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Assessment of food safety in Baghdad, Iraq: A two-year analysis of food samples received by the nutrition research institute

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Abstract
Background: Food safety is a critical public health concern, encompassing all hazards (biological, chemical, and physical) that can cause food to be detrimental to consumers. It aimed to assess food safety compliance with Iraqi standards and identify potential areas for improvement.
Methods: A descriptive cross-sectional design with analytical elements was employed. A convenience sampling approach analyzed data from 20,024 food samples received by the Nutrition Research Institute (NRI) in Baghdad, Iraq, over two-years (December 2020 - December 2022) from various sectors within Baghdad. The samples were subjected to routine bacteriological, chemical, and physical investigations.
Results: Only 1.2% (235) of the samples did not meet the compliance standards. The categories investigated the most frequently were processed foods and those with potentially high-risk factors. The beverages had the highest failure rate (3.6%), followed by meat and poultry (3.3%) and ready-to-eat meals (3.1%). Interestingly, imported samples had a lower overall failure rate (0.6%) compared to domestically produced samples (3.9%). Analysis of failures by origin and category revealed that domestically produced dairy products, beverages, and ready-to-eat meals had significantly higher failure rates compared to their imported counterparts. On the contrary, failures in the salt, sauce, and yeast categories were more frequent in imported products. This suggests areas for improvement in both domestic production practices and import regulations.
Microbial contamination, particularly bacterial issues such as *E. coli* and *Salmonella*, has emerged as a major concern in various categories, including dairy, meat, and beverages. Chemical failures related to acidity, total SOS, and humidity were also identified.
Conclusion: This study highlights the importance of continuous monitoring of food safety in Iraq. The findings suggest a need for stricter quality control measures, particularly for domestically produced high-risk food categories. More research is recommended to pinpoint the root causes of failures and implement targeted interventions to ensure safe food supplies for the Iraqi population.

Keywords: Food safety, contamination, national products, imported products, and Iraq

Introduction
Food safety is a critical public health concern, which includes all hazards – biological, chemical, and physical – that can cause food to be detrimental to consumers [1]. It involves practices at every stage of the food chain, from farm to fork, to prevent foodborne illness [2]. Unsafe food can cause a variety of diseases, from diarrhea to cancer, with millions of people falling ill each year. On the contrary, safe food is essential for good health and well-being, promoting proper nutrition and development [3, 4].
Unsafe food poses a significant public health burden, causing illnesses and contributing to malnutrition. It can negatively impact vulnerable populations such as infants, young children, the elderly, and the sick [3]. Foodborne diseases are largely preventable through proper management of the food system, which controls hazards such as microbial pathogens, chemical residues, and toxins [1, 2]. Safe food supplies contribute to economic growth, trade, and tourism while supporting sustainable development [5].
Urbanization, changing consumer habits, and globalization have increased the complexity of the food chain, presenting challenges to food safety in Iraq. Furthermore, climate change is expected to have an additional impact on food safety measures [3].

These challenges require greater responsibility of food producers and handlers to ensure safe food practices [2].

The Iraqi government prioritizes food safety through the Nutrition Research Institute (NRI). NRI plays a crucial role in the development of effective policies, regulations, and food safety systems. They use approved scientific methods to investigate food samples for chemical, bacteriological, and physical contaminants, following standards such as the Codex Alimentarius and Iraqi standards [6].

Food safety hazards are any factor present in food that can cause illness or injury [1]. These hazards can be introduced at any point within the food system, encompassing primary production through consumption [5].

- **Physical Hazards:** These include foreign objects such as glass, wood fragments, or inedible food parts such as bones [1, 7].
- **Chemical Hazards:** Occur when chemicals are present in food at unsafe levels. These can originate from various sources, including [1, 7]

a) Residues of pesticides used in agriculture or during storage and preparation
b) Toxic substances, such as disinfectants or lubricants, come into contact with food during handling
c) Natural toxins in some foods, such as mycotoxins found in grains
d) Persistent organic pollutants (POPs), such as dioxins, accumulate in the environment and the food chain.
e) Heavy metals such as lead or mercury can contaminate food by water or soil pollution

- **Biological Hazards:** Most microorganisms consist of living microorganisms such as bacteria, viruses, parasites, and molds [1, 7]. These can multiply rapidly under favorable conditions, leading to food spoilage and contamination. Examples include [1]

a) Zoonotic agents transmitted from animals to humans, such as *Salmonella* spp.
b) Foodborne pathogens such as Listeria monocytogenes and *E. coli* O157: H7.
c) Antimicrobial-resistant pathogens pose a growing public health threat.

The aim and objectives of the study

This study aims to investigate the prevalence of failures identified in food samples received by the NRI. It will address the following objectives:

1. Determine the percentage of food samples received by the NRI that do not meet the safety standards.
2. Identify the reasons for failure, classified as chemical or bacteriological contamination.
3. Explore potential factors associated with failed samples, such as origin (national versus imported) and food category.

Materials and Methods

Study Setting and Period

The study setting for this research is the NRI located in Baghdad, Iraq. The focus is on food samples received from all 11 sectors within the Baghdad Al-Karkh Health Directorate. These sectors include Kadhimiya, Al Adeal, Mansur, Aeamil, Karkh, Abu Ghraib, Taji, Dora, Mahmudia, Tarmiyah, and Al Aeilam. The study covers two-years, beginning on 25 December 2020 and ending on 25 December 2022. This time frame allows the collection and analysis of a representative sample of food items received by the NRI.

Study design

This study uses a descriptive cross-sectional design with analytical elements. Descriptive research aims to describe the characteristics of a population or phenomenon at a specific point in time. In this case, the research describes the food samples received by the NRI during a defined period. The inclusion of analytical elements allows for further exploration of relationships or patterns within the data. For example, the study might analyze whether specific food categories exhibit higher rates of contamination or noncompliance with Iraqi food safety standards.

Sample Selection

The study uses a convenience sampling approach. All food samples received by the NRI from the aforementioned sectors of the AL-Karkh Health Directorate during the designated study period are included in the analysis. This method is feasible due to the existing data collection practices at the NRI. However, it is important to note that convenience sampling may not be entirely representative of the larger population of food items consumed within the directorate.

Inclusion Criteria: The study incorporates all food samples received by the NRI that undergo the following routine analyses.

- **Bacteriological investigations:** These assess the presence or absence of potentially harmful bacteria in food samples.
- **Chemical Investigations:** These evaluate the presence of chemical contaminants, such as pesticides, heavy metals, or additives, which exceed the permitted levels established by Iraq's food safety standards.
- **Physical investigations:** These examine the physical properties of food items, which can include foreign objects, signs of spoilage, and proper labeling.

These investigations are crucial components of the NRI's food safety control system and ensure adherence to Iraqi standards for various food products.

Data Collection

Data for this study are retrieved from existing records maintained by the NRI. Researchers gather and download information from documented sheets to a computer program like Microsoft Excel using a format designed specifically for this research. This format facilitates the organization and analysis of data points related to food samples.

Data Analysis

Data analysis was used to characterize the collected food safety data from the NRI. This analysis will encompass several key aspects. First, the distribution of food samples across categories (fruits, vegetables, meat, dairy, processed) defined by the Codex Committee on Food Additives will be examined to assess the diversity of food items included in the study. Second, compliance rates with established Iraqi food safety standards will be determined to evaluate the overall effectiveness of current regulations and monitoring practices. Third, patterns of non-compliance, such as pesticide residue levels, pathogenic bacteria presence, or

labeling issues, will be identified to allow for targeted interventions in areas of highest concern. Finally, if the data allows, geographic variations in food safety issues across different sectors within the AL-Karkh Health Directorate will be explored using descriptive statistics (frequencies, percentages) as the basis. Depending on the data collected, additional statistical tests may be employed to investigate relationships between variables, such as comparisons between compliance rates between food categories.

Ethical considerations: This study investigates the prevalence of failures identified in food samples received by the Nutrition Research Institute (NRI) in Baghdad, Iraq. The study uses anonymized data collected during routine testing procedures to assess compliance with Iraqi food safety standards. The data will be analyzed to identify patterns of non-compliance and areas for improvement in food safety practices. The findings of this study will be valuable in forming public health interventions and improving the overall safety of the Iraqi food supply.

Results

This study investigated a total of 20,024 food samples over two years. The most frequent categories were "Salts, spices, soups, sauces, salads and protein products" (5,125 samples; 25.6%) and "Dairy products and analog" (3,776 samples; 18.9%), highlighting the focus on investigating processed and potentially high-risk food items. Fruits and vegetables (2,496 samples; 12.5%) formed a significant portion, followed by categories like "Foodstuffs intended for particular nutritional uses" (1,615 samples; 8.1%) and "Beverages excluding dairy products" (1,457 samples; 7.3%). In contrast, categories such as "Eggs and egg products" (35 samples; 0.2%) and "Ready to eat sweet" (96 samples; 0.5%) were the least investigated, suggesting a lower perceived risk or a smaller market share. This distribution provides valuable information on the focus of food safety efforts and the relative prevalence of different food categories within the investigated sample. (Table 1)

Table 1: Distribution of Investigated food samples (n= 20024)

Food samples categories	Frequency	%
Salts, spices, soups, sauces, salads and protein products	5125	25.6
Dairy products and analog	3776	18.9
Fruits and vegetables, seaweeds and nuts and seed	2496	12.5
Foodstuffs intended for particular nutritional uses	1615	8.1
Beverages excluding dairy products	1457	7.3
Fats and oils, and fat emulsions	1207	6.0
Bakery ware	1192	6.0
Cereals and cereal products	952	4.8
Meat and meat products including poultry and gams	819	4.1
Composite foods - foods that could not be placed in categories 01 – 15	489	2.4
Confectionery	442	2.2
Fish and fish products, and echinoderms including mollusks, crustaceans	153	0.8
Sweeteners, including honey	170	0.8
Ready to eat savory	96	0.5
Eggs and egg products	35	0.2

Table 2 presents a detailed breakdown of failure rates within the investigated food samples, categorized by both type and origin. Of the 20024 samples examined (100%), only 235 (1.2%) failed to meet compliance standards.

When looking at failure rates by food category, beverages had the highest proportion of failures (3.6%), followed by meat and poultry (3.3%) and ready-to-eat meals (3.1%). In contrast, fats and oils had the lowest failure rate (0.1%). Interestingly, although comprising the largest portion of the investigated samples (25.6%), the salt, soup, sauce, and yeast categories had a relatively low failure rate (1.4%).

Origin also played a role in failure rates. Although imported samples made up the majority of the items investigated (81.9%), they had a lower overall failure rate (0.6%) compared to domestically produced samples (3.9%). This suggests that import regulations might be stricter or that the types of imported food are inherently less prone to failure to comply with standards.

A closer look at specific categories by origin reveals some interesting trends. Dairy products, beverages, and ready-to-eat meals from national sources had significantly higher failure rates compared to their imported counterparts. In contrast, failures in the categories of salt, sauces, yeast, and flour were more common in imported products. This suggests potential areas for improvement in both domestic production practices and import regulations. (Table 2)

Table 2: Distribution of failed investigated samples, categorized by both type and origin

Food samples categories	Failed investigated samples 235 (1.2)		Non failed Investigated samples 1789 (98.8)		Total 2024 (100.0)
	Frequency	%	Frequency	%	
Dairy products & analogs	50	1.3	3726	98.7	3776 (18.9)
Meat, meat products, poultry	27	3.3	792	96.7	819 (4.1)
Beverages	52	3.6	1405	96.4	1457 (7.3)
Salt, soup, sauce, yeast	71	1.4	5054	98.6	5125 (25.6)
Fruit, vegetable	18	0.7	2478	99.3	2496 (12.5)
Cereal, flour	7	0.7	945	99.3	952 (4.8)
Composite, prepared	6	1.2	483	98.8	489 (2.4)
Ready to eat	3	3.1	93	96.9	96 (0.5)
Fat, oil	1	0.1	1206	99.9	1207 (6.0)

Food samples origin					
Imported	95	0.6	16300	99.4	16395 (81.9)
National	140	3.9	3489	96.1	3629 (18.1)

An analysis of the failed samples by origin and category (Table 3) reveals some interesting trends. While a small portion of the failures originated from imported sources in most categories (except cereals, prepared foods, and ready-to-eat meals), a significantly higher proportion of the failures stemmed from domestic items, particularly in dairy (86%), beverages (96.2%), and salt, sauces, and yeast (73.2%). This suggests that there might be areas for improvement in quality control practices for certain categories of food produced domestically. It is important to note that the table does not reveal the specific reasons behind the failures, so further investigation would be needed to pinpoint the root causes. (Table 3)

Table 3: An analysis of failed investigated samples by category and origin

Food sample categories	Failure samples		Total 235 (100.0)
	Imported N. (%)	National N. (%)	
Dairy products	7 (14.0)	43 (86.0)	50 (100.0)
Meat, poultry	17 (63.0)	10 (37.0)	27 (100.0)
Beverages	2 (3.8)	50 (96.2)	52 (100.0)
Salt, sauce yeast	52 (73.2)	19 (26.8)	71 (100.0)
Fruit, vegetable	9 (50.0)	9 (50.0)	18 (100.0)
Cereal, grains	7 (100.0)	0 (0.0)	7 (100.0)
Prepared (composite)	0 (0.0)	6 (100.0)	6 (100.0)
Ready to eat	0 (0.0)	3 (100.0)	3 (100.0)
Fat, oil	1 (100.0)	0 (0.0)	1 (100.0)

Table 4 details the investigation of dairy products and analogs, classified by failure rates and origin. Cheese and analogs comprised the majority of the investigated samples (2,072; 54.9%), with a very low overall failure rate (0.2%). On the contrary, fermented milk products had a higher failure rate (19; 5.4%) despite being investigated less frequently (354; 9.4%). Interestingly, all the failures in fermented milk originated from national producers. Liquid milk (1,096; 29.0%) and cream products (62; 1.6%) had minimal failures, with only national producers experiencing isolated incidents (0.05% and 0.03% failure rates, respectively). Dairy-based desserts, such as ice cream (192; 5.1%), exhibited a moderate failure rate (10.4%) only within national products. In general, national dairy products had a slightly higher failure rate (1.1%) compared to imported products (0.2%).

Table 4: Investigation of dairy products and analogs, categorized by failure rates and origin

Dairy samples category	Dairy sample investigated		Total failed samples		National failed samples		Imported failed samples	
	N	%	N	%	N	%	N	%
Cheese and analogs	2072	54.9	8	0.2	4	0.1	4	0.1
Fermented milk	354	9.4	19	0.5	19	0.5	0	0.0
liquid milk	1096	29.0	2	0.05	0	0.0	2	0.05
Cream (plain) and the like	62	1.6	1	0.03	0	0.0	1	0.03
Diary-based dessert (ice cream)	192	5.1	20	0.5	20	0.5	0	0.0
Total	3776	100.0	50	1.3	43	1.1	7	0.2

An analysis of meat and meat product samples (n=819) revealed that fresh meat, and poultry (48.2%) constituted the category most investigated, followed by heat-treated processed products (30.5%) and fresh and comminuted meat products (21.3%). The overall failure rate for this category was 3.3%, and the majority of failures (2.8%) occurred in fresh, non-comminuted meat and poultry of national origin. Interestingly, no failures were observed in fresh-cooked meat products from imported sources. (Table 5).

Table 5: Investigated meat and meat product samples according to categories 'failed rate'

Meat and Meat Products samples category comminuted	Meat sample investigated		Total failed samples		National failed samples		Imported failed samples	
	N	%	N	%	N	%	N	%
Heat-treated processed meat, poultry	250	30.5	2	0.2	1	0.1	1	0.1
Fresh meat, poultry	395	48.2	23	2.8	7	0.9	16	2.0
Fresh meat, poultry (comminuted)	174	21.3	2	0.2	2	0.2	0	0.0
Total	819	100.0	27	3.3	10	1.2	17	2.1

Of the beverages investigated that exclude dairy products (Table 6), fruit juice was the most common category (815 samples; 56.0%), followed by soft drinks (277 samples; 19.0%) and tea (211 samples; 14.5%). Alcoholic beverages were the least investigated category (154 samples; 10.5%). The overall failure rate for beverages was 3.6%. Failures were more frequent in nationally produced beverages (50; 3.5%) compared to imported ones (2; 0.14%). In particular, fruit juice had the highest number of failures (43; 3.0%) among all categories of beverages. (Table 6)

Table 6: Investigated beverages Excluding Dairy Products samples according to categories &the Failure Rate

Beverages samples category	Beverages sample investigated		Total failed samples		National failed samples		Imported failed samples	
	N	%	N	%	N	%	N	%
Fruit juice	815	56.0	43	3.0	42	2.9	1	0.07
Soft drink	277	19.0	7	0.5	7	0.5	0	0.0
Tea	211	14.5	1	0.07	1	0.07	0	0.0
Alcohol	154	10.5	1	0.07	0	0.0	1	0.07
Total	1457	100.0	52	3.6	50	3.5	2	0.14

Table 7 details the investigation and failure rates of "Salts, Spices, Soups, Sauces, Salads, and Protein Products" categorized by specific product types. Yeast and related products dominated the investigated samples (3,018; 58.9%), with a very low overall failure rate (18; 0.4%). Failures were primarily observed in imported yeast products (18; 0.4%). Salts and salt substitutes comprised 14.6% (748) of the investigated samples, with a slightly higher failure rate (46; 0.9%). Here, failures were more evenly distributed between national products (14; 0.3%) and imported products (32; 0.6%). Sauces and similar products (1,349; 26.3%) had minimal failures (6; 0.1%), with a slight bias towards national products (4; 0.08%). Vinegar represented a negligible portion (0.2%) with a single failure in a national product. In general, the category had a low failure rate (71; 1.4%). Interestingly, failures were more frequent in imported products (52; 1.04%) compared to national products (19; 0.4%) despite a higher investigation rate for national products within this category.

Table 7: Investigation and failure rates of "Salts, Spices, Soups, Sauces, Salads, and Protein Products" categorized by specific product types

Salt & Other Products samples category	Salt & other samples investigated		Total failed samples		National failed samples		Imported failed samples	
	N	%	N	%	N	%	N	%
Yeast and like products	3018	58.9	18	0.4	0	0.0	18	0.4
Salts and salt substitutes	748	14.6	46	0.9	14	0.3	32	0.6
Sauces and like products	1349	26.3	6	0.1	4	0.08	2	0.04
vinegar	10	0.2	1	0.02	1	0.02	0	0.0
Total	5125	100.0	71	1.4	19	0.4	52	1.04

Table 8 investigates failures within the category of Salts, Spices, Soups, Sauces, Salads, and Protein Products. Yeast and similar products were the most investigated (3,018; 58.9%), with a very low failure rate (0.4%). Failures were more prevalent in national salts and salt substitutes (46; 0.9%) compared to imported salts (32; 0.6%). A similar trend is observed in sauces, where national products had a higher failure rate (4; 0.08%) than imported products (2; 0.04%). Vinegar had a negligible failure rate (0.02%), with only one sample failing. Overall, the failure rate for this category was low (1.04%).

Table 8: Investigates failures within the category of Salts, Spices, Soups, Sauces, Salads and Protein Products

Salt & Other Products samples category	Salt & other samples investigated		Total failed samples		National failed samples		Imported failed samples	
	N	%	N	%	N	%	N	%
Yeast and like products	3018	58.9	18	0.4	0	0.0	18	0.4
Salts and salt substitutes	748	14.6	46	0.9	14	0.3	32	0.6
Sauces and like products	1349	26.3	6	0.1	4	0.08	2	0.04
vinegar	10	0.2	1	0.02	1	0.02	0	0.0
Total	5125	100.0	71	1.4	19	0.4	52	1.04

Looking at Table 9, a relatively low failure rate was observed in cereals and cereal-derived products (total investigated: 2644, total failures: 17, failure rate: 0.6%). Flour, the category most investigated (n = 952), had a minimal failure rate (0.7%), and imported and national flours performed similarly. However, prepared cereal products showed a higher national failure rate (1.2%) compared to zero failures in imported products. Snack items made with cereal-based ingredients also exhibited a slightly higher failure rate in national products (3.4%) compared to imported ones (0%). In particular, vegetable oils had a nearly perfect compliance rate (failure rate: 0.08%) in all samples and all oils investigated were imported.

Table 9: Investigated cereal and cereal products derived from cereal grains samples According to categories &the Failure Rate

Cereals & cereal products categories		sample investigated		Total samples failure	
		N	%	N	%
Flours	Total	952	100.0	7	0.7
	Imported	942	98.9	7	0.7
	National	10	1.1	0	0.0
Prepared	Total	489	2.4	6	1.2

	Imported	333	68.1	0	0.0
	National	156	31.9	6	1.2
Snack, potato, cereal, flour, or starch-based	Total	96	100.0	3	3.1
	Imported	7	7.3	0	0
	National	89	92.7	3	3.4
Vegetable oil	Total	1207	100.0	1	0.08
	Imported	1207	100.0	1	0,08
	National	0	0.00	0	0.00

Table 10 identifies the most common causes of failure for each failed food category. Microbiological contamination appears to be a major concern, with bacterial failures (eg total bacteria coliform, Escherichia coli, *Salmonella*) prevalent in dairy, meat, poultry, beverages, and composite prepared foods. Chemical failures also play a role, with acidity, total soluble solids (TSS), and humidity being significant factors in various categories. Furthermore, the table highlights specific concerns for certain categories, such as the lack of iodine in salt and spices, insect contamination in grains, and the presence of artificial colors in ready-to-eat snacks. These data suggest that food safety efforts should prioritize addressing these prevalent failure causes to ensure food quality and consumer health.

Table 10: Identifies the most common causes of failure for each failed food category

Food Category	Bacteriological failure	Chemical failure
Dairy products	Total bacteria coliform, Escherichia coli, total aerobic bacteria in	Acidity, TSS
Meat products, poultry	Bacteria (*Salmonella*)	Acidity, T.V.N increased
Beverages	Aerobic bacteria, Escherichia coli, total bacteria coliform, yeast, molds	Acidity, TSS
Salt, spices, sauce, yeast	Total bacteria coliform	Acidity, TSS, humidity, lack of iodine element, contaminants
Fruits, vegetables	-	Acidity, TSS, vegetable not firm, fresh, increase in salt contained
Cereal (flour), grains	-	Insects, flies, contaminants dead or alive
Composite (prepared)	*Salmonella*, e-coli	TSS
Ready to eat (snacks)	-	Artificial color
Fat, oil	-	Acidity

Discussion

This study investigated a substantial number of food samples (20,024) over two-years, providing valuable information on food safety trends and potential areas for improvement. The focus on processed and potentially high-risk categories such as "salts, spices, soups, sauces, salads, and protein products" (25.6%) and "dairy products and analogs" (18.9%) aligns with established practices in food safety risk assessment [8]. This prioritizes categories with a higher intrinsic risk of harboring pathogens or spoilage organisms.

Interestingly, the study revealed the disconnect between the volume of investigation and perceived risk. Categories such as "Eggs and egg products" and "Ready-to-eat" savory" were investigated the least (0.2% and 0.5%, respectively) despite the potential risks associated with *Salmonella* contamination in eggs and spoilage or pathogenic growth in ready-to-eat meals [9, 10]. This suggests a potential need to re-evaluate sampling strategies based on current scientific understanding of the risks of foodborne diseases.

The overall failure rate of 1.2% is consistent with the findings of other large-scale food safety studies. For example, a study by the European Food Safety Authority (EFSA) reported a non-compliance rate of 1.6% in various food categories in the European Union [11]. However, a closer look at failure rates by category reveals concerning trends. Beverages (3.6%), meat and poultry (3.3%), and ready-to-eat meals (3.1%) had significantly higher failure rates compared to fats and oils (0.1%). This is consistent with previous research that highlights the vulnerability of these categories to contamination with pathogens or spoilage organisms due to their inherent properties and handling practices [12, 13].

The study's finding that imported samples had a lower failure rate (0.6%) compared to domestically produced samples (3.9%) is intriguing. This could be attributed to stricter import regulations, inherent characteristics of imported food products (eg, preprocessing or packaging), or limitations in the study design that did not account for the specific origin countries of imported goods. More research is needed to understand the underlying reasons for this disparity.

A breakdown by origin and category (Table 3) offers valuable information. Significantly higher failure rates in domestically produced dairy (86%), beverages (96.2%), salt, sauces, and yeast (73.2%) compared to imported counterparts suggest potential areas for improvement in domestic food safety practices and regulations. This aligns with the concerns raised in other studies about hygiene practices, traceability systems, and adherence to food safety protocols within the domestic food production sectors in certain regions [14, 15].

The detailed analysis of specific categories, such as dairy products and beverages, further strengthens these observations. For example, the higher failure rate in fermented milk products from national producers (19; 5.4%) requires investigating the root causes behind these failures, potentially focusing on fermentation processes, sanitation practices, or contamination during handling.

Several recent studies support the key findings of this investigation. A 2023 study by the International Food Protection Association (IFPA) reported similar trends in failure rates by category, with higher non-compliance rates observed in meat, poultry, and beverages [16]. Furthermore, a 2022 study published in Food Control found that domestically produced dairy products in a specific region had a higher prevalence of microbial contamination compared to imported ones, echoing the observations of this study [17].

Conclusion and Recommendation

A two-year study of more than 20,000 food samples in Iraq revealed a national food control system with strengths and weaknesses. Although a relatively low failure rate of 1.2% suggests some baseline compliance, more than half of those failures originated domestically, indicating the need for stricter controls within Iraq's food production and distribution. The study also highlights the dependence of Iraq on imported food, emphasizing the importance of robust import checks. Certain food categories, especially domestically produced juices and meat/poultry, showed higher failure rates, prompting further investigation of potential risks. Encouraged, the study confirms that Iraqi food safety protocols encompass chemical, physical, and bacterial tests based on national standards. However, the most common chemical failure, related to total adulteration of SOS, suggests a specific area for increased vigilance.

Iraq can significantly improve its food safety system by building a stronger national food control system. This includes implementing rapid risk assessments and using internationally recognized frameworks like HACCP and Codex Alimentarius. Furthermore, developing specific strategies for domestic food production and prioritizing national product safety through stricter regulations and sampling will increase consumer confidence. Improved hygiene practices, training for food safety personnel, and shared responsibility between producers and supervisors are crucial. Expanding the analysis of food samples to include both imported and domestic products, with a focus on high-risk categories, will allow a better identification of hazards. Finally, continuous research is needed to refine Iraq's food safety measures and address new threats. By implementing these recommendations, Iraq can ensure a safe and high-quality food supply for its citizens.

Conflict of interest

The authors of Mohsin Ahmed Jasim, Zainab Ghassan Lutfi, Rana Faeq Saud, and Riyadh Shiltagh Al-Rudaini declare that there is no conflict of interest in the publication of this article.

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