

DEGLACIATION AND REAL PRICE OF TILAPIA FILLETS COMMERCIALIZED IN SÃO CARLOS CITY, SP

DESGLACIAMENTO E PREÇO REAL DE FILÉS DE TILÁPIA COMERCIALIZADOS NA CIDADE DE SÃO CARLOS, SP

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SUMMARY

Frozen fish can be stored in freezers for about a year. Glaciation, a stage that occurs after freezing, confers protection and prevents fish oxidation. Studies with fish showed fraud in relation to the glaciation process. In this context, the present research aimed to analyze the amount of glaciation in 81 samples of frozen tilapia fillets of 3 brands, as well as the real price, labeling, packaging integrity, weight and conservation status of these products in 3 supermarket chains in São Carlos-SP, in order to identify frauds. In relation to glaciation, 100% of the samples were in agreement with the current regulatory laws, which establishes the maximum icing in 20% of the total fish weight, as well as the real prices of each brand and the labels. There were irregularities with the net weights reported on the packages, where 95% of the samples were incompatible with the true weight of the products and only 4.05% were with the effective weights described in the labels. 37.5% of marketing freezers had temperatures above -18°C, which determines the irregularity of the merchant establishment. However, although the glaciation was respected by the three brands, the net weight characterized fraud by the fillet production companies.

KEY-WORDS: Frozen fish Fraud. Surveillance. Food safety. Shelf life.

RESUMO

O pescado congelado pode ser armazenado em freezers durante aproximadamente um ano. O glaciamento, etapa que ocorre após congelamento, confere proteção e evita a oxidação do pescado. Diversos estudos realizados com pescados, demonstraram fraudes em relação ao processo de glaciamento. Neste contexto, o presente trabalho objetivou analisar a quantidade de glaciamento em 81 amostras de filés de tilápia congelados de três marcas, assim como, os preços reais, rotulagem, integridade do pescado e da embalagem, peso líquido e modo de conservação, em três redes de supermercados da cidade de São Carlos-SP. Em relação ao glaciamento, 100% das amostras estavam de acordo com a normativa vigente, que estabelece o máximo de glacê em 20% do peso total do pescado, assim como os preços reais de cada marca e os rótulos. Houve irregularidades com os pesos líquidos informados nas embalagens, em que 95% das amostras estavam incompatíveis com o peso verdadeiro dos produtos e apenas 4,05% estavam com os pesos efetivos iguais ou superiores ao peso líquido descrito na embalagem. Das gôndolas verificadas com termômetro infravermelho externo, nas três redes de supermercados, 37,5% estavam com temperaturas superiores a -18°C, o que determina irregularidade do estabelecimento comercializador. Contudo, apesar do glaciamento ter sido respeitado pelas três marcas, o peso líquido caracterizava fraude das empresas de produção dos filés.

PALAVRAS-CHAVE: Peixe congelado. Fraude. Fiscalização. Segurança alimentar. Tempo de prateleira.

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INTRODUCTION

Fish world consumption has experienced a significant increase in the last decades, mainly due to population growth and the tendencies of consumers for healthier foods (BURGER, 2008). Thus, aquaculture is the most viable alternative to supply this market in the coming years, since fishery has stabilized production in the last 20 years (FAO, 2016).

Several benefits of fish consumption have been described as reducing the risk of stroke (SKERRET & HENNEKENS, 2007), Alzheimer's (SAMIERI et al., 2017) and heart disease (RAATZ et al., 2013). FAO (2009) recommends eating fish at least twice a week or ingesting about 2 g of the polyunsaturated fatty acids omega-3 to achieve their benefits.

Fish lipid composition contrasts with mammals because it contains a high proportion of polyunsaturated fatty acids with long chain, which has a positive impact on health and negatively on trade due to rapid deterioration and rancidification. This latter process of fat oxidation is caused by chemical compounds or oxygen reactive species that cause breakage of the double bonds in the phospholipidic fractions from cell membranes that are more susceptible because they have a higher degree of unsaturation (RUFF et al., 2004).

In order to avoid biochemical changes that depreciate frozen fish, the industry uses technologies such as glaciers or high-barrier packaging to protect the product and avoid excessive contact with atmospheric air, thus delaying moisture loss and lipid oxidation (LIN & LIN, 2005).

Glaciation is a process of covering the product with a layer of ice. This may have different thicknesses and may be accomplished by immersion or spraying of ice water containing additives or not. This process guarantees effective protection for the product, adding value and greater elasticity as regards the maintenance of quality aspects during the storage and marketing of fish products (GONÇALVES & GINDRI JUNIOR, 2009).

When this technique is used to increase the product weight, it may eventually damage the nutritional quality and represent a crime by fraud (VANHAECKE et al., 2010). In this context, the present study aimed to evaluate the loss liquid percentage in deglaciation and the real price of frozen tilapia fillets from three brands marketed in establishments from São Carlos city, São Paulo State.

MATERIAL AND METHODS

Samples were collected during the period from April to June 2016. The work was based on the weighing of frozen fillets of tilapia (*Oreochromis* sp.) stocked at -18°C according Normative Instruction n° 22, published in 24th November, 2005 (MAPA, 2005), purchased from three supermarket chains in the city of São Carlos, São Paulo State, Brazil. Samples (fillets) with Federal Inspection Seal were randomly acquired,

evaluating three brands named A, B and C in each supermarket chain, with different net weights, with a price defined by the establishment. According to the package, brand A had a net weight of 250 g; brand B, 550 g; brand C, 400 g. Nine samples were collected per tag in each supermarket chain, totaling 81 samples repeating this procedure in three periods with a 30 day interval.

In order to verify the product net weights and their glaciation percentage, the methodology described in the Technical Metrological Regulation for Determination of the Net Weight of Fish, Mollusk and Crustacean Glaciated, referred to Portaria Inmetro n° 38 of 11th February, 2010 (BRAZIL, 2010). The described methodology is based on the removal under controlled conditions of sample glaciation to determine the weight of the deglaciated product and the relative amount of ice in the sample. The technique was performed at the Microbiology Laboratory of Brazil University, Descalvado Campus.

For deglaciation analyzes, we use the circular of the Division of Animal Products (DIPOA) - MAPA, n° 26 of 19th August, 2010, which fixes the maximum value of glaciation in frozen fish by 20%. And in accordance with this normative, fish units were weighed individually with the original packaging, obtaining the gross weight (GW) and individually packaging weight (PW), the packaging was weighed totally clean and without residues. At the time of opening of the packaging the sensorial characteristics (flavor, smell and texture) of the product were analyzed after thaw. The evaluation of the packaging was carried out taking into account the integrity (perforations and information erased).

Product glaciated weight (PGW) was obtained by subtracting the package weight from the gross weight. The product already without the package was placed in cooled water (20 ± 1 ° C) in a suitable container to contain them until the tactile perception that all the glaciation had been withdrawn (approximately 50 seconds), avoiding defrosting, then they were removed and transferred to a sieve allowing them to drain for 30 second.

The water adhered to the sample surface was removed with the aid of paper towels, avoiding pressing, and the deglazed sample was weighed, to thereby determine the product deglaciated weight (PDW). To obtain the ice weight (IW) contained in the product the weight of the deglaciated product was subtracted from the weight of the glaciated product. With the data obtained, the product glaciated mean weight (PGMW) and the product deglaciated mean weight (PDMW) were calculated with the following formulas A and B, respectively:

$$\text{A) } \text{PGMW} = \frac{\sum_{i=1}^9 \text{PGW}}{9} \quad \text{B) } \text{PDMW} = \frac{\sum_{i=1}^9 \text{PDW}}{9}$$

The product relative amount of ice (PRAI) and product effective weight (PEW) were calculated with the following formulas C and D, respectively:

$$c) \quad PRAI (\%) = \frac{PGMW \times PDMW}{PGMW} \times 100$$

$$d) \quad PEW = (GW - PW) \times (1 - PRAI)$$

The price was transcribed together with the weights in order to compare the price ratio paid for the incorporated water between the purchased samples. For the labels evaluation was used Normative Instruction n° 22, published in 24th November, 2005 (MAPA, 2005). For the temperature evaluation in commercial freezer, a

digital infrared thermometer was used and the two temperatures compared.

RESULTS AND DISCUSSION

All samples (n = 81) complied with the standards established in the Technical Regulation for Labeling of Packaged Animal Products, Normative Instruction No. 22, dated 24th November, 2005 (MAPA, 2005) governed by the Chapter 3, Article 443, "Regulamento e Inspeção Industrial e Sanitária de produtos de Origem Animal" (RIISPOA, 2017). All required information about the product and packaging was easily accessible by the consumer and all criteria were met (Table 1).

Table 1 - Checklist of packaging labels according to Normative Instruction n° 22, 24 of November, 2005 of MAPA.

Requirements	Brands		
	A (%)	B (%)	C (%)
Product name	100	100	100
Product brand	100	100	100
Business name	100	100	100
Official seal of federal inspection	100	100	100
CNPJ	100	100	100
Category of market	100	100	100
Address of market	100	100	100
Registration n. of the competent authority	100	100	100
Identification of part	100	100	100
Date of manufacture	100	100	100
Storage precautions	100	100	100
Net weight	100	100	100

The data obtained on labeling contradict some data from a survey conducted between 2008 and 2009 in seven establishments in the Federal District of Brasilia. The research was carried out to evaluate the "in natura" boneless meat packed in a vacuum, recording the absence of information such as net weight, registration number of the competent organ, batch identification, product preservation and product trademark (FERNANDES, 2009), as well as in another study carried out in city of Petrolina (Pernambuco State), where supermarkets sold fish and some data on the labeling were absent, resulting in 100% of irregularities (BARROS et al., 2012). In the present study, only the C trademark did not specify the weight of the package on its label that is like the lack of compliance with the legislation which would imply that it could not be marketed, but this did not alter the main results, since when they were weighed and presented an equal or very similar weight, when compared to another two brands (A and B).

Regarding the integrity of the packaging, only 3,7% of them (3/81) were drilled, with marks A and C affected. All samples (fillets) analyzed had organoleptic characteristics within the parameters

established in the Portaria 459, September 10th of 2010 (MAPA, 2010).

All samples showed rigidity, mild odor, without presence of liquid inside the package, indicating absence of thawing and freezing; the coloring was characteristic and proper of fish meat. In small quantities, large ice crystals were observed in 88.88% of samples (8/9) of the C mark in the second collection. This may indicate that the freezing has been slower and uneven, which can lead to damage in the food, because these crystals break the cellular structure, affecting the product final texture after thawing.

Fillet real prices are within the limit established by the legislation, where the amount of glaciation in a sample should have a maximum of 20%, if the unit price were R\$ 10.00 the maximum paid by the glacier would be R\$ 2,00. We can observe in the Table 2 the data of corresponding real price to each brand and the price that could be paid if the maximum amount of glaciation allowed by the legislation was added. When comparing the maximum glaciation (20%), it was observed in cases with more surface water added decrease in the real price, according to the

Codex Alimentarius norms (RIBEIRO; MARCELLO, 2013). In both situations, the unit prices offered to the consumer do not exceed 20% of the price paid for glaciation.

The highest glaciation percentage was observed in the brand B during the second collection, in which the average was 16.64% (Table 2). The

glaciation for all trademarks was within the standard parameters, where none of the 81 samples presented more than 20% of superficial ice, contrary to the observation made by Bolsson (2012) in study with 36 samples of commercialized shrimps, which more than half were above the legislation limit.

Table 2 - Calculations of the real prices of frozen tilapia fillets relative to the glaciation found in each brand and 20% glaciation, if the maximum surface water was added.

	Supermarkets								
	Collection 1			Collection 2			Collection 3		
	A	B	C	A	B	C	A	B	C
Unit Price (R\$)	16,96	11,4	21,89	15,4	11,6	19,58	16	11,45	20,57
Glaciation found (%)	14,77	13,76	7,39	11,09	16,64	6,72	8,24	10,77	11,63
Glaciation maximum (%)	20	20	20	20	20	20	20	20	20
Price of glaciation found (R\$)	2,5	1,57	1,62	1,71	1,93	1,32	0,132	1,23	2,39
Price of glaciation maximum (R\$)	3,39	2,28	4,38	3,08	2,32	3,92	3,2	2,29	4,11
Real price of glaciation found (R\$)	14,46	9,83	20,27	13,69	9,67	18,26	14,68	10,22	18,18
Real price of glaciation maximum(R\$)	13,57	9,12	17,51	12,32	9,28	15,66	12,8	9,16	16,46

Effective weight is not declared on the label, and was determined following instructions from Portaria Inmetro No. 38, February 11th (2010) when compared to the net weight reported on the labels, the results demonstrated only 4.05% of the samples (5/81) were approved and presented expected ratio equal or superior (effective weight \geq net weight), and 95.95% were disapproved, showing little difference in relation to the study of Bolsson (2012) which obtained 83.33% of reprobatons.

Figures 1, 2 and 3 represent the sample effective weight ratio to the labels net weight declared. The relationships higher or equal were evident only in some 250 g samples (brand B) in the third collection. Such fact indicate that only this trademark attend the Technical Regulation for Labeling of Product of Packaged Animal Origin according to the Normative Instruction No. 22, from 24th November, 2005 (MAPA, 2005).

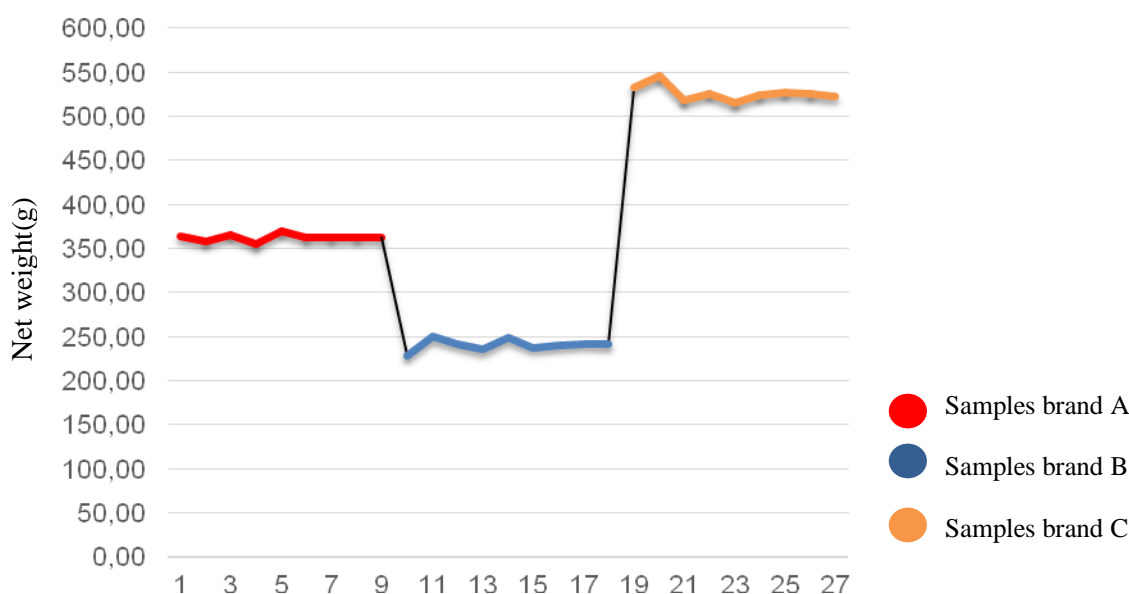


Figure 1 - Quantity of samples from the first collection (n=9, by brand) that the ratio of effective weight to declared net weight was equal to or greater than 400 g (Brand A), 250 g (Brand B) and 550 g (Brand C).

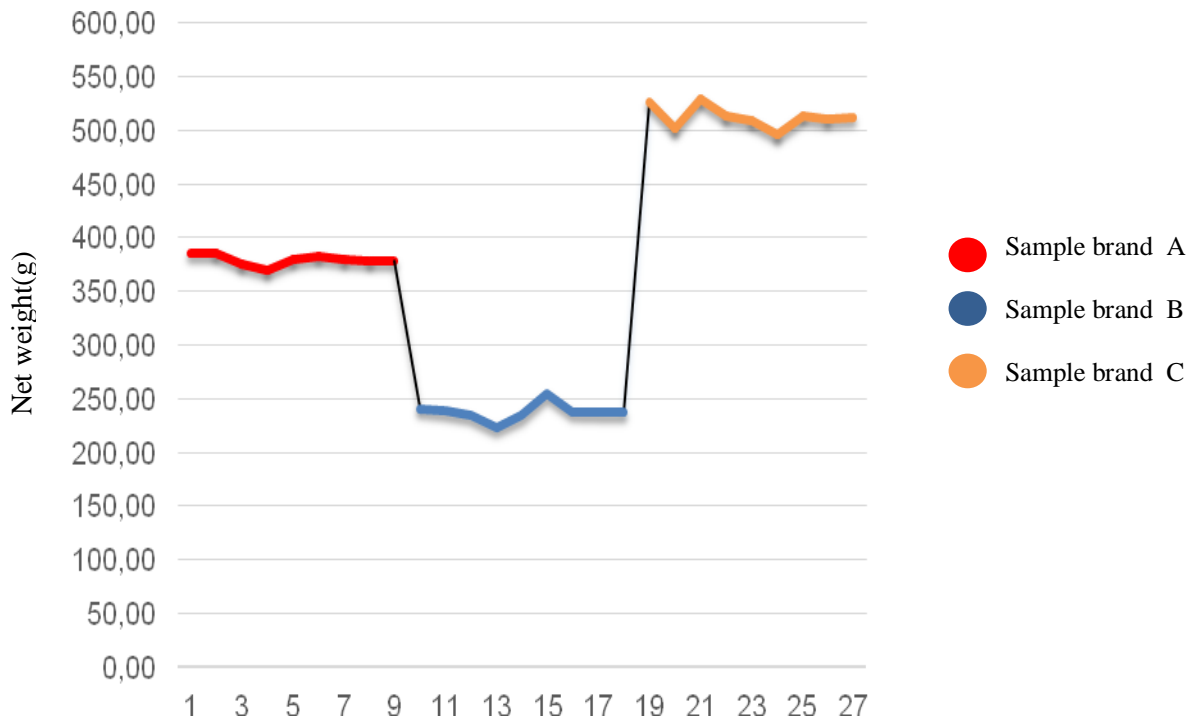


Figure 2 - Quantity of samples from the second collection (n=9, by brand) that the ratio of effective weight to declared net weight was equal to or greater than 400 g (Brand A), 250 g (Brand B) and 550 g (Brand C).

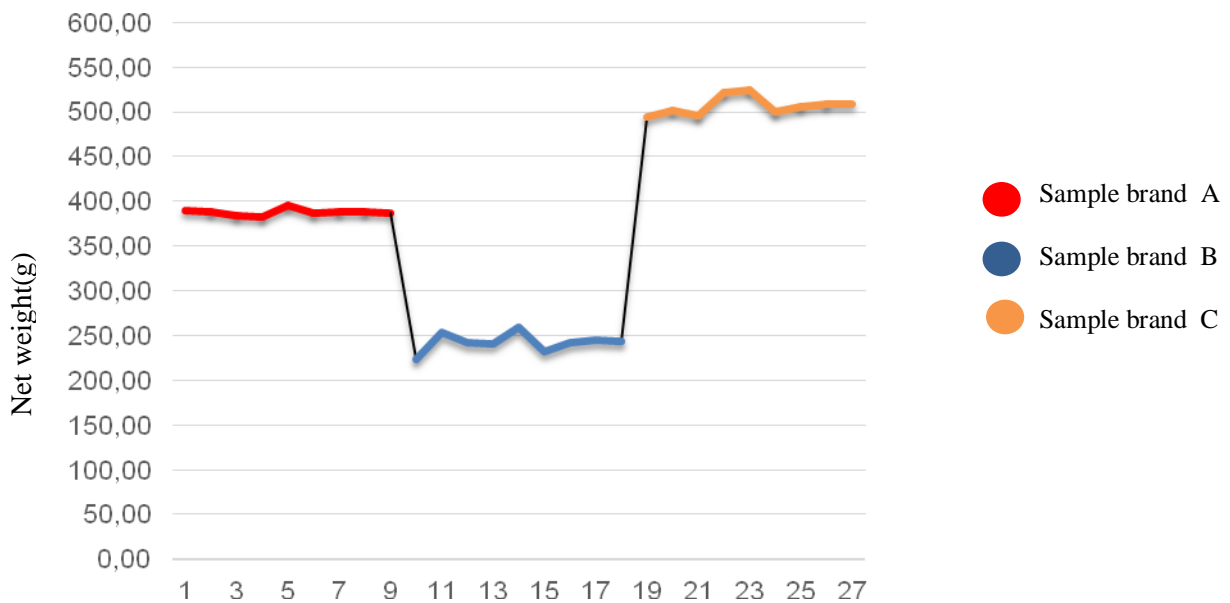


Figure 3 = Quantity of samples from the third collection (n=9, by brand) that the ratio of effective weight to declared net weight was equal to or greater than 400 g (Brand A), 250 g (Brand B) and 550 g (Brand C).

Regarding fish conservation, commercial freezer from the third supermarket chain (collection 3) presented the greatest variation between the temperature registered by the freezer and the temperature verified with the infrared digital laser

thermometer, being this variation of 1.8 °C in average. The first supermarket chain showed 0.5 °C of temperature variation and the second 0.8 °C (Table 3).

Collection	Supermarket	Temperature recorded (°C)	Temperature verified (°C)	Variation of temperature (°C)
1	a	-18,6 (+ 0,6)	-18,2 (+0,2)	-0,4
	b	-19,0 (+ 1,0)	-18,7 (+0,7)	-0,3
	c	-18,2 (+0,2)	-17,5 (- 0,5)	-0,7
2*	a	-19,2 (+1,2)	-18,3 (+0,3)	-0,9
	b	-16,2 (- 1,8)	-15,4 (-2,6)	-0,8
3	a	-19,6 (+1,6)	-17,6 (- 0,4)	-2,0
	b	-21,5 (+3,1)	-20,0 (+2,0)	-1,5
	c	-20,0 (+2,0)	-18,1 (+0,1)	-1,9

Table 3 - Temperatures recorded and verified in the commercialization freezers (variation with the legislation) determined in the supermarket chains.

*One value lost

Study conducted in Campos dos Goytacazes city (Rio de Janeiro State) by Silveira et al. (2010) revealed 35% of 17 surveyed establishments without thermometers. According to these authors, commercial establishments with freezer thermometers demonstrated to maintain the temperature correctly, fulfilling the determinations present in the product packaging. In the present study, all freezers had thermometers and only one temperature recorded at a supermarket 2 establishment did not match the instruction on the product conservation label. The freezer temperature verification with the infrared digital thermometer showed irregularities, since, an establishment of each supermarket had a freezer temperature below the norms, representing 37, 5% of irregularity, not complying with Portaria 459, September 10th of 2010 (MAPA, 2010), where the storage chambers of the producer or marketer must have conditions to store the product at temperatures not higher than -18 °C.

CONCLUSION

The fillets tilapia study demonstrated that the glaciation and the actual prices of the glaciated fillets were in accordance with the legislation. The characteristics of odor, color, stiffness and absence of liquid in the package were preserved, but large ice crystals were observed indicating slow freezing. The effective weight was below the declared net weight in the packages, besides temperature increase in the freezers of commercialization. However, although the glaciation was respected by the three brands, the net weight characterized fraud by the fillet production companies and the increased temperature in product stocking reveals irregularity in supermarket chains.

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