inspection and Quarantine, among others.^[66,67] This restructuring aimed to strengthen coordination and centralization in China's food safety system in 2000s. However, the newly established State Food and Drug Administration in 2003 faced limitations, including a lack of authority over food approval and routine supervision, as well as difficulties in coordinating with multiple ministry-level organizations.^[67] To address these weaknesses, the MOH was given a greater role in coordination and sole responsibility in 2007. The National Food Safety Commission was established at each level of government to oversee the national food safety system. Although administration and enforcement were divided among 14 agencies at the national level in 2013, this led to further fragmentation.^[68,69] To consolidate supervision, the China Food and Drug Administration (CFDA) was formed, operating as a ministerial-level agency directly under the State Council and regulating food safety law.^[70] This reorganization created a clearer division of responsibilities among agencies, leading to significant progress in food supervision in China.^[71] Moreover, the CFDA's establishment helped address the challenges of coordination between central and local governments resulting in more effective implementation of food safety policies.^[72] Overall, China's food safety regulatory structure has evolved over time, with the CFDA playing a key role in consolidating supervision and improving food safety outcomes.

Australia and New Zealand

Australia and New Zealand have a long history of cooperation in food production and trade. In 1991, they established a joint organization, Food Standards Australia New Zealand (FSANZ), which oversees the food safety system for both countries.^[73,74] In 1996, they signed a treaty to implement a unified food standard system, which enabled FSANZ to endorse international guidelines, such as those from Codex Alimentarius Commission, on food safety management practices like HACCP. Interestingly, Australia was already actively implementing HACCP in the food sector in the 1980s, possible due to its significant food export industry. The country's industry-oriented approach to HACCP implementation set it apart from other nations. By the mid-1990s, HACCP had received formal approval, and FSANZ played a crucial role in regulating food standards from "farm to fork." FSANZ's standards are mandatory for local governments, ensuring a consistent and high level of food safety across both countries.^[73,75]

In Australia, the New South Wales (NSW) Food Authority plays a crucial role in ensuring food safety throughout the entire food chain.^[76] The authority's primary objective is to safeguard the health and well-being of the NSW population

by minimizing food safety risks, responding promptly to incidents, and improving access to safe food. To achieve this, the NSW Food Authority conducts regular audits of licensed businesses to assess their food safety programs and compliance with relevant regulations. These audits involve evaluating the effectiveness of a business's food safety plans and procedures, as well as reviewing other related plans that are necessary for meeting food safety standards.^[77]

Key food safety laws in Australia include the Food Standard Australia New Zealand Act 1991, Australia New Zealand Food Standards Code, Food Safety Australia Act 1992, and various State and Territory Food Acts.^[78] These laws establish the framework for food safety regulations in Australia and New Zealand. The FSANZ Act 1991 sets the stage for developing food standards,^[75] while the Australia New Zealand Food Standards Code outlines specific standards for food handling, preparation, and storage.^[78] The Food Safety Australia Act 1992 provides a framework for regulating food safety in Australia, including the powers of food safety authorities and requirement for food businesses.^[79] Furthermore, each state and territory in Australia has its own food act that governs food safety within its jurisdiction, ensuring a comprehensive and harmonized approach to food safety regulation across the country.^[79]

Africa

In many developing countries, particularly in Africa, food system transformation is hindered by supply chain failures and outdated technology, making it challenging to deliver safe food to consumers.^[80,81] However, various regional organizations are working to regulate and monitor food safety in Africa.^[82,83] The African Food Safety Agency is a key player, responsible for ensuring the safety and quality of food products across the continent. Other organization, such as the Pan-African Organization for the Safety and Health of Animals, Plants and Environment and the Food Safety in Africa Network, also play important roles in promoting food safety and regional collaboration.^[82,84] At the country level, various organizations are responsible for regulating food safety. For example, in Nigeria, the National Agency for Food and Drug Administration and Control oversees food safety,^[85,86] while in South Africa, the Department of Health's Directorate is responsible for regulating food safety issues.^[87] Similar organizations exist in Kenya (Kenya Food and Beverage Inspection Unit),^[82] Ghana (Food and Drug Authority), and Egypt (MOH's; Directorate for Food Control).^[30] These organizations work to enforce food safety regulations and ensure the safety and quality food products in their respective countries.

Suggestion for improving food safety management in Iran

Each country's food safety regulations have both positive and negative aspects including strengths and weaknesses [Table 2]. As countries develop economically and socially, their food safety laws and regulations tend to become more refined, and the enforcement mechanisms become more effective and

Table 2: Strengths and weaknesses of food safety regulation in different countries

| Name of country | Strengths | Weakness |
|--------------------------------------|--|---|
| Developed countries ^a | Comprehensive framework for covering all aspects of food safety from farm to fork approach; scientific and evidence-based and proportionate to risks; focusing on the most critical risks to human health and allocating resources; strong enforcement mechanisms in place; accountable with clear labeling and public access to information on food safety risks, strong industry engagement ^[33,76,88,89] | Lack of uniformity in food safety standards across different provinces and territories; limited resources, inconsistent regulation in food safety enforcement in some states and local jurisdictions ^[35,76,90-92] |
| Developing country ^b | Comprehensive regulatory framework; strong government support; growing capacity of food safety agencies; increasing transparency ^[72] | Complexity of regulatory framework; lack of effective enforcement; insufficient funding; limited public awareness; high burden on small and medium-sized enterprises; need for improvement in laboratory testing capacity; not fully implementation risk-based approach ^[72] |
| Least developed country ^c | Establishment of food safety authorities; development policies and regulations to ensure food safety ^[93,94] | Inadequate enforcement mechanisms to ensure compliance with food safety regulations; limited funding, personnel, and equipment; lack of public awareness about food safety; outdated food safety regulations; limited laboratory capacity ^[87,95-98] |

^aIncluding USA, Europe, Canada, and Australia and New Zealand, ^bIncluding China, ^cIncluding Africa

transparent. Notably, developed countries have well-defined comprehensive frameworks that encompass all stages of food production, processing, and distribution, providing a holistic approach to food safety management.^[33,76,88,89] The laws governing food safety in developed countries are comprehensive and detailed, playing a crucial role in ensuring public health. Similarly, IFDA has been a significant step forward in enhancing food safety regulation in Iran. However, despite this progress, Iran still faces challenges due to inadequate legislation, resulting in inconsistent enforcement and coordination among organization involved in the food supply chain from farm to table. Moreover, the current laws in Iran fail to address issues of overlapping responsibilities among different agencies, and lack clarity in defining specific duties. The laws cannot explain existing defects such as vagueness in the description of responsibilities. In such a scenario, transaction costs are likely to escalate due to increased interactions and confusion between food processing plants and regulatory agencies. Although Iran has a comprehensive legislative framework for food safety, its regulatory framework is disjointed, with multiple government agencies responsible for different aspects of food safety, leading to confusion, overlap, and regulatory gaps.

The lack of clear definition of responsibilities among authorities overseeing food manufactures in Iran creates a critical issue of overlapping tasks, despite effort by the Supreme Council of Health and Food Security. A potential solution to this problem is to designate a single organization as the lead authority responsible for overseeing the entire food supply chain, thereby clarifying the roles and boundaries of different regulators. In contrast, developed countries have well-coordinated food regulatory organizations with minimal overlap between departments, facilitating a more efficient and effective food safety system. Consequently, the establishment of a clear and unified regulatory framework can lead to significant reductions in business costs for both food industries and regulator organoids, allowing them to operate more efficiently and effectively.

In comparison to countries such as Canada, Europe, Australia, New Zealand, and the United States, Iran's food safety systems fall short, lacking transparency and accountability, particularly in terms of clear labeling and public access to information of food safety risks.^[33,89] Furthermore, the Iranian public is not well-informed about food safety issues, which can lead to inadequate food handling and consumption practices, ultimately contributing to a higher risk of foodborne diseases.^[99-101]

In addition, government is provider of legal food safety monitoring and social public at weak condition in Iran. Compared with developed countries, Iran should involve public and stakeholder participation in the establishment and revisions of food safety laws. The responsibility of food safety monitoring primarily falls on the government in Iran, with limited participation and input from the general public and relevant stakeholders. Unlike developed countries, which involve their citizens and stakeholders in shaping and refining their food safety laws, Iran can benefit from similar inclusivity and collaborative approaches. Furthermore, Iran's emergency preparedness and response systems for food safety incidents are limited, which can exacerbate the impact of food safety crises.

In contrast to developed countries, the private sector and food industries in Iran are not proactively involved in food safety initiatives, which can hinder the effectiveness of food safety regulations and the adoption of best practices. Another issue plaguing Iran's food law is the leniency of fines imposed on food production units that violate regulations. This had led to a situation where food manufactures weight the costs of violating regulations against the potential profits, and often choose to pay the fine as a cost of doing business, prioritizing higher profits over compliance with food safety standards. As a result, revising the punishment system is essential to ensure compliance with food safety regulations.

Notably, Iran has collaborated with international organization, such as the World Health Organization and the FAO,^[24] to

enhance its food safety regulations and systems. However, despite progress in establishing a national food safety authority and legislative framework, Iran still faces significant challenges, including limited resources, fragmented regulation and inadequate enforcement.

This study has some limitations, including a scarcity of scientific articles on Iranian food safety regulations and a lack of official reports on strategies for monitoring food adulteration, controlling of foodborne diseases, tracing food contaminants, and preventing food allergens throughout the food supply chain. Nevertheless, the study's findings are valuable, as they highlight the strengths and weaknesses of Iran's food safety regulations, providing a foundation for future improvements.

CONCLUSION

Considering that food is an integral component of everyday life, countries worldwide have consistently emphasized ensuring public confidence. The modern food supply system is so complex and widespread, with health threats emerging from various locations, and intersecting with numerous policy areas, that is has become extremely challenging to effectively regulate and oversee food safety. Countries around the world have unique law governing food products, with various organizations involved in shaping policies, monitoring and enforcing regulations. As economies evolve, food laws also undergo changes, with ongoing reforms and revisions aimed at improving the supervision and monitoring of food quality and safety. Iran is also undergoing this evolutionary process, with its food laws being revised and updated to combat food fraud and improve the monitoring of food production and distribution, ultimately aiming to establish a robust FSMS. In Iran, food laws have played a significant role in ensuring the availability of safe and health food for its citizens. With a history dating back to the 1960s, Iranian food law has undergone significant developments, having major revisions to date, underscoring its evolving efforts to maintain public health through safe food systems. A comparative analysis of Iran's food laws with those of countries such as Canada, Europe, USA, Australia and New Zealand, China, and Africa reveal that Iran's food safety system has shortcomings and the areas for improvement. Iran can achieve best practices in food safety regulation by streamlining its regulatory framework, bolstering its food safety agencies with more investment, promoting transparency and public awareness, prioritizing high-risk areas, and fostering global cooperation on food safety matters. To ensure the quality, health, and safety of food products, it is essential to foster strong collaboration and interaction between the government, producers, and consumers, leveraging modern technology, and innovative approaches to achieve this goal.

Acknowledgment

We would like to acknowledge for the funding granted by Vice-Chancellor of Research and Technology of Isfahan University of Medical Sciences in Iran.

Financial support and sponsorship

This study was financially supported and supervised by the Isfahan University of Medical Sciences (Research Grant Number: 2401211).

Ethical code

This study was approved by the ethics committee of Isfahan University and Medical Sciences (IR. MUI. RESEARCH. REC.1401.285).

Conflicts of interest

There are no conflicts of interest.

Authors' contributions

Zahra Esfandiari: Conceptualization; Data curation; Funding acquisition; Investigation; Methodology; Supervision; Validation; Writing-original draft; Samar Mansourpour: Conceptualization; Data curation; Writing-original draft; Farzaneh Vaseghi Baba: Data curation; Formal analysis; Methodology; and Writing-review and editing; Yadollah Fakhri: Methodology; Writing-original draft; and Writing-review and editing; Mohammadreza Rostami: Methodology, Writing-original draft; Antoni Szumny: Original draft; and Writing-review and editing;

REFERENCES

1. Fung F, Wang HS, Menon S. Food safety in the 21st century. *Biomed J* 2018;41:88-95.
2. Abegaz SB. Food safety practices and associated factors in food operators: A cross-sectional survey in the students' cafeteria of Woldia University, North Eastern Ethiopia. *Int J Food Sci* 2022;2022:7400089.
3. Nau A, Fröhlich J, Lauck C, Dorn-In S, Guldemann C. Impact of the revision of European food hygiene legislation and the introduction of convenience-based food on food safety in the German military. *J Food Prot* 2023;86:100073.
4. Khodaei SM, Esfandiari Z, Sami M, Ahmadi A. Determination of metal (oids) in different traditional flat breads distributed in Isfahan City, Iran: Health risk assessment study by Latin hypercube sampling. *Toxicol Rep* 2023;10:382-8.
5. Akbari-Adergani B, Shahbazi R, Esfandiari Z, Kamankesh M, Vakili Saatloo N, Abedini A, *et al.* Acrylamide content of industrial and traditional popcorn collected from Tehran's market, Iran: A risk assessment study. *J Food Prot* 2023;86:100001.
6. Varzakas T, Smaoui S. Global food security and sustainability issues: The road to 2030 from nutrition and sustainable healthy diets to food systems change. *Foods* 2024;13:306.
7. Varzakas T, Antoniadou M. A holistic approach for ethics and sustainability in the food chain: The gateway to oral and systemic health. *Foods* 2024;13:1224.
8. Lee JC, Neonaki M, Alexopoulos A, Varzakas T. Case studies of small-medium food enterprises around the world: Major constraints and benefits from the implementation of food safety management systems. *Foods* 2023;12:3218.
9. Saraswat S, Khan R, Kumar A, Singh AP. Impact of mandatory food and agriculture laws on the food manufacturing industry: Review of 75 years of challenges and changes. In: *Convergence of Cloud Computing, AI, and Agricultural Science*. IGI Global Scientific Publishing: USA; 2023. p. 228-60.
10. Alrobaish WS, Vlerick P, Luning PA, Jacxsens L. Food safety governance in Saudi Arabia: Challenges in control of imported food. *J Food Sci* 2021;86:16-30.
11. Gul N, Muzaffar K, Ahmad Shah SZ, Assad A, Makroo HA, Dar B. Deep learning hyperspectral imaging: A rapid and reliable alternative to conventional techniques in the testing of food quality and safety. *Qual*

- Assur Saf Crops Foods 2024;16:78-97.
12. Jia C, Jukes D. The national food safety control system of China – A systematic review. *Food Control* 2013;32:236-45.
 13. Masoumi Asl H, Gouya MM, Soltan-Dallal MM, Aghili N. Surveillance for foodborne disease outbreaks in Iran, 2006-2011. *Med J Islam Repub Iran* 2015;29:285.
 14. Madani A, Esfandiari Z, Shoaei P, Ataei B. Evaluation of virulence factors, antibiotic resistance, and biofilm formation of *Escherichia coli* isolated from milk and dairy products in Isfahan, Iran. *Foods* 2022;11:960.
 15. Özlü H. Occurrence, dietary exposure and risk assessment to aflatoxins in red pepper flakes from Southeast of Türkiye. *Qual Assur Saf Crops Foods* 2024;16:69-77.
 16. Gao L, Huang X, Wang P, Chen Z, Hao Q, Bai S, *et al.* Concentrations and health risk assessment of 24 residual heavy metals in Chinese mitten crab (*Eriocheir sinensis*). *Qual Assur Saf Crops Foods* 2022;14:82-91.
 17. Todd EC. Foodborne disease in the Middle East. In: Murad S, Baydoun E, Dagher N, editors. *Water, Energy and Food Sustainability in the Middle East*. 1st ed. Switzerland: Springer; 2017.
 18. Sadati AK, Nayedar M, Zartash L, Falakodin Z. Challenges for food security and safety: A qualitative study in an agriculture supply chain company in Iran. *Agric Food Secur* 2021;10:41.
 19. Chen H, Liu S, Chen Y, Chen C, Yang H, Chen Y. Food safety management systems based on ISO 22000: 2018 methodology of hazard analysis compared to ISO 22000: 2005. *Accred Qual Assur* 2020;25:23-37.
 20. FAO. Iran among World's Top Agro-Food Exporters in 2022. Available from: <https://www.tehrantimes.com/news/493079/Iran-among-world-s-top-agro-food-exporters-in-2022-FAO>. [Last accessed on 2022 Dec 01].
 21. IFDA. Introduction to Iranian Food and Drug Administration. Available from: <https://www.fda.gov.ir/iran/news/detail-events/en/c/461361>. [Last accessed on 2016 Jan 16].
 22. MOHME. Introduction to Ministry of Health and Medical Education. Available from: <https://behdasht.gov.ir>. [Last accessed on 2023 Feb 17].
 23. Ghazavi N, Rahimi E, Esfandiari Z, Shakerian A. Accuracy of the amount of trans-fatty acids in traffic light labelling of traditional sweets distributed in Isfahan, Iran. *ARYA Atheroscler* 2020;16:79-84.
 24. MAJ. Introduction to Ministry of Agriculture-Jahad. Available from: <https://maj.ir>. [Last accessed 2022 Jan 21].
 25. INSO. Introduction to Iran National Standards Organization. Available from: <https://www.inso.gov.ir>. [Last accessed on 2023 Sep 13].
 26. IVO. Introduction to Iranian Veterinary Organization. Available from: <https://www.ivo.ir>. [Last accessed on 2022 Oct 18].
 27. IFO. Introduction to Iranian Fisheries Organization. Available from: <https://www.fisheries.ir>. [Last accessed on 2023 Jul 19].
 28. MIMT. Introduction to Ministry of Industry, Mining and Trade. Available from: <https://www.mimt.gov.ir>. [Last accessed on 2022 Dec 12].
 29. PHCO. Interlocution to Primary Health Care Organization. Available from: <https://phcq.ir>. [Last accessed on 2021 Jan 29].
 30. Faour-Klingbeil D, Todd EC. Prevention and control of foodborne diseases in Middle-East North African countries: Review of national control systems. *Int J Environ Res Public Health* 2019;17:70.
 31. King T, Cole M, Farber JM, Eisenbrand G, Zabarás D, Fox EM, *et al.* Food safety for food security: Relationship between global megatrends and developments in food safety. *Trends Food Sci Technol* 2017;68:160-75.
 32. Ebdali H, Sami M, Bahreini N, Esfandiari Z. Knowledge, attitudes and self-reported practices of food technical assistants toward hazard analysis critical control point in Isfahan, Iran: A survey in dairy processing plants with different grading level of prerequisite programs. *Nutr Food Sci* 2021;51:375-86.
 33. Sreenivasan A, Suresh M. Sustainability-controlled measures for resilient management of fresh and short food startups supply chain. *Sustain Manuf Serv Econ* 2024;3:100024.
 34. Vallec JC, Charlebois S. Benchmarking global food safety performances: The era of risk intelligence. *J Food Prot* 2015;78:1896-913.
 35. Charlebois S, Juhasz M, Music J, Vézeau J. A review of Canadian and international food safety systems: Issues and recommendations for the future. *Compr Rev Food Sci Food Saf* 2021;20:5043-66.
 36. Keener L, Nicholson-Keener SM, Koutchma T. Harmonization of legislation and regulations to achieve food safety: US and Canada perspective. *J Sci Food Agric* 2014;94:1947-53.
 37. GOC. Introduction to Government of Canada. Available from: <https://inspection.canada.ca/en/food-safety-industry/toolkit-food-businesses/sfcr-handbook-food-businesses>. [Last accessed on 2018 Feb 21].
 38. Phillips AC. Canadian organics: Enhancing food safety and trade growth through regulatory harmonization and international collaboration. In: Goh B, Price R, editors. *Regulatory Issues in Organic Food Safety in the Asia Pacific*. 1st ed. Singapore: Springer; 2020.
 39. Zanabria R, Racicot M, Cormier M, Arsenault J, Ferrouillet C, Letellier A, *et al.* Selection of risk factors to be included in the Canadian food inspection agency risk assessment inspection model for food establishments. *Food Microbiol* 2018;75:72-81.
 40. USFDA. Complete Text of the Federal Food and Drugs Act of 1906 (The “Wiley Act”). Public Law 59-384 34 Stat. 768.906. Available from: <https://www.fda.gov/RegulatoryInformation/Legislation/ucm148690>. [Last accessed on 2012 Feb 17].
 41. USFDA. Complete Text of the Food, Drugs, and Cosmetic act (FDCA) of 1938. Available from: <https://www.fda.gov/RegulatoryInformation/legislation/federalfooddrugandcosmeticactfdca/default.htm>. [Last accessed on 2012 Feb 17].
 42. US Department of Agriculture. Poultry Products Inspection Act. Available from: https://www.fsis.usda.gov/Regulations_and_Policies/Poultry_Products_Inspection_Act/index.asp;2011. [Last accessed on 2012 Feb 17].
 43. US Department of Agriculture. Complete Text of the Federal Meat Inspection Act as Amended by the Wholesome Meat Act of 1967 Public Law 90-201 81 Stat. 584. 1967. Available from: https://www.fsis.usda.gov/Regulations&Policies/Federal_Meat_Inspection_Act/index.asp;2011. [Last accessed on 2012 Dec 20].
 44. US Department of Agriculture. Complete Text of the Poultry Products Inspection Act as Amended by the Wholesome Poultry Products Act of 1968. Public Law 90-492 82 Stat. 791; 1968. Available from: https://www.fsis.usda.gov/regulations_&_Policies/Poultry_Products_Inspection_Act/index.asp. [Last accessed on 2012 Dec 21].
 45. US Department of Agriculture. Complete Text of the Egg Products Inspection Act of 1970. Public Law 91-597 84 Stat. 1620; 1970. Available from: https://www.fsis.usda.gov/Regulations_and_Policies/Egg_Products_Inspection_Act/index.asp;December2009. [Last accessed on 2012 Dec 12].
 46. Johnson R. *The Federal Food Safety System: A Primer*. Washington, DC: Congressional Research Service Report for Congress; 2011.
 47. USEPA. Complete Text of Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA). Public Law 104. 61 Statutes at Large Chapter 125; 1947. As Added by Public Law 92-516, Sec. 2, 86 Stat. 973; 1972. Available from: <https://www.ag.senate.gov/download/fifra>. [Last accessed on 2012 Jan 15].
 48. DeWaal CS, Roberts C, Plunkett D. The legal basis for food safety regulation in the USA and EU. In: *Foodborne Infections and Intoxications*. 5th ed. Cambridge: Academic Press; 2021. p. 563-81.
 49. Guo Z, Bai L, Gong A. Government regulations and voluntary certifications in food safety in China: A review. *Trends Food Sci Technol* 2019;90:160-5.
 50. DeWaal CS, Plunkett DW. The food safety modernization act – A series on what is essential for a food professional to know. *Food Protect Trends* 2013;33:252.
 51. USFDA. The FDA Food Safety Modernization Act (FSMA). Available from: <https://www.fda.gov/food/food-safety/fsma>. [Last accessed on 2012 Jan 18].
 52. Spink J, Hegarty PV, Fortin ND, Elliott CT, Moyer DC. The application of public policy theory to the emerging food fraud risk: Next steps. *Trends Food Sci Technol* 2019;85:116-28.
 53. Ghaida TA, Spinnler HE, Soyeux Y, Hamieh T, Medawar S. Risk-based food safety and quality governance at the international law, EU, USA, Canada and France: Effective system for Lebanon as for the WTO accession. *Food Control* 2014;44:267-82.
 54. Cattaneo I, Astuto MC, Binaglia M, Devos Y, Dorne JL, Agudo AF, *et al.* Implementing new approach methodologies (NAMs) in food safety assessments: Strategic objectives and actions taken by the European Food Safety Authority. *Trends Food Sci Technol* 2023;133:277-90.

55. Blom-Hansen J, Christensen JG, Grøn CH, Jensen MH, Mortensen PB. Transposition of EU regulations: The politics of supplementing EU regulations with national rules. *J Eur Public Policy* 2022;30:2786-806.
56. Cattaneo I, Kalian AD, Di Nicola MR, Dujardin B, Levorato S, Mohimont L, *et al.* Risk assessment of combined exposure to multiple chemicals at the European Food Safety Authority: Principles, guidance documents, applications and future challenges. *Toxins (Basel)* 2023;15:40.
57. EC. European Commission Regulation with No. 178/2002. Available from: <https://www.food.gov.uk/scotland/regsscotland/regulations/scotlandfoodlawguide/sfkg200501>. [Last accessed on 2002 Jan 01].
58. EC. European Commission Regulation with No. 852/2004. Available from: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32004R0852>. [Last accessed on 2004 Feb 23].
59. EC. European Commission Regulation No. 625/2017. Available from: <https://www.legislation.gov.uk/eur/2017/625/contents>. [Last accessed on 2017 Mar 13].
60. Schober K, Balling R, Chilla T, Lindermayer H. European integration processes in the EU GI system – A long-term review of EU regulation for GIs. *Sustainability* 2023;15:2666.
61. Chatzopoulou S, Eriksson NL, Eriksson D. Improving risk assessment in the European food safety authority: Lessons from the European medicines agency. *Front Plant Sci* 2020;11:349.
62. Grob K. The role of the European Food Safety Authority (EFSA) in a better European regulation of food contact materials – Some proposals. *Food Addit Contam Part A Chem Anal Control Expo Risk Assess* 2019;36:1895-902.
63. EFSA Scientific Committee (SC), More S, Bampidis V, Benford D, Bragard C, Hernández-Jerez A, *et al.* Guidance on protocol development for EFSA generic scientific assessments. *EFSA J* 2023;21:e08312.
64. Chung SS, Wong CK. Regulatory and policy control on food safety in China. *J Epidemiol Community Health* 2013;67:476-7.
65. Fewsmith J, Gao X. Local governance in China: Incentives and tensions. *Daedalus* 2014;143:170-83.
66. Holtkamp N, Liu P, McGuire W. Regional patterns of food safety in China: What can we learn from media data? *China Econ Rev* 2014;30:459-68.
67. Yasuda JK. Why food safety fails in China: The politics of scale. *China Quart* 2015;223:745-69.
68. Wu Y, Chen Y. Food safety in China. *J Epidemiol Community Health* 2013;67:478-9.
69. Lancet Publication. Food safety in China: A long way to go. *The Lancet* 2012;380:75.
70. Connolly AJ, Luo LS, Woolsey M, Lyons M, Phillips-Connolly K. A blueprint for food safety in China. *China Agric Econ Rev* 2016;8:129-47.
71. Roberts MT, Lin C. China food law update: The 2015 food safety law and social governance on food safety. *J Food Law Policy* 2016;12:238-63.
72. Kang Y. Food safety governance in China: Change and continuity. *Food Control* 2019;106:106752.
73. Ghosh D. Food safety regulations in Australia and New Zealand food standards. *J Sci Food Agric* 2014;94:1970-3.
74. Arthur H, Sanderson D, Tranter P, Thornton A. A review of theoretical frameworks of food system governance, and the search for food system sustainability. *Agroecol Sustain Food Syst* 2022;46:1277-300.
75. Healy M, Brooke-Taylor S, Liehne P. Reform of food regulation in Australia and New Zealand. *Food Control* 2003;14:357-65.
76. Kotsanopoulos KV, Arvanityannis IS. The role of auditing, food safety, and food quality standards in the food industry: A review. *Compr Rev Food Sci Food Saf* 2017;16:760-75.
77. Hussain MA, Saputra T, Szabo EA, Nelan B. An overview of seafood supply, food safety and regulation in New South Wales, Australia. *Foods* 2017;6:52.
78. Winger R. Australia New Zealand food standards code. *Food Control* 2003;14:355.
79. Polya R. Food Regulation in Australia – A Chronology. 1st ed. Australia: Department of the Parliamentary Library; 2001.
80. Madilo FK, Kunadu AH, Tano-Debrah K. Challenges with food safety adoption: A review. *J Food Saf* 2024;44:e13099.
81. Hendriks S, Soussana JF, Cole M, Kambugu A, Zilberman D. Ensuring access to safe and nutritious food for all through the transformation of food systems. Part II: Actions on hunger and healthy diets. In: *Science and Innovations for Food System Transformation*. 1st ed. Switzerland: Springer Publication; 2021.
82. Mutukumira AN, Jukes DJ. The Development of National Food Safety Control System in Sub-Saharan Africa: Issues and Opportunities, in *Food Africa*. Available from: https://www.worldfoodscience.org/pdf/Mutukumira_AfricaWFS.pdf. [Last accessed on 2003 Dec 17].
83. Kussaga JB, Jaxsens L, Tiisekwa BP, Luning PA. Food safety management systems performance in African food processing companies: A review of deficiencies and possible improvement strategies. *J Sci Food Agric* 2014;94:2154-69.
84. Gbashi S, Adebo O, Adebisi JA, Targuma S, Tebele S, Areo OM, *et al.* Food safety, food security and genetically modified organisms in Africa: A current perspective. *Biotechnol Genet Eng Rev* 2021;37:30-63.
85. Mensah P, Mwamakamba L, Mohamed C, Nsue-Milang D. Public health and food safety in the two WHO African region. *Afr J Food Agric Nutr Dev* 2012;12:6317-35.
86. Ojonugwa AF, Gwom DG. The role and challenges of the national agency for food and drug administration and regulation of alternative medicine in Nigeria. *Wolverhampton Law Journal* 2021;53-68.
87. Morse TD, Masuku H, Rippon S, Kubwalo H. Achieving an integrated approach to food safety and hygiene – Meeting the sustainable development goals in Sub-Saharan Africa. *Sustainability* 2018;10:2394.
88. Drew CA, Clydesdale FM. New food safety law: Effectiveness on the ground. *Crit Rev Food Sci Nutr* 2015;55:689-700.
89. Overbosch P, Blanchard S. Principles and systems for quality and food safety management. In: *A Practical Guide for the Food Industry*. 1st ed. Cambridge: Academic Press; 2023. p. 497-512.
90. Zach L, Doyle ME, Bier V, Czuprynski C. Systems and governance in food import safety: A U.S. Perspective. *Food Control* 2012;27:153-162.
91. Schebesta H, Alessandrini M, Rolandi FC, Hillesheim A, Vos E, Helmlinger M, *et al.* The future of food law: Synopsis article and research agenda. *Ital Food Law Assoc* 2024;1:62-81.
92. Powell DA, Erdozain S, Dodd C, Costa R, Morley K, Chapman BJ. Audits and inspections are never enough: A critique to enhance food safety. *Food Control* 2013;30:686-91.
93. Kareem FO, Martínez-Zarzoso I, Brümmer B. What drives Africa's inability to comply with EU standards? Insights from Africa's institution and trade facilitation measures. *Eur J Dev Res* 2023;35:938-73.
94. Ofori-Amoah B. The economic community of West African States. In: *The African Continental Free Trade Area*. 1st ed. Switzerland: Springer; 2024.
95. Jongwanich J. The impact of food safety standards on processed food exports from developing countries. *Food Policy* 2009;34:447-57.
96. Ortega DL, Tschirley DL. Demand for food safety in emerging and developing countries: A research agenda for Asia and Sub-Saharan Africa. *J Agribus Dev Emerg Econ* 2017;7:21-34.
97. Grace D. Food safety in low and middle income countries. *Int J Environ Res Public Health* 2015;12:10490-507.
98. WHO. Manual for Integrated Foodborne Disease Surveillance in the WHO African Region. 1st ed. Africa: WHO Publication; 2012.
99. Esfandiari Z, Mirlohi M, Tanha JM, Hadian M, Mossavi SI, Ansariyan A, *et al.* Effect of face-to-face education on knowledge, attitudes, and practices toward "traffic light" food labeling in Isfahan Society, Iran. *Int Q Community Health Educ* 2021;41:275-84.
100. Esfandiari Z, Marasi MR, Estaki F, Sanati V, Panhai E, Akbari N, *et al.* Influence of education on knowledge, attitude and practices of students of Isfahan University of Medical Sciences to traffic light inserted on food labeling. *Tehran Univ Med J* 2019;77:54-62.
101. Baba FV, Esfandiari Z. Theoretical and practical aspects of risk communication in food safety: A review study. *Heliyon* 2023;9:e18141.