

Republic of Iraq

Ministry of Planning

Central Organization for Standardization and Quality Control

Quality Control Department

Food Industries



**A Comprehensive Study Evaluated the Quality of
Some Iraqi Food Categories during 2022.**

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2023

Acknowledgement

To the Head of the Food Industries Department Mr. (Hayder Fadhel), the laboratory officials, and all the technicians for their efforts.

In addition to the Evaluation and Follow-up Division, especially Mr. Sinan Ghassan.

Thanks, and gratitude goes to the Technical and Administrative Services Directorate/ Documentary section and the official (Haleemah Kadhm) for providing us with the evidence required to complete this study.

Abstract

Access to safe food is considered a basic human right, but food-borne disease presents significant public health concern globally.

This analytical case study was collected from January to December 2022. It classified (438) samples into (4) food categories that include: Dairy products, Meat and products, Variety food products and dried food products. The study aimed to assess the quality of food categories by using different specifications and standard tests; which include (microbiological, chemical, and physical) analysis, packing, explanatory labels, expired duration checking.

Results showed the highest frequency of food categories recorded in Dry foods (36.5%), Meat category (28.5%), Variety food (25.3%) and Dairy products (9.5%) significantly ($P \leq 0.01$). The study revealed that un-conforming food products to IQS were recorded in Dairy products (52.3%), Meat (48.8%), Variety and Dried food (35.1%, 22.5%) significantly ($P \leq 0.01$). Labeling was the main reason for non-conformity in (3 out of 4) food categories including a variety of food, Dairy products and meat.

Microbial test contamination was equally recorded in both Meat and Dairy products (18%), followed by variety and Dried food. Physical tests failure was recorded in Meat and Variety food (6.5%, 5.1%), followed by Dairy products. Packing non-conformities were recorded in meat (9.8%) and Dried food (2.7%). Chemical test failure was recorded in Dried and dairy products (83.3%, 31.8%) followed by a variety of foods. Expired dates cause was highly frequent in meat (34.4%) and Dairy products.

Non- conforming expiration duration, packing, microbial contamination and physical tests had the most frequency in Meat and its products.

List of Contents

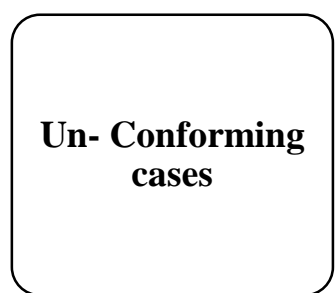
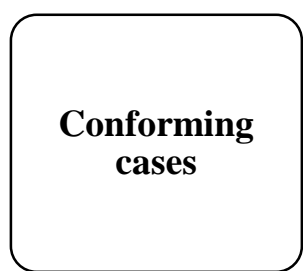
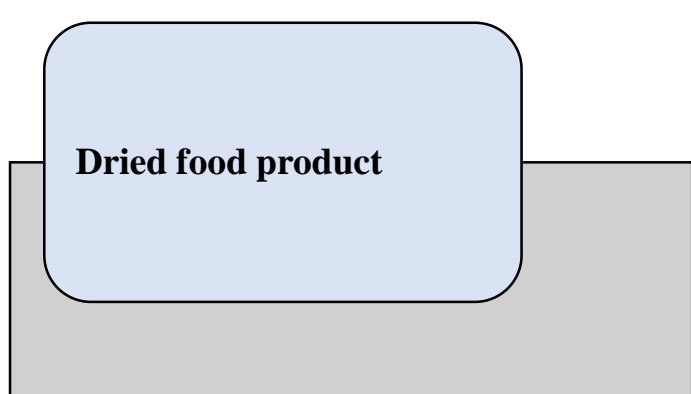
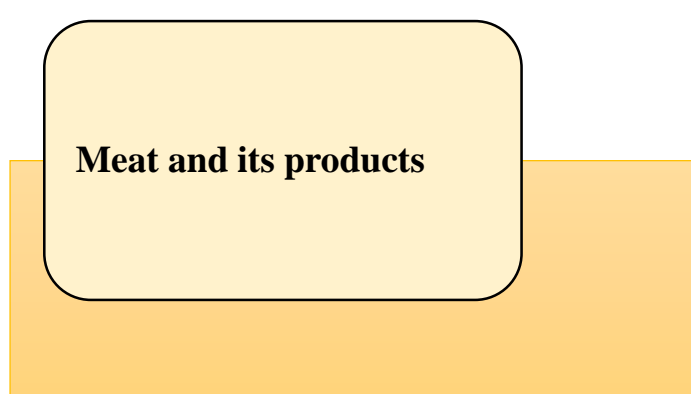
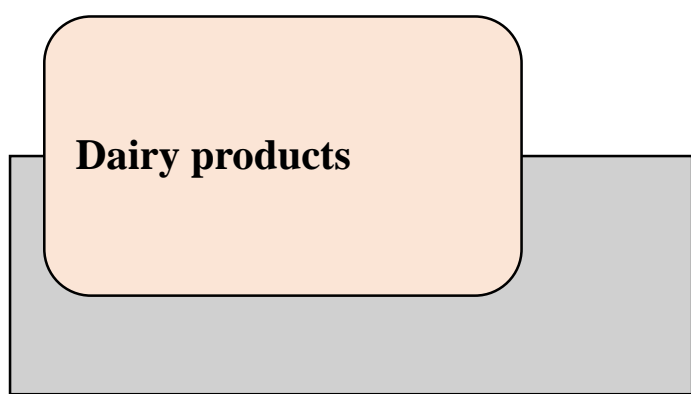
| Subjects | Pages |
|--------------------------------------|--------------|
| List of Contents | I |
| List of Tables and figures | II |
| Study Design | III |
| Aims of the Study | IV |
| Abstract | i |
| Introduction | V |
| Chapter One | |
| | 1 |
| Chapter Two | |
| 2.1 Study design and Data collection | 3 |
| 2.2 Food Analysis | 3 |
| 2.3 Statistical Analysis | 6 |
| Chapter Three | |
| Results | 7 |
| Discussion | 11 |
| Conclusion | 14 |
| Recommendation | 15 |
| References | 16 |

List of Tables and Figures

| Table no. | Title of Tables | Pages |
|-------------------|------------------------------------------------------------------------------------------------|--------------|
| 3.1 | Comparison between conformities and non-conformities of food categories | 8 |
| 3.2 | un- conforming caursrs of food categories | 9 |
| Figure no. | Title of Figures | Pages |
| 2.1 | A- Weights, B- PH meter | 4 |
| 2.2 | Nitrogen and crude protein equipment. | 5 |
| 2.3 | Laminar flow cabinet | 6 |
| 3.1 | Total percnrntages (%) of samples included in laboratory testing in COSQC during 2022 | 7 |
| 3.2 | Comparison between conformities and non-conformities between major categories of food products | 8 |
| 3.3 | Main causes of non- conformity causes of food categories | 10 |

List of Abbreviations

| | |
|--------------|---------------------------------------------------------------------|
| IQS | Iraqi Organization of Specification |
| WHO | World Health Organization |
| COSQC | Central Organization for Standardization and Quality Control Center |
| FBD | Food Born Diseases |
| ISO | International Organization for Standardization |



Study design

❖ *Aim of Study*

- Detection the quality and specifications of some food categories that are available in Iraqi local markets.
- To ensure and monitor how closely the approved Iraqi standard is being applied in local and imported food.
- Inventory of the reasons for non- conformity of food categories in order to find out the ability to avoid and control their occurrence.
- Evaluating the performance of the organization's field teams responsible for withdrawing samples by knowing the numbers and types of samples received during the year 2022.

❖ *Introduction*

Access to sufficient amounts of safe and nutritious food is key to sustaining life and promoting good health [1].

Foodborne diseases (FBD) commonly known as food illnesses are caused by ingested food contaminated with microorganisms, such as bacteria, fungi, viruses, parasites as well as by natural toxins, chemical and physical agents [2].

Contamination of food products including chemical contaminants, such as allergens, histamine, cyanogenic glycosides, mycotoxins, toxic elements, etc. [3].

Biological contaminants, such as *Campylobacter*, *Brucella*, viruses, *Escherichia coli*, prions, *Staphylococcus aureus*, *Listeria monocytogenes*, protozoa, parasitic pathogens.

While, physical contaminants, such as bone, glass, metal, personal effects, plastic, stones, wood, etc. [3].

These diseases still reason of a substantial public health, economic and social burden worldwide [4]. In low- and middle- income nations, 110 billion US Dollars is lost every year in medical expenses and loss of productivity due to unsafe food.

Food safety, nutrition and food security are inextricably linked. Many foodborne diseases may lead to long- lasting disability and death [1].

Every year (FBD) diseases cause illness among 1 in 10 people, affecting about 33 million lives per year globally. In developed countries, 20%- 40% intestinal disturbances linked with foodborne pathogens [2]. Children under five years of age carry 40% of the FBD burden, with 125, 000 deaths every year, with the highest burden in low and middle income countries [5].

The prevention depends on consumer aptitude to interpret knowledge of food safety to the practices of food production and preparation at each level of the food system [2]. Good collaboration between governments, producers and consumers is needed to help ensure food safety and stronger food health [1].

1. Chapter One

A key concern in agriculture is how to feed the expanding population and safeguard the environment from the ill effects of climate change. To feed a growing global population, food production and security are significant problems, as food output may need to double by 2050. The world's most widely cultivated grains include corn, wheat, and rice, which serve as the foundation for basic foods [6].

Since rice is the second- largest food crop in the world, rapid climate change brought on by human activity has a significant impact on rice. More than one- third of the world's population, 90% of whom live below the poverty line, depend on rice as a major food source [7].

Wheat is the most important staple crop in temperate zones and is in increasing demand in countries undergoing urbanization and industrialization. In Iraq, it is the main cereal produced, accounting for 70% of total cereal production in the country. It is a major source of starch and energy (bread), wheat also provides protein, vitamins (notably B vitamins), dietary fiber, and phytochemicals [8, 9].

After rice and wheat, maize (*Zea mays L.*) is the third- most significant food crop in the world. The most abundant cereal in the world is corn, which is utilized as fuel, food for livestock, and human consumption. Along with rice and wheat, maize is one of the “big three” grain species that account for more than half of the calories consumed globally [6].

Poultry is thriving across the globe. Chicken meat is the most preferred poultry worldwide, and its popularity is increasing. It is a nutritious, healthy food which is low in fat and cholesterol compared to other meats but an excellent source of protein.

However, poultry also threatens human hygiene, especially as a fomite of infectious diseases caused by the major foodborne pathogens (*Campylobacter*, *Salmonella*, and *Listeria*). Meat must be of a high microbiological quality in order to ensure that the consumer receives a product that is not spoilt or does not carry food- borne disease [10, 11].

Dairy include products made from milk which produced after optional homogenization or pasteurization, in several grades after standardization of the fat level, and possible addition of the bacteria *Streptococcus lactis* and *Leuconostoc citrovorum*. Milk can be broken down into several different categories based on type of product produced, including cream, butter, cheese, infant formula, and yogurt [12].

The potato has a major role to play in feeding the increasing population worldwide. It can grow in all kinds of environments and have high nutritional value, are an excellent source of carbohydrate, protein, vitamins, minerals and dietary fiber and are also one of the richest sources of antioxidants [13].

2. Chapter Two

2.1 Study design and Data Collection

This analytical case study was collected from January to December 2022. The data presented in this study was available surveillance database collected from Central Organization for Standardization and Quality Control Center (COSQC).

All the (438) samples subjected to a precise microbiological analysis by accredited food laboratories. Additionally, chemical, physicals and packing tests were done by training professionals' analyses. The approved Iraqi criteria and the international quality specifications served as the foundation for all of these testing.

The study classified food products according to Unified Index Iraqi Standard Specifications in to four main categories that include: Dairy products, Meat and products, Variety food products and Dried food products [14].

2.2 Food analysis methods

Food is always prone to structural modifications during storage or processing. Analysis and quantification of food components is required to determine nutritional value and quality assurance of food products [15].

1. Packing

The product is packed in appropriate, clean and sound containers that protect it from contamination, damage and dryness and preserve its natural, manufacturing and sensory properties without damage. Each packaging method has its own expiration duration (IQS 1847) [16].

2. Physical analysis

Many physical tests and sensory were performed during food analysis including:

- It retains its natural properties and is free of unnatural flavors and odors
- Filling ratio
- It is free of insects, their larvae and their stages.
- It is free of rancidity, corruption and mold.

- Free from fillers such as starch and flour
- Homogeneity and free from agglomeration
- Conforming weight
- Measurement of exuded fluid
- Percentage of broken parts



(A)



(B)

Figure (2.1): A- Weights, B- PH meter

3. Chemical analysis

Food chemical contamination may occur at any point of the various stages of processing, packaging, transportation and storage of food. It may also be the result of environmental contamination, as in the case of toxic metals, or through the intentional use of chemicals such as pesticides, veterinary medicinal products and food contact materials [17]. This type of contamination can lead to acute poisoning or long- term diseases, such as cancer. [1]. Many chemical tests were performed in COSQC food analysis laboratories including measured of:

- | | |
|--------------------------|------------------------------|
| • Ash | • Nitrogen and crude protein |
| • Ash –insoluble in acid | • Acidity of oil |
| • Moisture | • PH |

- Fat
- Vacuumed moisture
- Aromatic oils
- Iron
- Pollutants
- Peroxide
- Calcium
- Potassium
- Sodium
- Phosphate



Figure (2.2): Nitrogen and crude protein equipment.

4. Microbial analysis

- General Counting Methods of Bacteria (Aerobic Plate count)
- Coliform
- Fecal Coliform
- Mold and Yeasts
- *Salmonella Typhoid*
- *Staphylococcus aureus*



Figure (2.3): Laminar flow cabinet

2.3 Statistical Analysis

The Statistical Analysis System- SAS (2018) program was used to detect the effect of difference factors in study parameters. Chi-square test was used to significant compare between percentage (0.05 and 0.01 probability) in this study [18].

Notice:

* ($P \leq 0.05$) معنوي, ** ($P \leq 0.01$) عالي المعنوية, NS: غير معنوي

3. Results

The study was an analytical case of 438 samples from various food categories. The results showed that Dry foods 160 (36.5%), had the highest percentage of food products under examination in the Central Organization for Standardization and Quality Control, followed by meat category 125 (28.5%) and Variety food products 111 (25.3%). While, Dairy products 42 (9.5%) occupied the lowest percentage of overall amounts of examined food products ($P \leq 0.01$). Figure (3.1).

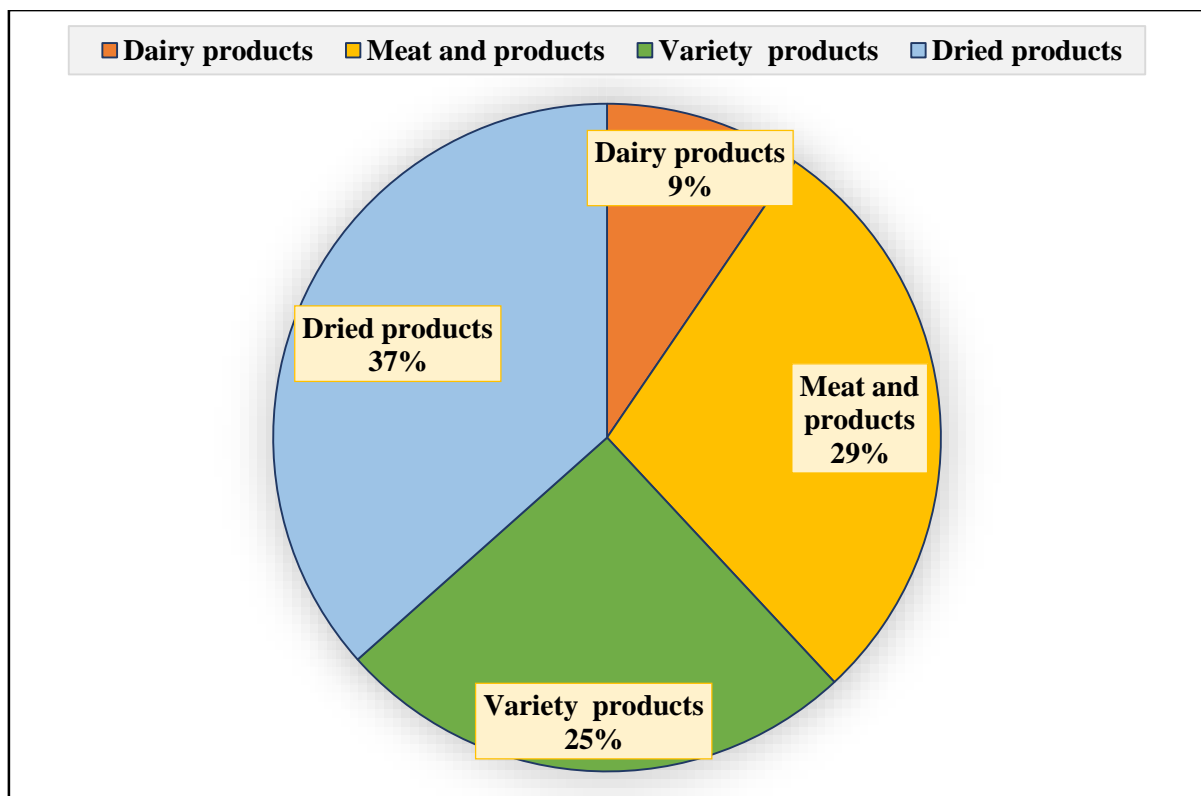


Figure (3.1): Total percentages (%) of samples included in laboratory testing in COSQC during 2022

The study revealed that un-conforming food products to IQS were recorded in Dairy products (52.3%), Meat and products (48.8%), Variety food products (35.1%) and Dried food product (22.5%) significantly ($P \leq 0.01$). Table (3.1).

While, (IQS) conformance cases was highly seen in Dried food product (77.5%), Variety food products (64.8%), Meat and products (51.2%) and Dairy products (47.6%) with significant differences ($P \leq 0.01$) Figure (3.2).

Table (3.1): Comparison between conformities and non-conformities of food categories

| Products Categories | Conforming to IQS (%) | Un Conforming to IQS (%) | Total number of samples | P-value |
|--------------------------------------------|-----------------------|--------------------------|-------------------------|---------|
| Dairy products | 20 (47.6%) | 22 (52.3%) | 42 | NS |
| Meat and products | 64 (51.2%) | 61 (48.8%) | 125 | NS |
| Variety food | 72 (64.8%) | 39 (35.1%) | 111 | ** |
| Dried food | 124 (77.5%) | 36 (22.5%) | 160 | ** |
| P-value | 0.0001 ** | 0.0001 ** | 438 | --- |
| ** ($P \leq 0.01$), NS: Non-Significant. | | | | |

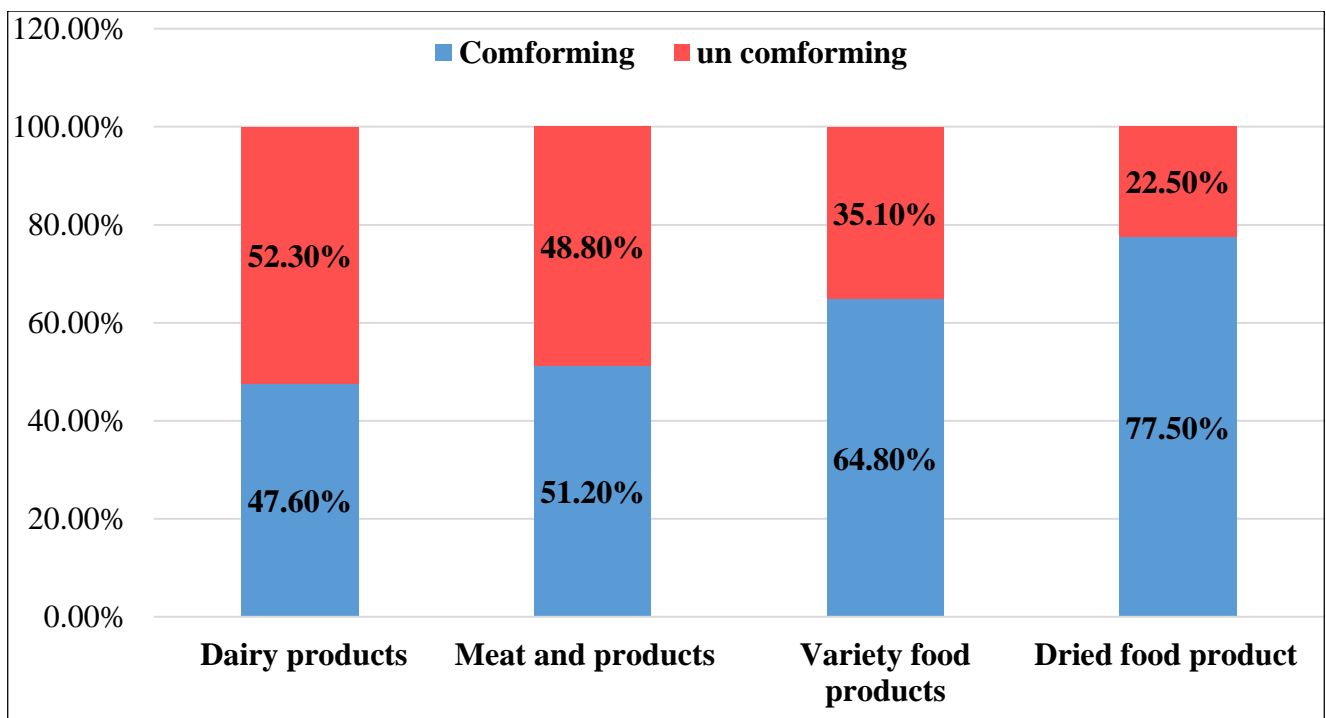


Figure (3.2): Comparison between conformities and non-conformities of food categories

Table (3. 2): un- conforming causes of food categories

| Products Categories | Physical tests | Chemical tests | Microbial tests | Packing | Labelling | Expired duration | Total |
|-----------------------|----------------|-------------------|-----------------|----------|-------------------|------------------|-----------|
| Dairy products | 1(4.5%) | 7(31.8%) | 4 (18. %) | 0 (0%) | 17 (77.2%) | 2 (9.0%) | 22 |
| Meat and products | 4(6.5%) | 0 (0%) | 11(18%) | 6 (9.8%) | 25 (40.9%) | 21(34.4%) | 61 |
| Variety food products | 2(5.1%) | 11(28.2%) | 5(12.8%) | 0 (0%) | 33 (84.6%) | 0 (0%) | 39 |
| Dried food product | 0 (0%) | 30 (83.3%) | 4(11.1%) | 1(2.7%) | 12(33.3%) | 0 (0%) | 36 |

Results show the six essential causes of non- conformities of food products were physical tests, chemical tests, microbial tests, labelling, packing and expired duration.

Labeling was the main reason for non- conformity in 3 out of 4 food categories included: Variety food, Dairy and meat products(84.6%, 77.2%, 40.9%) respectively. On the other hand, chemical test failure was the most frequent cause of Dried food (83.3%).

Results revealed that no failure cases in the expiration duration was seen in both of Variety and Dried food 0 (0%). On contrast, expired dates cause was highly frequent in meat (34.4%) and Dairy products (9%).

Physical tests failure was recorded in Meat (6.5%) and Variety food (5.1%), followed with Dairy products (4.5%). Microbial tests contamination was equally recorded in meat and Dairy products (18%). Followed with variety (12.8%) and Dried food (11%).

Dairy and Variety food products packed well 0 (0%), although non- conformities cases were meat and products (9.8%) and Dried food (2.7%). Chemical tests failure was recorded in Dried food (83.3%) and dairy products (31.8%) followed with Variety food (28.2%). While, no failure cases recorded in meat and its products 0 (0%). All it clarified in Table (3. 2).

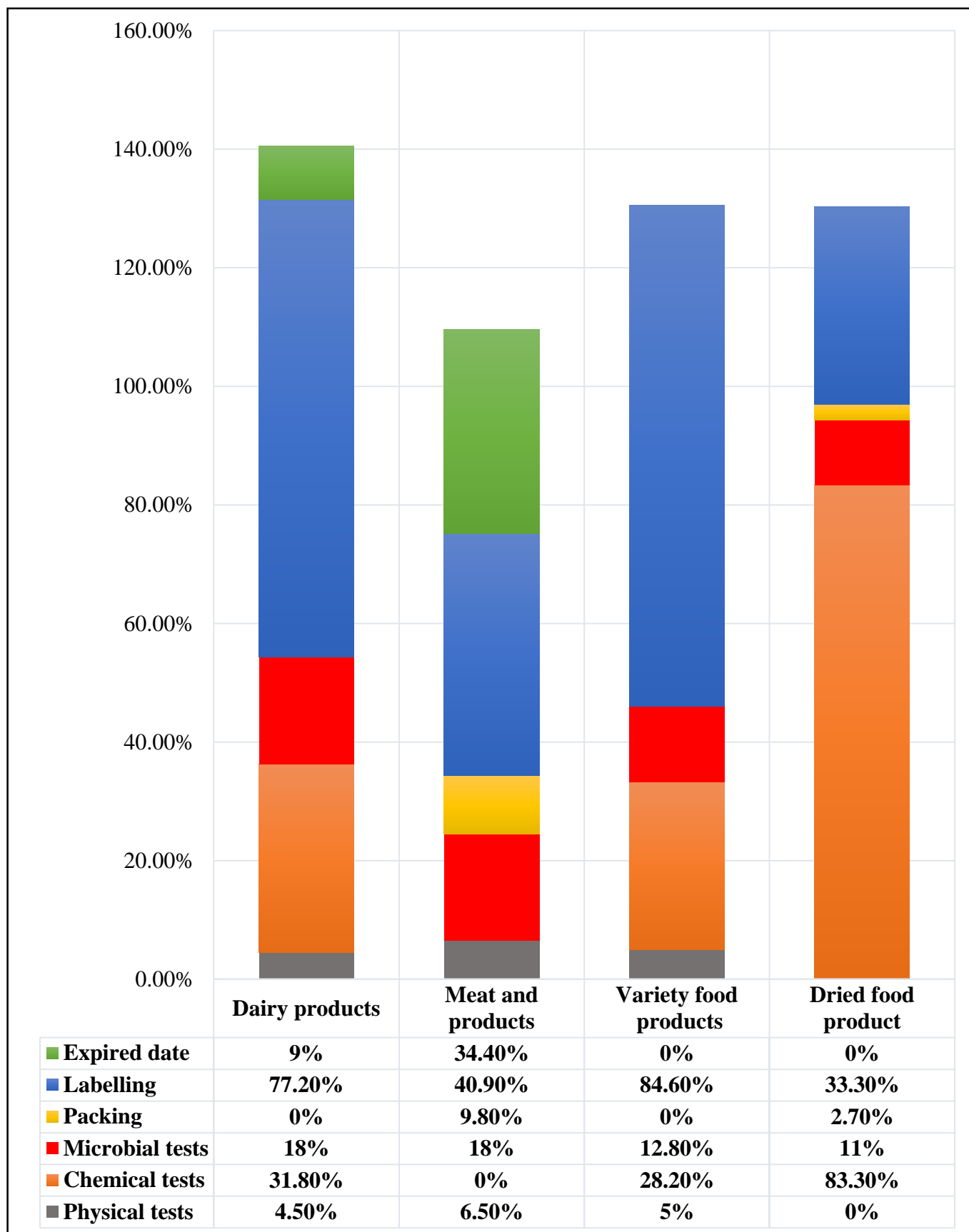


Figure (3.3): Main causes of non- conformity causes of food categories

3.2 Discussion

This study showed that dry foods, had the highest percentage of food products, followed by meat category, Variety food products and Dairy products. The organization's teams deployed in most Iraqi governorates monitor cases of non-conformity, whether the goods are local or imported. Quality control of goods is by conducting "field inspections" of hundreds of food manufactories.

These inspections included the government, private, mixed and investment sectors for most Iraqi cities and districts, except for the Kurdistan region. The basis of their work depends on arriving and taking samples from food factories according to the geographical area and within a specific timetable. Additionally, the organization is making continuous "market tours" to follow up and monitor goods inside the Iraqi markets. All these teams' procedures are subject to the Organization's Law no. (54) of 1979 [16].

On the other hand, imported food products arriving to the (Iraqi Customs Authority) through the border crossings. There are authorized and trained teams to perform a random withdrawal of samples using the "Sampling" method in application of international quality standards [19, 20]. All of the above explains the existence of a large discrepancy in the numbers of food products that arrive and subjected to examination within the COSQC's laboratories.

The current study found incorrect explanatory labels considered the main reason for the emergence of non-conformities in (3 out of 4) of food categories. It may be interpreted that traders did not adhere to the provisions of the standard specification, which stipulates the importance of providing all informational labeling for the food product, such as the name of the product, the name of the manufacturer, chemical additives, sensitivity, origin...etc. as it is cleared in specification (IQS 230) stipulates in the general requirements: "It is not permissible to offer for sale any packaged or canned food item without an identification card .[19]

Other study related between socio-demographic characteristics and food labeling consumption in Sulaimani city. It results that educated consumer' showed that to be

higher than the level illiterate skills with attention and use food labelling information before purchase it. In addition, 52% of female respondents were checking the food labelling information before purchase the food. Otherwise, the data are associated to the read of food labelling information, it can be identified that our consumers generally notice information labels, but do not take much attention in its content [21].

Poultry and Dairy products had the most microbial food contamination. Meat products including (chicken) can be contaminated by microorganisms anywhere in the supply chain, from farm to market, and these microorganisms can be transmitted to humans through direct contact, contact with the environment, and food consumption [22]. poultry also threatens human hygiene, especially as a fomite of infectious diseases caused by the major foodborne pathogens (*Campylobacter*, *Salmonella*, and *Listeria*) [11].

A similar Iraqi study isolated bacteria from (100) meat and chicken frozen samples in (Misan) governorate. The an aerobic plate count results showed that “all meat and chicken products were contaminated with bacteria, but the imported products were more contaminated than the local products” [22]. Additionally, Indonesian study of (60) samples of fresh chicken meat obtained from 10 traditional markets were examined for the presence of bacteria [4]. Asian study revealed low- quality bulk farm milk with high bacterial counts and a high occurrence of *S. aureus* [20]. Other A global systematic review and meta-analysis discuss “Contamination of milk and dairy products by *Brucella* species” [21] .

Chemical tests, the highest percentages of foods products failure recorded in dried food and variety food. Indeed, food is a complex mixture of water, proteins, lipids, and carbohydrates, which make various intra- and intermolecular interactions in the texture. The chemical composition of foods is usually made from a variety of different chemical components [15]. Therefore, specific criteria for chemical quality have been set for the standard specifications according to the type of each food products.

The study resulted that “expired duration, packing and physical test causes had the most frequency in Meat”. This may explained by ignorance of the requirements of the Iraqi

standard IQS (1847) which determined shelf life of food stuffs [16]. Moreover, achievement of profitable illegal goals by merchants and importers. It must also be ensured that the samples received for examination are tightly sealed in accordance with the specific requirements of the specifications under which the form is examined.

This agreed with recent Iraqi study evaluated the efficiency of packing milk powder that available in Iraq markets accordance with the Iraqi standard specification No. 1847 [18].

(Mohammed, H.N) *et al.* study discuss “some chemical, physical, sensory and bacteriology characteristics of canned chicken meat”. It was on the same line to our study in microbiological investigations, sensory properties. Although in contrast in chemical analyses. These differences between the studies may due to differences in the type of chemical tests performed and samples size [1].

❖ *Conclusions*

1. Incorrect explanatory labeling was the highest percentage (%) of non-conformance in (3 out of 4) food categories, which were Dairy, Meat, and Variety food discerningly.
2. There was a noticeable difference in the number of analyzed food samples. The numbers were high in dried products and began to decrease gradually in Meat, Variety food and Dairy products discerningly.
3. Microbial tests contamination was equally recorded in both of Meat and Dairy products, followed by Variety and Dried food.
4. Regarding chemical tests, the highest frequency (%) of foods failure recorded in Dried, Dairy, Variety food, although no failure recorded in Meat products.
5. Un- conforming physical tests were recorded in Meat, Variety and Dairy products. In contrast, no failure cases were seen in Dried food.
6. Expired duration was highly persistent in Meat and Dairy food. Whereas, no expired dated samples were seen in Variety and Dried food.
7. Un- conforming packing cases were found in Meat and Dried food. Although, both of Variety and Dairy products packed perfectly.
8. Non- conforming “expiration duration, microbial contamination, packing, and physical tests” had the most frequency (%) in Meat and its products

❖ *Recommendations*

1. It is necessary recommended to establish Iraqi index of conformity in order to assessment “Iraqi and imported” food products and monitoring them according to time scheduled program.
2. Conduct future studies to determine the reasons for the failure of each (food products) involved in chemical, microbial, and physical examination and determine the type of analysis that fail the most in an attempt to avoid them in the future.
3. Activating the role of the “visual and audio” media in spreading community awareness of quality and the requirements of the Iraqi Food standards.
4. Direct communications and helping (companies or factories) owners and importers avoid causes of non-conformity in their specific products.

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❖ الخلاصة

يعتبر الحصول على الغذاء الآمن حقاً أساسياً من حقوق الإنسان، ولكن الأمراض التي تنتقل عن طريق الأغذية تمثل قلق كبير على الصحة العامة على مستوى العالم.

تم جمع عينات دراسة الحالة التحليلية هذه خلال الفترة من يناير إلى ديسمبر 2022. وصنفت (438) عينة إلى أربع اصناف غذائية وتشمل: منتجات الألبان، اللحوم ومنتجاتها، المنتجات الغذائية المختلفة، المنتجات الغذائية الجافة. هدفت الدراسة إلى تقييم جودة الاصناف الغذائية باستخدام المواصفات والاختبارات القياسية المختلفة، والتي تشمل التحاليل (المكروبيولوجية والكيميائية والفيزيائية) اضافة الى التأكد من تثبيت العلامات التوضيحية ومدة الصلاحية واختبارات التعبئة.

أظهرت النتائج أن أعلى تكرار لأعداد المنتجات الغذائية تم تسجيله في الأغذية الجافة (36.5%)، فئة اللحوم (28.5%)، الأغذية المختلفة (25.3%) ومنتجات الألبان (9.5%) بفرق معنوي.

حيث كشفت الدراسة عن تسجيل حالات عدم المطابقة للمواصفات القياسية العراقية في منتجات الألبان (52.3%)، اللحوم (48.8%)، الأغذية المختلفة والاعذية الجافة (35.1%، 22.5%) على التوالي وبشكل ملحوظ. وقد كان عدم تثبيت العلامات الايضاحية هو السبب الرئيسي لعدم المطابقة في (3) من أصل (4) الاصناف الغذائية وهي مجموعة الاغذية المختلفة ومنتجات الألبان واللحوم.

تم تسجيل التلوث الميكروبي بالتساوي في كل من منتجات اللحوم والألبان (18%) بالرغم من اختلاف اعدادها، تليها الاغذية المختلفة (12.8%) والأغذية الجافة (11%) على التوالي.

اما فيما يخص الاختبارات الفيزيائية فقد تم تسجيل فشل في اللحوم والأغذية المختلفة (6.5%، 5.1%) بالتتابع، واخيراً منتجات الألبان. وتم تسجيل حالات عدم مطابقة بالنسبة للتعبئة في اللحوم (9.8%) والأغذية الجافة (2.7%). بالنسبة للاختبارات الكيميائية فقد كانت الاغذية الجافة ومنتجات الألبان (83.3%، 31.8%) الاكثر فشلاً في تطبيق المواصفة، يليها مجموعة الاغذية المختلفة بالتتابع. وقد كانت التواريخ منتهية الصلاحية شائعة بشكل كبير في اللحوم (34.4%) ومنتجات الألبان (9%).

وقد كشفت الدراسة ان حالات عدم المطابقة في كل من مدة الصلاحية، والتعبئة، والتلوث الميكروبي، والاختبارات الفيزيائية كانت بأعلى مستوياتها في اللحوم ومنتجاتها.



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وزارة التخطيط
الجهاز المركزي للتحقيق والسيطرة النوعية
دائرة السيطرة النوعية
قسم الصناعات الغذائية

دراسة شاملة لتقييم جودة بعض الاصناف الغذائية العراقية للعام 2022

قدمت من قبل

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2023