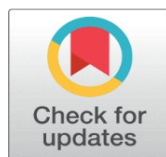
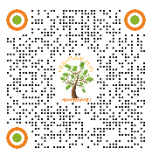


MICROBIOLOGICAL QUALITY OF IMPORTED FROZEN FISH FILLETS IN KOSOVAR MARKETS

Albana UKA ¹ 

¹ PhD, University of Prishtina “Hasan Prishtina, Faculty of Agriculture and Veterinary Prishtine, Kosovo



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Corresponding Author

Albana UKA, albanauka@hotmail.com

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ABSTRACT

Fish meat is a good source of nutritional value, but due to rapid and possible microbial contamination, it can pose a high risk to the health of consumers. In this study, 43 samples of imported fish frozen meat, which were collected in the markets of Prishtina, Kosovo, were analyzed. The microbiological parameters that are used are *Escherichia coli*, *Salmonella*, *Listeria monocytogenes*, and *Vibrio cholerae*. In the last three parameters, we have no detections in all samples. The exception is *Escherichia coli*, appearing in 85% of the analyzed samples with values <10 CFU/g.

This contamination is likely from poor hygienic practices of the workers during the process of processing the fish fillet and presence of can cause severe foodborne disease.

Keywords: Frozen Imported Fish, Microbiological Quality, *Salmonella*, *Escherichia Coli*, *Listeria Monocytogenes*, *Vibrio Cholerae*

1. INTRODUCTION

Fish is an essential part of the human diet and as such big industry functions to produce fish in different varieties. These products include anything from whole fish—large and small—to pieces of fish like cuts and fillets, to cans of fish in many different varieties, dried and cured goods, fish oils and extracts, frozen portions and whole meals. There is a vast array of potential outcomes, opportunities, and challenges presented by each of these variants and combinations [Herrero et al. \(1999\)](#), [Bremner \(2002\)](#). Fish nutrition significantly affects a number of factors, including color and appearance that have a direct impact on the fish's quality [Nollet \(2012\)](#).

Fish is a food that consumers prefer when it is fresh or very minimally treated. Maintaining appropriate manufacturing practices is crucial to upholding hygienic standards since the tissues of meat and fish are ideal substrates for bacterial development. The majority of contamination happens after shipping, killing, and subsequent processing; in a healthy, living animal, animal food muscle tissue is practically free from contamination. According to [Madden \(1994\)](#), when an animal's skins are contaminated during transportation, the contamination transfers to the flesh during the earliest steps of chopping and killing [Baird-Parker \(1990\)](#), [Pearson \(1997\)](#). Fish and fish products are frequently less microbiologically stable and handling them can result in contamination from the environment. To prevent microbial decomposition and quality loss, fish must be preserved because it is recognized as very perishable product, especially if it must be transported to markets located far from the ports of landing [Garthwaite \(1997\)](#).

By lowering the temperature at which chemical reactions occur and by decreasing water activity (a_w), which prevents microbiological development, freezing works as a preservative. The most common method of preservation is freezing, which was employed to maintain the quality of fish aboard ships and along the "cold chain" of product distribution, accounting for 53% of all fish processed for direct human consumption (DHC) in 2004 and 50% in 2006.

This usual method of freezing in order to keep fish cool eliminates the chance that the temperature may drop too low, and the fish's flesh will freeze sequentially, resulting in a loss in quality upon defrosting if gradual freezing occurs. Thus, keeping the fish cold increases their high-quality life [Hall \(1997\)](#). The sustainability of the freezing/chilling process from catch-transport-consumer is of utmost relevance given the scope and value of the frozen fish trade, particularly the flow between developing and industrialized nations. Either the freezing process needs to be made more energy efficient as is, or it needs to be augmented or replaced by alternative technologies.

Due to the adaptability of the various freezing technologies, fish can be frozen in a variety of forms, including whole fish, fillets, and a variety of coated and shaped goods.

To ensure the viability of freezing as the primary preservation method for fish and fish products, the design knowledge and skills that gave rise to this flexibility must be used in order to create those sustainability features.

Although freezing reduces water activity (a_w), which in turn limits microbial activity, not all bacteria are killed by freezing, with some Gram-positive bacteria and spores being particularly resistant. The rate and extent of growth in organisms that survive the freezing process are up for controversy, with different results coming from experimental work, but this is true for all organisms that survive the freezing process. After freezing and thawing, a number of factors influence the survival and growth of bacteria, including:

- the pre-freezing fish and flora quality, such as the presence of psychrotrophs.
- the freezing rate, such as quick freezing causing less tissue damage.
- the storage conditions such as maintaining a steady temperature.
- the thawing method.

2. MATERIALS AND METHODS

2.1. SAMPLE COLLECTION AND PREPARATION

This study case at hand was conducted on 43 samples of frozen imported fish from Vietnam that had been imported over the course of 20 days.

They were kept chilled, and 24 hours after being caught, they were evaluated. All these samples have been purchased from the Pristina fish markets in Kosovo in September 2022.

Fish samples were right away stored in refrigerator (1:1 ratio of fish to ice) and transported to the lab in a sterile container under hygienic conditions. The fish samples were then further processed for microbiological investigation by homogenizing and cutting using sterile cutters.

In [Table 1](#), a list of the fish samples' scientific names is provided.

Table 1

Table 1 Scientific Name of Fish			
Scientific name	n	Weight/carton	Source
Pangasius hypophthalmus	43	1 kg	FI

FI, frozen imported

2.1. MICROBIOLOGICAL ANALYSIS

In the framework of the microbiological aspect, four parameters were analyzed in the frozen fish meat. The analyzed parameters are *Escherichia coli*, *Salmonella*, *Listeria monocytogenes* and *Vibrios cholerae*.

2.2. ESCHERICHIA COLI

The number of beta-glucuronidase-positive *E. coli* was counted using the Horizontal method described in Microbiology of Food and Animal Feeding Stuffs, Part 2: Colony counting method employing 5-bromo-4-chloro-3-indolyl-beta-D-glucuronide at 44°C for 24 hours (ISO 16649, 2001). Use was made of Tryptone Bile X-glucuronide Agar (TBX/TBGA), which was created by combining Tryptone Bile Agar with the chromogen X-glucuronide.

Escherichia coli colonies have a characteristic green/blue appearance on this medium.

2.3. SALMONELLA

Salmonella species were identified using a horizontal approach for the detection of *Salmonella*, including *S. typhi* and *S. paratyphi*, as described in the Microbiology of food and animal feeding stuffs - Horizontal method for the enumeration of *Salmonella* spp. [International Standard - ISO 6579. \(2002\)](#).

Pre-enrichment was carried out using samples that had been diluted in 225 ml of buffered peptone water and incubated for 18 hours at 37°C. Secondary selective enrichment was carried out in Muller-Kauffmann tetrathionate broth with Novobiocin (37°C for 24 h) and Rappaport-Vassiliadis peptone broth (41°C for 24 h), and plating on XLD agar and Rambach agar, XLT-4 agar (37°C for 24 h).

2.4. LISTERIA MONOCYTOGENES – PRESENCE OF THIS HARMFUL BACTERIUM

Listeria Enrichment Broth Base Fraser, which is an appropriate medium for preparing Fraser by adding the appropriate supplements, was tested for *Listeria monocytogenes* using the Microbiology of food and animal feeding stuffs - Horizontal method for the detection and enumeration of *Listeria monocytogenes* - Part 1: Detection method [International Commission on Microbiological Specifications for Foods, and ICMSF. \(1996\)](#) Pre-enrichment was carried out for 24 hours at 30°C in Half Fraser Broth.

The primary and secondary enrichment tubes were incubated for 48 hours at 37°C after being inoculated upon Oxford and ALOA agar (Agar *Listeria* selon Ottaviani and Agosti).

Table 2

Table 2 The Results of Microbiological E.Coli, Salmonella, Vibrio Cholerae and Listeria Monocytogenes of Imported Frozen Fish Fillet

Microorganisms	Fish types
	Frozen imported fish
E.Coli	<10
Salmonella	ND
Vibrio cholerae	ND
Listeria monocytogenes	ND

ND= not detected

2.5. VIBRIOS

Vibrios were found using the Horizontal approach for the detection of possibly enteropathogenic *Vibrio* spp. described in the Microbiology of food and animal feeding stuffs. A horizontal approach for the detection of this dangerous *Vibrio* species that causes intestinal disease in humans is described in Part 1: Detection *V. cholerae* (ISO/TS 21872-1, 2007). Paraphrased as of 225. The homogenate was incubated for a further 6 hours at 37°C (for frozen seafood). Following incubation, Thiosulfate Citrate Bile Salts Sucrose Agar (TCBS) was inoculated onto and incubated for 24 hours at 37°C using 1 ml of alkaline saline peptone water in a tube holding 10 ml of alkaline saline peptone water.

3. RESULTS AND DISCUSSION

In order to maintain the nutritional value and quality of fish while preventing waste and losses, post-harvest handling, processing, preservation, packaging, storage, and transportation must be done with special care. Fish can be supplied and marketed globally in a variety of product forms intended for food or non-food uses, from live organisms to more complicated preparations, thanks to preservation and processing that can lower the rate of deterioration. [Food and Agriculture Organization-Food and Agriculture Organization. \(2018\)](#).

In order to prevent microbial decomposition and quality loss, fish must be preserved as it is recognized as very perishable product [Garthwaite \(1997\)](#). The most common method of preservation is freezing, which is employed to maintain

the quality of fish and this method eliminates the chance that there will be a loss in quality upon defrosting if gradual freezing occurs.

Thus, keeping the fish cold increases their high-quality life Hall (1997).

The freezing process is seen to have impacted in our samples as in the organoleptic properties also microbiologically wise.

In our study, three out of four microbiological parameters did not appear in the 40 analyzed samples. So based on table number 2, we have no detection or appearance of three types of microorganisms Salmonella, Vibrio cholerae, and Listeria monocytogenes.

As for the microbiological parameter, *Escherichia coli* is present in 85% of the total samples. More precisely, the value <10 cfu/g was identified in 30 samples. This represents a consolidating risk level. Based on the technical condition of the samples, it follows that small markets are included in 25% of the negative presence of samples with microbial load.

4. CONCLUSIONS

According to this study carried out in September 2022, we can conclude that the microbial flora is at a satisfactory level. This happens because the analysis made for four microbiological parameters shows us the absence of three types of microorganisms, and the presence of *Escherichia coli* within the allowed limits. This contamination could be attributed to poor sanitation practice and unsuitable conditions during the production and handling processes.

CONFLICT OF INTERESTS

None.

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