Research Article

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Food Control System in Libya

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ABSTRACT: The food control system in the country should be effective and able to ensure the safety and quality of food. The study aimed to assess the current situation of the food control system in Libya. The mandates of food control are fragmented among different bodies, which sometimes perform the same functions and thus cause an unnecessary burden on the country's budget. Although there appear to be activities related to national standards that align with international standards, the 1973 health law has yet to be updated. The food inspection has not been based on a risk analysis. Also, there are inadequate laboratory support services, and laboratories are unaccredited. There is also an absence of action plans in both the short and long term for information, communication, and education. The inspectors need training, especially in risk-based inspections. Importantly, analysts' lack of expertise makes determining the compliance of food products with Libyan legislation difficult. Poor-quality and unsafe foods enter Libya due to the control system's weakness and the political crisis; therefore, the government should implement an integrated food control system to improve the situation. As well, the United Nations should politically support Libya's stability.

Keywords: assessment, food control, food safety, food inspection, Libya

INTRODUCTION

Food control is defined as a mandatory regulatory activity of enforcement by national or local authorities to provide consumer protection and ensure that all foods are safe, wholesome, and fit for human consumption during production, handling, storage, processing, and distribution; conform to safety and quality requirements; and are truthfully and accurately labeled following law (FAO/WHO, 2003). Food safety is one of the most important issues for consumers and decision-makers in the developed world. However, food safety issues are not given the required importance on the agenda of decision-makers in developing countries (FAO/WHO, 2005). An effective food control system in the country is essential to protect the health and safety of local consumers. Food control is ineffective in some countries due to the presence of numerous laws, the multiplicity of jurisdictions, and weaknesses in management, monitoring, and enforcement. Some African countries have rules and regulations but lack enforcement and do not follow a preventive system that prevents foodborne disease (FBD) outbreaks and non-compliance, but instead follow a punishment approach that does not guarantee the non-recurrence of violations (Todd, 2017).

Libya is located in North Africa on the southern coast of the Mediterranean, with a coastline of about 1,770 kilometers. Libya is a southern Mediterranean country bordered by Tunisia, Algeria, Egypt, Sudan, Chad, and Niger. The population of Libya reached 7.471 million individuals in 2019 (Central Bank of Libya, 2020). Most of the Libyan territory is covered by a desert, and its primary source of foreign revenue is oil (UNDP & FAO, 2021). Oil exports account for 75% to 90% of income (Filogh, 2019). The most important agricultural areas are the coastal plains, the northern mountains, Kufra, and the southern mountain and Jifara plains. Approximately half of the crops are grown in Jabal al Akhdar, with the other half in Jabal Nafusah, Kufra, and the desert mountains to the south (UNDP and FAO, 2021). Estimated Libya's production of basic food commodities in 2019, which include primary crops, vegetable oils, meat, milk, hen eggs, and fisheries and aquaculture production, was 2152, 17, 180, 238.0, 71.8, and 32.5 thousand tons, respectively (FAO, 2021a). Food imports totaled 2868 USD million in the same year. They included fruits and vegetables, cereals and cereal products, meat and meat products, beverages, fats and oils (excluding butter), dairy products and eggs, sugar and honey, fish, and other foods (FAO, 2021a). Fisheries production contributes to Libyan food, where the production of fisheries products reached 31,627 metric tons in 2020 (World Bank, 2022). It is worth mentioning that the highest production of fisheries products (52,117 metric tons) was in 2009 (World Bank, 2022). In addition, in the 2022–23 marketing year, the import requirement for cereal, mainly wheat and barley, is projected at 3.2 million tons (FAO, 2022). Libya's primary trading partner is the EU27, where 46% of Libya's imports of consumer-oriented products in 2021 were from the EU27 (USDA, 2022). Aside from the fact that Libya heavily relies on imports to meet its food needs, its food control system cannot protect food and ensure that it reaches consumers safely. Food poisoning has been repeated in recent years in the country due to eating meals

Table 1. List of abbreviations used in the article

Abbreviation	Full name
AICP	Administration of Inspection and Consumer Protection
AESA	Administration of Environmental Sanitation Affairs
APA	Animal Production Administration
APRC	Agricultural Pesticides Registration Committee
CAC	Codex Alimentarius Commission
FDCC	Food and Drug Control Center
FAO	Food and Agriculture Organization
FBD	Foodborne Disease
FCL	Food Control Laboratory
HACCP	Hazard Analysis and Critical Control Points
IEC	Information, Education, and Communication
ISO	International Organization for Standardization
LNCSM	Libyan National Centre for Standardization and Metrology
MAL	Ministry of Agriculture and Livestock
MET	Ministry of Economy and Trade
MG	Municipal Guards
MH	Ministry of Health
NCAH	National Center for Animal Health
NCAPQ	National Center for Agricultural Prevention and Quarantine

in restaurants and at weddings, etc., resulting in people falling ill and deaths being recorded.

Food poisoning is a real threat to people's health and social development through a negative impact on the economy (Abuhlega, 2020). Over the last twelve years, Libya has suffered from a civil conflict that has destabilized its food security and lowered the safety and quality of food available to consumers. According to official statements from the responsible authorities, in recent years, in particular, many cases of poisoning have been recorded in different cities in Libya, for instance, in 2022 recorded several food poisoning incidents. Two people out of 44 cases of food poisoning died from eating meals in a wedding hall in the Suq Aljuma municipality in Tripoli. There were 142 cases of food poisoning in Tripoli's Hai Al Andulas municipality due to eating spoiled food in a restaurant. Sixty cases of poisoning have been reported in Zawiya city as a result of eating spoiled chicken used in the preparation of meals at a restaurant. In Kufra city, 53 cases of food poisoning were recorded due to eating spoiled food in a restaurant. In 2021, in Tobruk city, 15 cases of food poisoning were recorded due to eating spoiled food in a restaurant. In 2018, in Ajdabiya City, 46 cases of food poisoning have been reported due to eating spoiled food in a restaurant. It is worth mentioning that there was no documentation of FBDs in the Ministry of Health (MH), despite there being a department of information and documentation, as well as Libyan hospitals that do not have a database for documenting the diseases, including FBDs. Thus, it is difficult to get complete information because of the primitive routine of recording the patients. Thus, it cannot practically develop the health system without sufficient information.

To overcome the incidence of FBDs, whether food poisoning or food infection, the state should prioritize issuing laws and legislation related to health standards and updating them in line with scientific and industrial developments. Also, food producers and manufacturers should adopt food safety programs such as Hazard Analysis and Critical Control Points (HACCP), International Organization for Standardization (ISO) 22000, and Publicly Available Specification (PAS) 220, which are the most commonly used and internationally approved (Uçar *et al*., 2015). The food control administration should also be able to monitor food produced locally or imported.

Before arriving at decisions on improvements to the national system, it is necessary to analyze the food safety system's current status. Almost no previous studies evaluated food control management in Libya, except for a few international reports that did not accurately clarify the components of food control management. For instance, the paper prepared by the Food and Agriculture Organization (FAO) Regional Office for Africa incorrectly mentioned that the Food and Drug Control Center (FDCC) has authority for all inspections and that there are adequate and competent laboratory support services (FAO/WHO, 2005). Also, the report issued in 2018 mentioned that the FDCC is responsible for food safety in Libya (WHO, 2019), and that does not represent reality, where different agencies are involved in food control. Therefore, this study aimed to assess the Libyan food control system and analyze its components and their effectiveness by comparing it with the 2006 document "Strengthening national food control systems: Guidelines to assess capacity building needs" issued by the FAO (FAO, 2006). As well as suggesting recommendations

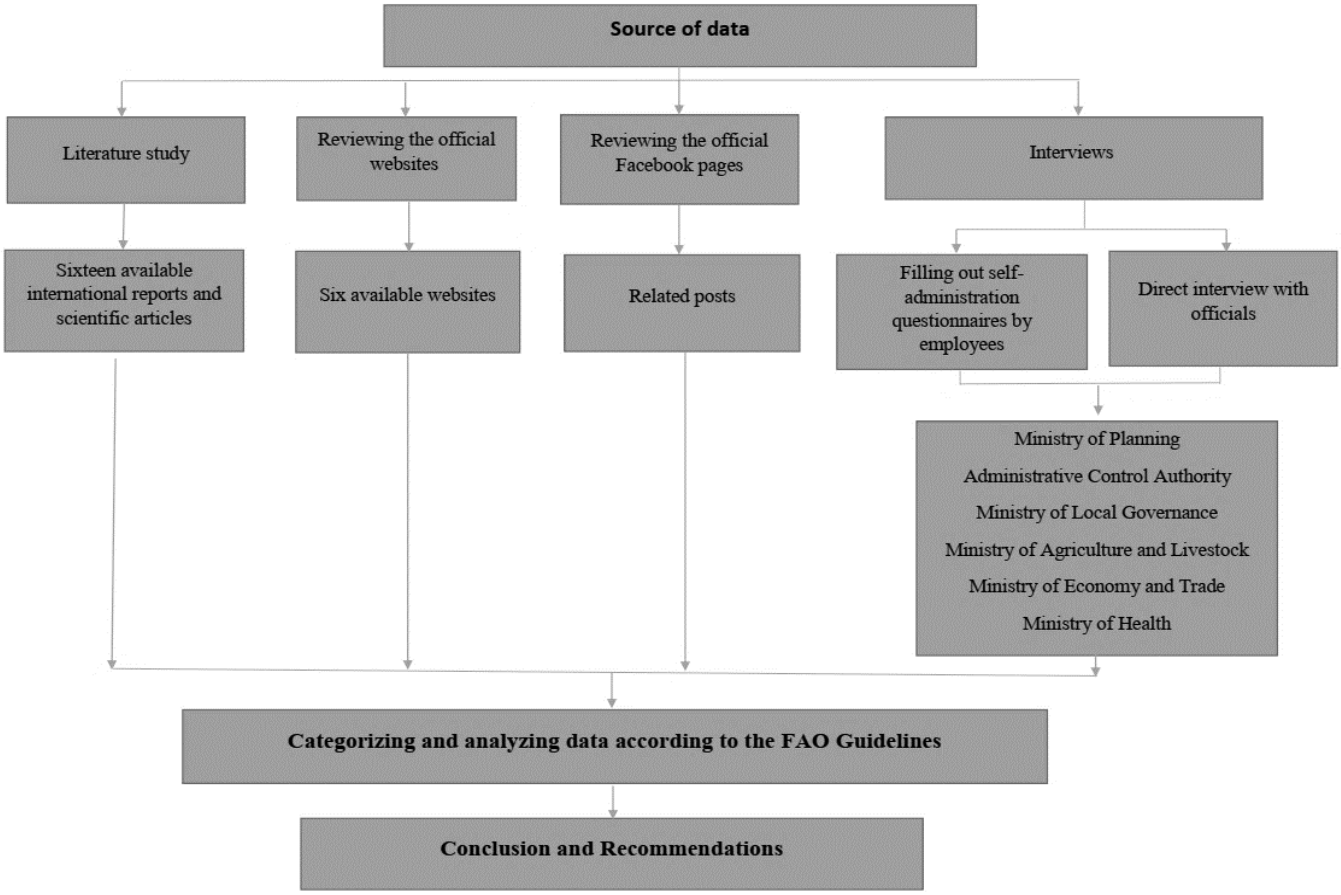

Figure 1. Diagram of The Research Methodology

that help the responsible authorities improve the level of performance of the food control system in Libya. A list of abbreviations used in this paper is shown in Table 1.

MATERIALS AND METHOD

The methodology followed to achieve the aims of this study relied on the following: 1. literature study: reviewing available international reports and scientific articles related to the food control system in Libya, which were sixteen. 2. reviewing the six available websites of the bodies formed for the food control system and their related government publications; 3. exploring the activities of the various bodies by reviewing their posts on their official Facebook pages; and 4. interviews: visiting all bodies formed for the food control system. The visits included various offices affiliated with the Ministry of Planning, the Administrative Control Authority, the Ministry of Agriculture and Livestock, the Ministry of Local Governance, the Ministry of Economy and Trade, and the Ministry of Health. They included interviewing sixteen senior officials as well as filling out the self-administration questionnaires by twelve staff. In addition, the assessment of the food control system in Libya is based on the document "Strengthening National Food Control Systems: Guidelines to Assess Capacity Building Needs" issued by FAO (FAO, 2006). The gathered information was used to build a SWOT analysis of the system. The study was conducted between January 2022 and February 2023. Figure 1 displays a diagram of the research methodology.

RESULT AND DISCUSSION

Food Law and Regulations

In Libya, Health Law No. 106 of 1973 is in effect, which gives the MH the right to ban the import or handling of food products, containers, or ingredients that are involved in their preparation or added to them. Although the previous role is now not one of the functions of MH, the law has not been updated. The food part of the law consists of 15 arts (Art 6 to Art 20), which include four chapters that include food handling control, milk and dairy products, meat, and health requirements for those who work in jobs directly related to food (FAO, 2021b). The health law prohibits handling food products that do not comply with standards and regulations. As well as imported food, it can be released only based on a health certificate issued by the competent authority (FAO, 2021b). The health law does not contain provisions for the traceability of foods and food establishments. Importantly, in Libya, the inadequacy and effectiveness of the legal texts in several laws within the Libyan legislation regarding the protection of consumers of foodstuffs

(Allaq, 2015). For instance, there is no national legislation or regulation requiring prescriptions for antibiotic use in animals, as well as the weakness of the punitive policy adopted by the criminal legislator in consumer protection, as most of them consist of imprisonment and a fine (Allaq, 2015). It is crucial in Libya today to update the health law and separate the arts related to food into a separate law known as the food law. It is worth noting that there is a project of law for food and drug control that was achieved and submitted to the relevant authorities for years, but it has not yet been approved for implementation.

The standardization activity started in 1965 through a department under the Ministry of Industry called the Department of Standards and Metrology, which was later transferred to the Industrial Research Center in 1984 under the name of the Standards, Metrology, and Industrial Property Department. Under Law No. 5 of 1990 and General People's Committee Decree No. 27 of 2005, the Libyan National Center for Standardization and Metrology (LNCSM) is the only national official authority concerned with standardization, quality, and metrology. It works under the Ministry of Planning. The organizational structure of the LNCSM is illustrated in Figure 2. The LNCSM is responsible for issuing, accrediting, reviewing, and amending standards regarding all products and services and disseminating these standards. The number of standards that have been issued in the field of food is 268 up to 2022. The responsibility of issuing, approving, reviewing, and amending standards lies with technical committees comprising members representing public and private entities and institutions of civil society. Also, the LNCSM is responsible for granting Libyan quality marks and marks of conformity. The preliminary, documentary, and field evaluations are carried out by a specialized technical committee formed by the LNCSM, and the samples are analyzed in the laboratories approved by the LNCSM, which mostly sends them abroad because of weak infrastructure. The food standards are based on Codex Alimentarius Commission (CAC) standards and ISO standards. Also, its activities include standard-setting coordination between Arab, regional, and international bodies to promote the exportation of national goods and products and expand cooperation between Arab, regional, and international bodies in fields of common interest. The responsibility for food safety lies with national and international agencies. Therefore, LNCSM is a member of the ISO, the Standards and Metrology Institute for Islamic Countries, the African Organization for

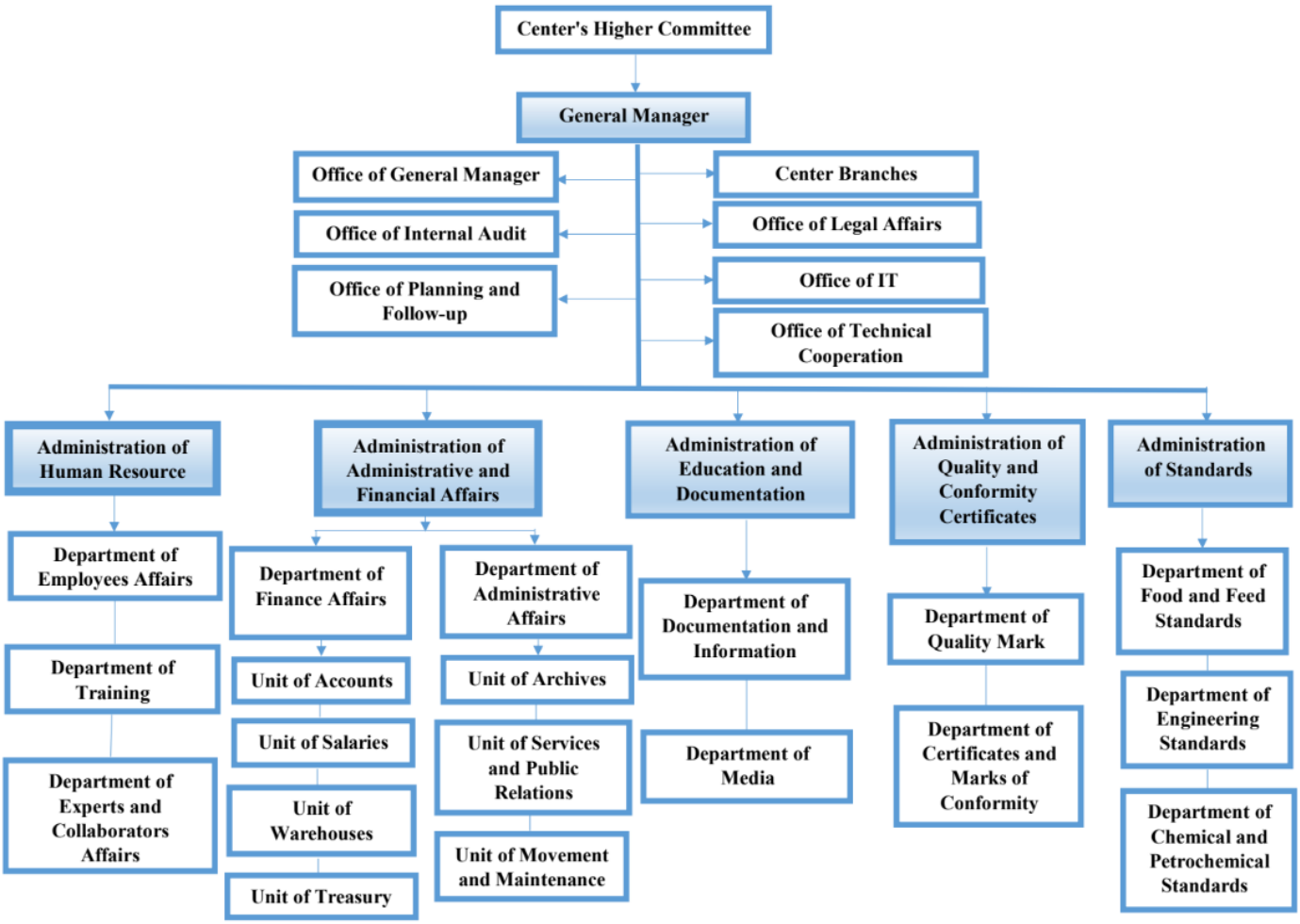

Figure 2. Organizational structure of the Libyan National Center for Standardization and Metrology

Table 2. The food control system in some countries

Country	System of food control	Reference
Afghanistan	Multiple agency system	Khalid (2015)
Guyana	Multiple agency system	Phillips *et al*. (2020)
Egypt	Multiple agency system	Ibrahim and Abdel-Haleem (2016)
Kuwait	Moving from a multiple-agency approach to a single-agency system	Alrobaish *et al*. (2021)
Indonesia	Multiple agency system	Barinda and Ayuningtyas (2022)
Malawi	Multiple agency system	Morse (2014)
Oman	Moving from a multiple-agency approach to a single-agency system	Alrobaish *et al*. (2021)
Saudi Arabia	Moving from a multiple-agency approach to a single-agency system	Alrobaish *et al*. (2021)
UAE	Moving from a multiple-agency approach to a single-agency system	Alrobaish *et al*. (2021)

Table 3. Main mandates of the authorities concerned with food safety control

Authorities	Mandates*	Decree Number, Year
Food and Drug Control Center	detecting, inspecting, and conducting the necessary tests on all locally produced and imported food commodities and issuing the necessary permits for their release detecting and inspecting local food-producing companies, all distribution and storage channels in the country, and servicing facilities; and following the food commodities even after they are traded in the local market	77, 2002
Ministry of Agriculture and Livestock (Animal Production Administration)	participation with the relevant authorities in setting the technical standards for the requirements of animal production developing programs to introduce good genetic traits to improve local breeds and take advantage of all modern technologies in this field preparing the technical and educational standards necessary for importing different types of animal breeds with genetic characteristics that are in line with the conditions of breeding and the local environment granting permits to import and export wild animals and providing technical supervision of their locations in various regions	101, 2012
Ministry of Agriculture and Livestock (National Center for Agricultural Prevention and Quarantine)	control the local and imported seedlings in Libya, ensuring that they are free from plant diseases and pests, and granting import and export permits for plant products follow up on the implementation of the legislation in the matter of plant protection and internal and external agricultural quarantine, the implementation of agricultural pest control programs, and follow up on the supply, handling, and inspection of pesticides carrying out the necessary analyses of the imported pesticides and their conformity with the required standards, managing the pesticide analysis laboratory, and coordinating with the licensing authorities in granting permits to companies to import pesticides	98, 2012
Ministry of Agriculture and Livestock (National Center for Animal Health)	updating the Libyan veterinary health requirements for the import and export of animals issuing veterinary health certificates for live animals, birds, and locally traded products conducting diagnostic tests for animal diseases and common diseases and working on the continuous updating of the methods of diagnosing diseases conducting analyses of the feed and raw materials used in its manufacture to determine their compliance with Libyan standards determining the countries from which the import of live animals, birds, and their products is permitted supervising the workflow of the veterinary quarantine offices located in all ports approved by the competent air, sea, and land authorities. Inspect veterinary drug shops and distribution centers and ensure their compliance with the applicable health conditions granting the necessary permissions for the supply of veterinary medicines, vaccines, and serums in cooperation with the relevant authorities	100, 2012
Ministry of Economy and Trade (Administration of Inspection and Consumer Protection)	following up on the implementation of the policies, plans, and controls for consumer protection and inspection of goods and merchandise traded in the market and the procedures related to this in coordination with the competent authorities receiving complaints and communications received, whether from the consumer or other competent authorities, related to the goods and merchandise offered in the market and studying and treating them inspecting and monitoring markets, factories, bakeries, pharmacies, and analysis centers, and verifying their compliance with the provisions of legislation and technical standards	368, 2013
Administration of Environmental Sanitation Affairs	carrying out periodic health control and ensuring the availability of health conditions for commercial activities such as butchers, poultry slaughterhouses, cafes, restaurants, hotels, places selling dairy products, beverage factories, bakeries, catering services, and food factories.	1500, 2021

*The most important mandates

Standardization, the Arab Industrial Development, Standardization, and Mining Organization, the CAC, and the American Society for Testing and Materials. In addition, LNCSM serves as the national codex focal point, and national codex committees have recently been formed. international agencies. Therefore, LNCSM is a member of the ISO, the Standards and Metrology Institute for Islamic Countries, the African Organization for Standardization, the Arab Industrial Development, Standardization, and Mining Organization, the CAC, and the American Society for Testing and Materials. In addition, LNCSM serves as the national codex focal point, and national codex committees have recently been formed.

National health law and national standards help determine the safety of the final product, as well as imposing penalties after the occurrence of food poisoning, such as withdrawing the final product or closing the food facility, which has serious consequences for health and the economy; penalties are also insufficient to deter non-compliance with legislation, as they often cost the business owner only hundreds of dinars. Thus, the food safety system should include a program for risk assessment, management, and communication. The legislation also does not include the obligation to apply good agricultural practices, good manufacturing practices, good hygiene practices, or the HACCP plans. Therefore, the responsible authority should issue legislation obligating those involved in the food supply to apply for these preventive programs. In addition, there are no regulations on biotechnology or genetically modified foods.

Food Control Management

The national food control system should be able to promote public health, protect consumers from commercial fraud, and develop the economy (FAO, 2006). It is recommended to adopt one of the three regulatory arrangements appropriate at the national level: a system based on multiple agencies, a system based on a single agency, or an integrated system at the entire national level for food control (FAO, 2006). The Food Control Administration is responsible for developing a national strategy for food control, updating legislation, participating in setting international standards, issuing certifications, controlling and inspecting domestically produced and imported food based on risk analysis, monitoring compliance, and implementing training, education, and communication with stakeholders along the food chain, as well as communicating and maintaining liaison with other countries about food safety and quality issues (FAO, 2006). Table 2 displays the food control system in some countries.

In Libya, the tasks of the food control system are fragmented among a group of different government centers and ministries (Table 3). The food control system consists of the FDCC, the Administration of Environmental Sanitation Affairs (AESA), the Ministry of Agriculture and Livestock (MAL) through the Animal Production Administration (APA), the National Center for Animal Health (NCAH), the National Center for Agricultural Prevention and Quarantine (NCAPQ), and the Agricultural Pesticides Registration Committee (APRC), and the Ministry of Economy and Trade (MET) through the administration of Inspection and Consumer Protection (AICP). The bodies responsible for food control in Libya work under fragmented government decrees and are not integrated. It is worth noting that the food control system in many countries depends on the multi-agency system, in which the mandates are fragmented among several national bodies with unequal levels of experience and resources, resulting in differing implementation efficiency. Among its most prominent disadvantages are the inability to coordinate work, an absence of transparency, and the contradiction between public health goals and the facilitation of trade and industry. Therefore, the inability of the system to ensure safe food for all consumers throughout the country (FAO/WHO 2003). Although a single agency system involves consolidating all responsibilities for protecting public health and food safety into a single food control agency with clearly defined terms of reference, it affects both the legislation and the organizational structure for enforcement, and therefore it is not possible to recommend a single organizational structure that meets the requirements and resources of the social, economic, and political environment of each country (FAO/WHO 2003).

Historically, the FDCC was developed from the Board for Food and Nutrition established in 1975, which became the National Center for Food Inspection and Control in 1995, then the National Center for Food and Drug Control in 2002, and finally the FDCC in 2006. The FDCC aims to protect consumers through the monitoring and inspection of food and drugs. The food administration operates separately from the drug administration; each administration has its own departments and staff. There are seven branches in Tripoli, Benghazi, Misrata, Khoms, Zuwara, Tobruk, and Al Bayda, and 50 offices in different cities. The FDCC controls domestic and imported food and works under the Administrative Control Authority. Also, the AESA, which belongs to the Ministry of Local Governance, inspects food inside the municipalities. Thus, there is an overlap in duties, which results in a negative image for food business owners when the two bodies sometimes conduct the inspection at the same time or on the same day. Therefore, the responsibilities of the food control system components should be precisely determined and consistent among them by establishing a national integrated system.

The tasks of MAL include granting permission to import and export wild animals and providing technical supervision of their locations in various regions through the APA. In addition, one of their responsibilities is pesticide inspection by the NCAPQ. It is worth confirming that no laboratory in the entire country can determine pesticide residues in food. There is a committee (APRC) that is also affiliated with MAL and registers agricultural pesticides. The roles of NCAH include issuing veterinary health certificates for live animals and birds; conducting diagnostic tests for animal diseases and common diseases; working on continuously updating the methods of diagnosing diseases; determining the countries from which the import of live animals, birds, and their products is permitted; and inspecting veterinary drug shops and distribution centers to ensure their compliance with the applicable health conditions.

The AICP belonged to MET. It comprises four departments: commercial fraud, calibration, quality, awareness, and guidance. Also, there are offices belonging to AICP in the municipalities. Depending on the government decree, the AICP has an important role in the food control system, especially in suggesting policies, plans, and controls for the inspection of merchandise traded in the markets and related procedures and following up on their implementation in coordination with the competent authorities. In reality, the role of AICP is to respond to consumers' complaints and conduct investigations by inspectors who visit the food establishment that is the source of the complaints. Importantly, the weak performance of the administration is due to a lack of financial and human resources in terms of equipment for inspection, transportation means, and qualified staff.

It was noted that the number of staff involved in the food control system in Libya is massive, and they are not all suitably qualified and experienced. As well, some administrations do not perform their tasks as mentioned in government decrees. Therefore, the competent authorities have to ensure the appropriate number and move unqualified staff in the field of food science and technology and the related important specialties to other sectors that suit their qualifications. The multiplicity of bodies responsible for food control in Libya resulted in overlapping responsibilities, no effective coordinated effort, a lack of information exchange between authorities responsible for the food control system, and an absence of transparency. To overcome these weaknesses and strengthen the system, it is necessary to either follow the single-agency system or the integrated system. Because the bodies already exist, the integrated system is optimal.

Inspection Services

The responsibility for food inspection mainly falls on the FDCC, AESA, and NCAH. The FDCC inspects locally produced, processed, and packaged food products. There are 50 inspection offices in all municipalities in Libya, and the internal control offices are in most cities. Inspectors of the FDCC inspect wholesalers, retailers, hotels, restaurants, bakeries, fast food chains, and fish and meat markets in terms of food labels, including expiration dates and banned food colors, sanitary and storage conditions, product handling, the security and safety program, and the pest control program. Law enforcement is done by municipal guards (MG). On April 5, 2022, FDCC announced the launch of a national campaign to protect consumers inside Libya by inspecting food establishments such as shops, supermarkets, restaurants, catering services, and small and large factories and taking the proper steps against undisciplined establishments. The campaigns are in the presence of the MG, which is the regulatory authority that enforces laws against the undisciplined. It is worth noting that, despite frequent and continuous inspections of food establishments, the number of irregularities has not decreased. The continuing irregularities reflect the weaknesses in the regulations and law enforcement.

Furthermore, the FDCC is responsible for inspecting imported processed and packaged food products at the various ports of entry. There is an office of the FDCC at every port. There are two land ports: Ras Jedir Port and Amsaad Port; five seaports: Tripoli Port, Benghazi Port, Misurata Port, Al-Bayda Port, and Al-Khums Port; and three airports: Mitiga Airport, Benina Airport, and Misurata Airport. The inspection mechanism is carried out by comparing the conformity of the data in the documents with the shipment in terms of quantity and explanatory data, after which samples are drawn from the product according to the approved sampling guide (FDCC, 2017). The number of drawn samples is large, hence the importance of sampling based on risk analysis. The drawn samples are analyzed at FDCC Laboratories. When a radiological examination of samples is needed, the FDCC sends samples to a laboratory at the Nuclear Research Center to analyze.

Law enforcement is done by customs guards, who are solely responsible for ports. It is worth mentioning that there are three categories of inspectors: those who have a university education in food inspection science; those who received a university education in sciences that are not related to food inspection but mostly received courses in food inspection; and those who do not have a university education but may have received courses in food inspection. In addition, although it is difficult to obtain the exact number of inspectors at the state level, the officials and employees indicated that the number is very large. As a result of that, the inspectors work for a few days during the month. The reputation and integrity of the food control system depend, to a very large extent, on inspectors' integrity and skill (FAO/WHO, 2003). FDCC has a

database for its different control activities, including the number and type of consignments of food products that enter the country; the number and type of samples taken by the laboratories; the results of food quality control; the results of all tests conducted; the enforcement procedures that have been taken; and the inspection records of food ports, food handling facilities, and food companies.

Although legally, MAL is responsible for the inspection of livestock, fresh fruits, fresh vegetables, seedlings, seeds, pesticides, animal feed, and veterinary medicines, in reality, fresh fruits and fresh vegetables are controlled by the FDCC. MAL, through NCAH, is responsible for the control of imported and domestic live animals. The headquarters of the NCAH is located in Tripoli. NCAH is divided into four divisions and one department at the central level: Animal health, laboratories, quarantine and drug and vaccine control, and the support services department. It is worth noting that diseases of major economic importance and the main zoonotic diseases are endemic in the country without information about their epidemiological situation, prevalence, and distribution. Veterinary medicine distribution and usage are not under control, which results in a negative impact on animal resistance and public health. There is no national epidemic surveillance system to monitor epidemics.

Inspection activities in Libya do not follow a risk-based inspection model but follow a traditional inspection model where the inspection includes end-product sampling and compliance with different requirements. Sareen (2014) summarized the features of traditional inspection and risk-based inspection. A traditional inspection is a corrective inspection in which inspections are carried out randomly to examine the final product and food facility and collect samples to ensure compliance with legislation. Risk-based inspection is a preventive inspection in which the inspection is based on risk factors, emphasis is placed on the controls in place to treat those factors, and samples are collected for verification purposes.

Food Control Laboratory Services

FDCC has seven food control laboratories (FCLs) in Tripoli, Benghazi, Misrata, Al Bayda, Khoms, Tobruk, and Zuwara. In Sabha, the laboratory is under construction. The laboratories are divided into four sections: a chemical section, a microbiological section, a mycotoxin section, and a heavy metals section. The pesticide residues section is under establishment and is expected to start operating in the near future. In the microbiological laboratory, many tests are conducted, such as the total bacteria count, yeasts and molds, *Salmonella* spp., *Shigella* spp., *Campylobacter* spp., *Escherichia coli*, *Bacillus cereus*, *Listeria monocytogenes*, and *Staphylococcus aureus*. Also, in the chemical laboratory, several tests are carried out, such as proximate analysis, acidity percent, insoluble ash, salt content, fiber content, color additives, and alcohol. It is important to mention that there is no stability in conducting the tests due to the lack of immediate maintenance or quick replacement of faulty devices with functioning ones or the failure to supply the operational materials. Also, there is no possibility to test polychlorinated biphenyls, polycyclic aromatic hydrocarbons, acrylamide, veterinary drug residues such as antimicrobial and anabolic residues, hormones, pesticide residues, or genetically modified food. Despite the existence of Libyan standards regarding the maximum levels of ionizing radiation in food, feed, and drinking water, FDCC does not have a laboratory to monitor the levels of radioactive contaminants within acceptable limits. It is worth mentioning that, despite the fact that analysts received a university education, they still need continuous training in modern methods of analysis, especially the methods required to determine compliance with Libyan standards for food products. Importantly, no laboratories in Libya are accredited in accordance with the general requirements for competence, impartiality, and consistent operation of the international standard (ISO/IEC 17025). Therefore, the results issued by these laboratories may not be trusted.

There are two central veterinary laboratories in Libya, one in Tripoli and one in Benghazi. At the same time, there are peripheral vet labs in Zawiya, Garyan, Sabha, Zintan, Misrata, Derna, Tobruk, Al Qubah, Bayda, Ajdabiya, and Marj. The samples are only sent to the laboratory analysis center in Tripoli because of the lack of capabilities in other labs. The Tripoli lab contains a microbial section that is able to diagnose bacteria: *Bacillus antiracis*, *Bacillus cereus*, *Brucella abortus*, *Campylobacter jejuni*, *Clostridium botulinum*, *Clostridium perfringens*, *Escherichia coli*, enterotoxigenic (ETEC), enteropathogenic (EPEC), enteroinvasive (EIEC), *Listeria monocytogenes*, *Mycobacterium bovis*, *Salmonella typhi*, *Salmonella* (non-typhi), *Shigella*, *Staphylococcus aureus* (enterotoxins), *Vibrio parahaemolyticus*, and *Yersinia enterocolitica*, viruses, protozoa: *Entamoeba histolytica*, *Giardia lamblia*, helminths: *Taenia saginata*, *Taenia solium*, *Trichinella spiralis*, and *Trichuris trichiura*. As well, there is a section for the analysis of mycotoxin and serology that is able to diagnose mycotoxins and antibiotics. It is noted that the link between the laboratory and the field is weak. Many of the samples reach the laboratory, where biosecurity measures are unavailable and are thus not to be analyzed. Important diseases that deal with the laboratory for cattle include Foot and Mouth Disease, Bluetongue, Peste des petits ruminants, Brucella, Chlamydia, and Toxoplasma, while for poultry, they include Avian Influenza, Infectious Laryngotracheitis, Mycoplasma Gallisepticum, Salmonella, Newcastle Disease, and Infectious Bronchitis. Vet laboratories face challenges such as not implementing ongoing and long-

Table 4. SWOT analysis for the food control system in Libya

Strengths	Weaknesses	Opportunities	Threats
National standards are based on international standards	The recent political unrest in the country has worsened the quality of various food control bodies	The increasing demand from consumers for healthy food that does not cause disease	Increasing the country's dependence on importing food products
The majority of staff involved in the food control system received a university education	No strategy for food control covers the food chain from farm to table	Membership in several international organizations such as the World Trade Organization, the World Organization for Animal Health, and CAC	Absence of joint and cooperative work between the bodies of food control
Carrying out continuous campaigns of inspections on all different food establishments in the country by FDCC and AESA	The food control mandates are fragmented among many bodies	Harmonizing national standards with Codex standards	Weak food safety system and the prevalence of food poisoning incidences throughout Libya
	Some leadership positions in food control bodies are held by individuals whose qualifications are not related to the food field		Non-compliance with Libyan legislation by some suppliers along the food chain
	The decision-making and action of the food control system are not based on risk analysis		The low standard of living of the population leads to their purchasing low-quality and safe food products
	Failure to update the health law or adopt the project of the law of food and drug control		Internal resistance to adopting the project of food control law
	Inspectors are mostly not qualified and lack skills and training		
	FCLs are uncredited		
	FCLs lack the capacity to perform certain microbial and chemical analysis		
	Analysts in the FCLs are mostly not skilled in modern techniques to assess the compliance of domestic or imported food products with Libyan legislation		
	There is no food rapid alert system or crisis management		
	The application of food safety systems such as ISO 22000 and HACCP is not mandatory for locally produced or imported food		
	The fluctuation of financial support from the government		
	There is no zoonotic disease surveillance plan that the country has identified as a high priority to aid in early detection and response to zoonotic diseases		
	The illegal animal trade has an additional impact on emerging and re-emerging zoonotic diseases in the country		
	Most of the relevant institutions do not have a database for all the activities related to them		

term training programs; not having an abundance of operating materials in the central laboratory; having no link with the veterinary services; newly established laboratories lack biosafety measures; a majority of these labs having only minimum facilities such as incubators, ovens, refrigerators, autoclaves, centrifuges, micropipettes, biological safety cabinets, etc.; and the majority of lab personnel needing appropriate training on the potential hazards associated with their work. As well, all veterinary laboratories in Libya are not accredited. Importantly, there is insufficient technical expertise and diagnostic laboratory capacity for zoonotic disease detection and response in the veterinary sector.

Food safety and quality information, education, and communication

Education, training, and communication are vital for raising comprehensive awareness of food safety and quality. The information, education, and communication (IEC) activities target producers, manufacturers, distributors, wholesalers, retailers, and consumers. Many studies recently concluded that Libyan consumers need intense efforts to raise their awareness level about food safety (Abuhlega, 2020; Abuhlega & Maamar, 2020; Abuhlega *et al*., 2020; Abuhlega and Greesh, 2021; Abuhlega and Abduljalil, 2022). Informing consumers of any related incidents is essential to building trust in the system. The media administration belonging to FDCC makes efforts to raise the knowledge and awareness of consumers. Through a Facebook page, consumers are informed of refused shipments and the results of inspections of different food establishments. However, it posts a small amount of simple information about facts about the safety and quality of the food. As well, the FDCC presents a radio program every week that concerns FDCC activities and consumer awareness. In addition, it conducted numerous interviews on TV and radio, most of which focused on public opinion issues such as the issue of potassium bromate in bread and the comments about food poisoning incidents. Importantly, in Libya, the competent authorities did not publish final reports of all their announced food poisoning incidents to inform consumers about the details in terms of responsible food items or pathogens. The center also offers opportunities to train students and newly graduated food engineers on various methods of analysis. In addition to assisting in the conduct of some tests available to students, whether in graduation or master's projects.

The IEC activity also includes training food inspectors and analysts. High priority must be given to training and raising the efficiency of inspectors and food analysts, which will positively impact the food control system (FAO/WHO, 2003). The executive regulations of the

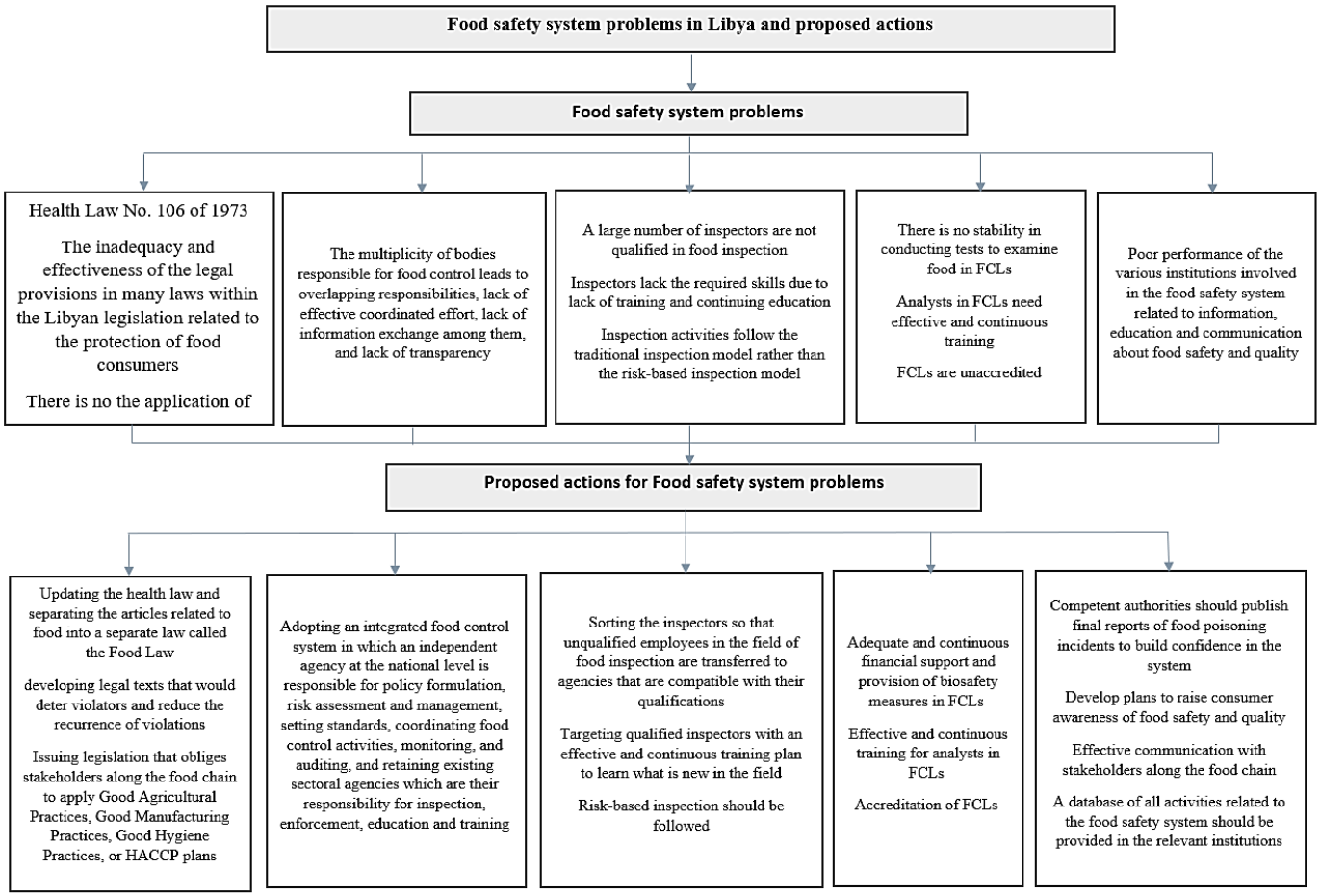

Figure 3. Food safety system problems in Libya and proposed actions

Libyan Health Law stipulate that the food inspector must be fully conversant with all laws, decisions, and instructions that determine the handling of foodstuffs and should be constantly informed of what is being developed or modified. Some FDCC inspectors took training courses that included a course in good inspection practices and techniques, systems and mechanisms of control that work according to Libyan standards, and a HACCP. However, the inspectors did not receive training in risk-based sampling. Also, some analysts have received courses abroad. However, there must be a continuous program for training, with these trained analysts training other analysts and making the best use of them inside the laboratories. As a result of the poor quality and safety of bakery products and the frequent complaints from consumers, the FDCC recently conducted a training course on the professional processing of bread, targeting 200 trainees. It is worth mentioning that the FDCC conducts continuous workshops to communicate with the manufacturers. It is necessary to establish training programs for veterinary staff in NCAH to raise their levels in all aspects of public health. Also, additional well-trained staff must be designated to fulfill their responsibility in combating zoonotic diseases because human resources are mostly allocated at the central level.

SWOT Analysis

From the situation analysis based on the information collected during the study, strengths, weaknesses, opportunities, and threats were extracted, as shown in Table 4. Figure 3 illustrates the most critical problems facing the food safety system in Libya and the possible actions that the government should take to improve the current situation.

CONCLUSION AND RECOMMENDATION

The food control system in Libya applies a multiple-agency system where the mandates are fragmented among them. It is recommended to adopt an integrated system in which a single agency at the national level is responsible for policy development, risk assessment and management, the development of regulations and laws, and overall food control supervision while existing agencies are responsible for the rest of the food control tasks such as food inspection, law enforcement, education, and training. As well as reconsidering the roles and responsibilities of the relevant authorities so as to prevent overlap among them, resulting in the effective administration of the financial resources of the state. To strengthen the food control system, it should be built with the capacity for risk assessment, the monitoring of food contaminants, the

control of foodborne illness, food rapid alert, and crisis management, as well as the application of ISO standards. Implement a national program on traceability where traceability is mandatory in the food chain and feed. In addition, develop clear and documented national protocols for effective multi-sectoral communication and information sharing. As well as establishing mechanisms for coordination, cooperation, and communication among all stakeholders, including the public and private sectors. Workshops and scientific seminars for decision-makers should be held to demonstrate the importance of strengthening the food control system to ensure food safety, as well as the importance of adopting and supporting any new requirements that would strengthen the system. In addition, providing information and educational programs for officials and employees in the food industry and adopting advanced and renewable training programs for food inspectors and analysts. Implementing awareness programs to raise consumer awareness about proper food practices and how to prevent FBDs.

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CONFLICT OF INTEREST

There is no conflict of interest.

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