Scientific Papers. Series D. Animal Science. Vol. LXIII, No. 2, 2020
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

DETERMINATION OF THE PHYSICO-CHEMICAL, MICROBIOLOGICAL AND PARASITOLOGICAL PARAMETERS OF FROZEN FISH, MARKETED BY A COMMERCIAL COMPANY FROM THE NORTHEAST OF ROMANIA

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Abstract

The purpose of this paper is to identify the extent to which the veterinary legislation of the European Union is complied with by a company from North-Eastern Romania. The parasitological analysis of the fish had as reference the EC Regulation no. 2074/2005, and the test result was negative. To measure the level of radioactivity, a 500 gram sample of "Alaska Froock Pollock File Code" was sent to the laboratory, the detected values being compliant. The same range of frozen fish was analyzed from a microbiological and physico-chemical point of view. After self-monitoring on five samples of 900 grams, Listeria monocytogenes was not present in fish meat (absent / 25 grams), and sulfite-reducing bacteria were within the specified standard value <1.0 x 10 cfu g. In the case of easily hydrolyzable nitrogen, the value of 29.13 mg / 100g was obtained, so below the maximum value of 35 mg / 100g. As a result of the analysis samples, it is found that the fish assortments studied correspond both from a physico-chemical, microbiological, parasitological, but also radioactive point of view.

Key words: *analyzes, frozen fish, health, quality.*

INTRODUCTION

Fish is a product highly appreciated by educated consumers; its quality being given by the totality of organoleptic, physico-chemical, microbiological and parasitological properties. The significance of this product is increasing due to the high percentage of protein, polyunsaturated fatty acids, minerals represented by potassium, magnesium, iron, phosphorus and vitamins, especially vitamins A and D. The white-pink colour of the meat fish traced its inclusion in the group of white meats (Banu, 2009). In fish meat, proteins and lipids have a high biological value and provide digestibility (Oliveira et al., 2017). In the sphere of food quality is the consumer who occupies the central place. Production and trade must take place in such a way as to satisfy the consumer's requirements, the most important requirement being quality, more precisely this highlights the extent to which that product, the commodity satisfies the customer (Ionescu et al., 2006). Practically, in order to ensure consumer protection, it is necessary to combine all the elements related to the quality, safety and traceability of the food product, hence the idea that they form a whole (Rodriguez-Salvador and Dopico, 2020). Assessing the quality of fish meat is essential to ensure products compliance and customer satisfaction (Grassi et al., 2019). The aim of our research was to identify the extent to which the veterinary legislation of the European Union is complied with the commercial unit in Bacau in order to ensure the protection of the consumer of frozen fish.

MATERIALS AND METHODS

In order to assess the quality of frozen fish belonging to the commercial unit in Bacău County, a series of physico-chemical, microbiological, parasitological and radioactive analyzes were performed in May-June 2019. Also, certain varieties of fish were checked by

sampling (5 samples of frozen mackerel 250 g - parasitological examination; 1 sample "Alaska code file" 500 g - radioactive examination; 5 samples "Alaska code file" 900 g - microbiological and physical - chemical examination) to determine the extent to which consumer safety is not in danger. Due to the importance and veracity of the results of the analyzes, the sampling was performed in optimal conditions from a sanitary-veterinary point of view and thus all the previously mentioned parameters were analyzed, respectively the control of the work surfaces hygiene and the control of the packagings. Physico-chemical, microbiological, parasitological analyzes and sanitation tests were performed by the sanitary-veterinary laboratory S.C. Concordia Laboratory S.R.L. Bacău, the contamination with residues was evaluated within D.S.V.S.A. Suceava, while the identification of possible migratory substances from food packaging took place at the National Research-Development Institute for Food Bioresources of Bucharest (IBA). The parasitological analysis of the fish had as reference the EC Regulation no. 2074/2005, the analysis regarding the control of packaging had as reference the EU Regulation no. 10/2011 - (the method for identifying chemical contaminants in packaging that can migrate to food was ICP-MS spectrometry with inductively coupled plasma mass spectrum), this being a method that complies with the provisions of EU Regulation no. 10/2011, Annex II). The radioactivity of the two parameters (Cesium 134 and Cesium 137) is provided in Regulation no. 733/2008 in Article 2 and the determination of easily hydrolysable nitrogen was determined in accordance with SR 9065-7 / C91 / 2009.

RESULTS AND DISCUSSIONS

After taking the sanitation tests from the repackaging section of the frozen products on 10cm^2 surfaces on the floor, table, right side wall, calibration machine from the "Fish Packing Room", the following results on the enumeration of microorganisms were identified - total number of germs (NTG) but also on coliform bacteria, the tests being satisfactory, within the maximum allowed limits (Table 1).

Table 1. Work surfaces hygiene control

Sanitation tests	Characteristics	Results	
FISH PACKAGING ROOM - FLOOR -number of units / sample: 1 swab -sampled from 10 cm2 -sealed: insured -receipt status: Corresponding	Enumeration of microorganisms - NTG through SR EN ISO 4833-1/2014 (AR)(PS-CL M-04), CM	3 ufc/cm^2	The test result/ Satisfactorily (Corresponds to the provisions Ord. MS no. 976/98)
	Coliform bacteria through SR ISO 4831/2009 (NR)	abs/10 cm^2	
FISH PACKAGING ROOM - RIGHT SIDE WALL -number of units / sample: 1 swab -sampled from 10 cm2 -sealed: insured -receipt status: Corresponding	Enumeration of microorganisms - NTG through SR EN ISO 4833-1/2014 (AR)(PS-CL M-04), CM	4 ufc/cm^2	The test result/ Satisfactorily (Corresponds to the provisions Ord. MS no. 976/98)
	Coliform bacteria through SR ISO 4831/2009 (NR)	abs/10 cm^2	
FISH PACKAGING ROOM - FISH CALIBRATION TAPE -number of units / sample: 1 swab -sampled from 10 cm2 -sealed: insured -receipt status: Corresponding	Enumeration of microorganisms - NTG through SR EN ISO 4833-1/2014 (AR)(PS-CL M-04), CM	5 ufc/cm^2	The test result/ Satisfactorily (Corresponds to the provisions Ord. MS no. 976/98)
	Coliform bacteria through SR ISO 4831/2009 (NR)	abs/10 cm^2	

Sanitation tests	Characteristics	Results	
FISH PACKAGING ROOM - PACKING ROOM TABLE -number of units / sample: 1 swab -sampled from 10 cm2 -sealed: insured -receipt status: Corresponding	Enumeration of microorganisms - NTG through SR EN ISO 4833-1/2014 (AR)(PS-CL M-04), CM	2 ufc/cm^2	The test result/ Satisfactorily (Corresponds to the provisions Ord. MS no. 976/98)
	Coliform bacteria through SR ISO 4831/2009 (NR)	abs/10 cm^2	

* SR EN ISO 4833-1/2014
** SR ISO 4831/2009
*** Ord. MS nr.976/98

Article 84 of ch. VI of the Order no. 976/1998 allows the presence on the work surfaces in the food sector of 20/cmp NTG, only insofar as the coliform bacteria are absent on 10 cmp.
Given the frequent consumer complaints to the A.N.P.C. (National Authority for Consumer Protection) regarding the presence of the Anisakis parasite in the frozen mackerel and the controls carried out by the D.S.V.S.A. (Sanitary-Veterinary and Food Safety Directorate) on the quality of fish meat on the Romanian market through actions to verify and withdraw the amount of fish in which parasitic formations were discovered in the viscera and muscles, we sent to the laboratory five (5) samples of frozen mackerel of 250 grams each, finally the total relating to 1,25 kg to verify its conformity and to guarantee the safety of the consumer within the company from Bacău.
The mackerel came from the Netherlands, was valid and the lot was 30155.
The samples were collected in polyethylene bags for food use, stored and transported according to the rules in force. Also, the test result was negative, because the visual control did not identify Anisakis spp. in the viscera and muscles, which is a good thing (Table 2).

Table 2. Parasitological examination of frozen mackerel fish

Sample description	Test, method of analysis, referential	Sample no./ Values obtained	Conclusions
FROZEN MACKEREL 5 pcs x 250 g each Whole fish with head and viscera	Fish parasitological examination Reg. EC no. 2074/2005	At the parasitological examination performed by visual control, no specific parasitic formations Anisakis spp. in the viscera and musculature	The test result According to the results

* Reg. EC no. 2074/2005

It is known that mackerel is one of the most commonly involved fishery products in anisakidosis. Anisakis is a 2-3 cm worm and is positioned in the intestines; the negative hypostasis is when it migrates to the muscles and viscera, which makes it unsuitable for consumption.
Therefore, in financially developed countries with a food education, of course at a much higher price, it is preferable to trade and consume a gutted fish, because this parasite is removed, with no risk.
It should be noted that the parasite Anisakis spp. once reached the muscles affects the safety of today's consumer. Regarding the control of packagings, I asked the National Research and Development Institute for Food Bioresources (IBA) Bucharest to perform a set of analyzes on printed bags of various sizes and I wanted: to investigate the components of packaging in terms of their migration, examination of organoleptic changes and verification of specific migration of metals.
The standard sets a maximum value of 10 mg/dm^2 in terms of global migration of components, our values in the issued bulletin falling within the limit specified above.
For the organoleptic assessment of packaging, according to EU Regulation no. 10/2011, no changes of samples and extraction liquids are allowed, the result of our test being compliant.

The maximum permissible limits set by the standards for heavy metals are: barium (Ba) <1 mg/kg, cobalt (Co) <0.05 mg/kg, copper (Cu) <5 mg/kg, manganese (Mn) <0.6 mg/kg, zinc (Zn) <25 mg/kg and iron (Fe) <48 mg/kg. The values obtained after the test report were within the normal range, being small deviations in the case of metals: barium, cobalt and manganese (Table 3).

Table 3. Identification of chemical contaminants in packaging

Features	U.M.	Method of analysis	Results
Global migration of components -Extraction 10 days at 40ºC in ✓ 10% ethyl alcohol solution ✓ 3% acetic acid solution -Extraction 10 days at 40ºC in ✓ olive oil	mg/dm^2	PS-AB-01 SR EN 1186-9:2003 PS-AB-01 SR EN 1186-2:2003	 0.83 1.08 0.95
Organoleptic changes - Extraction 10 days at 40ºC in - 10% ethyl alcohol solution ✓ sample ✓ extract - 3% acetic acid solution ✓ sample ✓ extract		PS-AB-04	unchanged
Specific migration of metals - Extraction 10 days at 40ºC in - sol.acetic acid 3% ✓ Barium ✓ Cobalt ✓ Copper ✓ Zinc ✓ Mangan ✓ Iron	µg/kg	ICP-MS spectrometry	 4.2 0.19 2.1 12.19 0.67 11.93

* SR EN 1186-9:2003
** SR EN 1186-2:2003

For the measurement of the level of radioactivity, which consists in determining the chemical elements Cesium 137 and Cesium 134 in fish meat, we sent a sample of 500 grams of "Alaska Frozen Pollock Code File" (lot 0029935; valid) to the Sanitary-Veterinary and Food Safety Directorate Suceava (the only accredited laboratory in the area of Moldova), the transport being carried out in conditions of maximum safety, at a temperature of -18ºC, in order to ensure the verticality of food safety at the company in Bacău. The value obtained for Cesium 137 from fish meat was 10.9 Bq/kg and Cesium 134 was not detected (Table 4).
The maximum foreseen is 370 Bq/kg in the case of dairy products and baby food and 600 Bq/kg for other food groups (fish).

Table 4 Determination of the radioactivity of frozen fish

Sample details	Test, method of analysis / Performance parameters		Results	Conclusions
Frozen Alaska Pollock cod file	Specific activity radionuclides by Sp. Range with det. Pan flute (PS-CLR-RAD-01)	30744-1.1: Cs 137 Cs 134	 =10.09 (AMD=0,14) Bq/kg undetectable (AMD=2.06) Bq/kg	The test result corresponds to Order No. 1805 / 29.12.2006 to the M.P.S .; 286 / 08.12.2006 to the A.N.S.V.S.A .; 314 / 06.11.2006 to the C.N.C.A.N. and Reg. (Eurotom) no. 52 / 15.01.2016 of the Council

* Order No. 1805 / 29.12.2006

The same assortment of frozen fish (Frozen Alaska Pollock cod file) was analyzed microbiologically and physico-chemically at the laboratory of S.C. Concordia Laboratory S.R.L. Bacau. Following self-monitoring on five sample samples of 900 grams each, Listeria monocytogenes was not present in fish meat (absent/25g) and sulfite-reducing bacteria were within the standard value <1.0 x 10 cfu/g.

Regarding the determination of easily hydrolyzable nitrogen that indicates the freshness of the meat, the value of 29.13 mg/100g was obtained, so below the maximum of 35 mg/100 g (Figure 1).

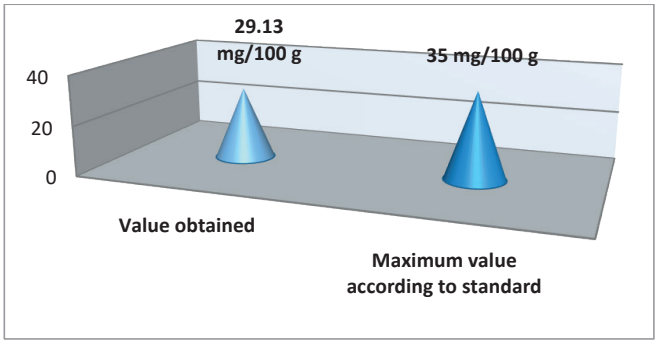

Figure 1. Easily hydrolyzable nitrogen for Alaska cod fillets

The assortments of fish belonging to the company from Bacău and appear on the list of Romanian consumers meet the food safety measures, because both the results of sanitation tests within the production unit and others such as: packaging compliance, parasitological, microbiological, physical examination - chemical but also the radioactivity test are compliant from a sanitary-veterinary point of view. The veracity of the conformity of the goods is given by the analysis bulletins issued by authorized laboratories. Although fish is not in the first place in terms of consumption for the population, especially ocean fish, it is appreciated for its taste and price. However, the research has achieved its goal, so we continued with the desire to capture several varieties of frozen fish in the network of stores in our country to see what stage it is at the level of presentation. The fish that was the subject of our study looked very good at first sight, the packaging was in a proper, compliant condition, the labels were visible, clean, with all the necessary information. We did not find any deviations from the above, nor in terms of price. The refrigerator provides the right temperature for the food product and its image had a strong impact in attracting the consumer (Figure 2).

Figure 2. Presentation of frozen fish in the commercial space

CONCLUSIONS

As a result of the analysis samples, it is precisely stated that the fish assortments within the Bacau Company correspond both from a physical-chemical, microbiological, parasitological, but also radioactive point of view. The control of the hygiene of the surfaces in the work unit resulted in the qualification "satisfactory", and regarding the global migration of components from the packaging, the values obtained were within the normal range, with very small deviations in the case of metals: barium, cobalt and manganese. Also, frozen fish retains its quality characteristics during storage, all parameters being met, especially climatic ones; the packaging appears with all the identifying elements and maintains the temperature of the product, the labelling is carried out according to the legislation and aims to ensure traceability, starting from the origin of the product with the aim of correctly informing the consumer; the transport gives safety to the goods, the refrigeration chain is not interrupted, so the frozen fish is kept at a temperature of -18ºC.
At the end of the conformity assessment of the frozen fish, in the commercial space, the form of its presentation was within the appropriate parameters, there were no deviations or deficiencies.

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