Bacteriological evaluation in Salmon (*Salmo salar*) benefit in fish`s warehouse in Rio de Janeiro, Brazil

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Introduction

Salmon (*Salmo salar*) is one of the popular fish consumed raw in Brazil. In 2010, the product ranked as the third most imported fish in the Brazilian market and it was the third best-selling imported fish in supermarkets of Rio de Janeiro, representing about 17% of the total [1-2]

In raw consumption, there isn't a food preparation using high temperatures, so the material must be stored in cold temperatures, as well as handled in hygienic conditions, throughout the food processing, to obtain a good microbiological quality [3].

Therefore, the objective of this work was to realize bacteriological analyzes of salmon samples, benefited in a fish warehouse located in Rio de Janeiro, Brazil, to evaluate their quality before and after processing for preparation of fresh boneless fillets and with skin. Samples were collected in two stages of the process, the fish reception and after processing.

Material and methods

The samples were collected from fresh and gutted salmon imported from Chile for the production of fresh salmon fillet without bones and with skin.

Fig. 1: Sampling in the final product

With the intention of evaluating the quality of fish before and after processing to produce fillets, it was collected a total of 32 samples divided into four different lots. For each lot it was collected four samples in the receipt of raw materials and four in the final product before being packed. Randomly, it was taken samples with 200 g of each fish, from the animal's lower back and belly, following the procedures of collection, packaging and transport described by the "International Commission on Microbiological Specifications for Foods" and "American Public Health Association" [4-5] (Figure 1).

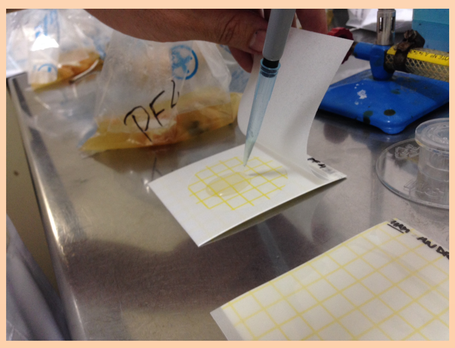

Fig.2: Preparation of *Staphylococcus aureus* plate.

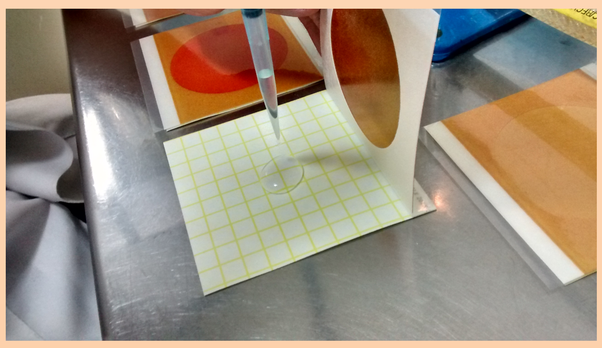

Fig.3: Hidratation of 3M Petrifilm™ plate for *Salmonella* spp.

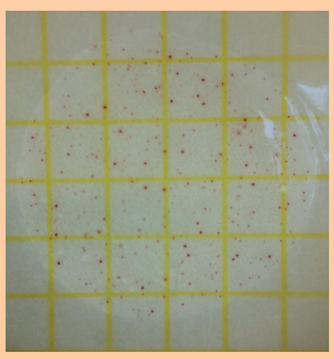

Fig.4: Reading 3M Petrifilm™ plate for Aerobic bacterias

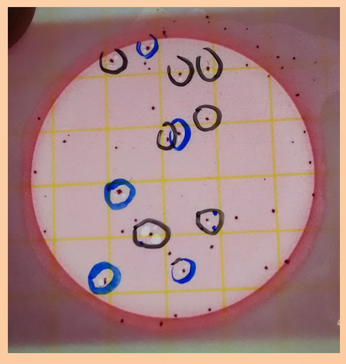

Fig.5: Typical colonies of Total Coliforms in 3M Petrifilm™ plate

Microbiological analysis were performed using Petrifilm™ plates purchased from 3M company, researching *Salmonella* spp. and promoting counts of *Staphylococcus aureus*, Aerobic bacterias and Total Coliforms and *E. coli.* For each bacterial analysis, specific methodology was performed by following approved methods of the official AOAC®, according to the instruction manuals assigned by 3M Company [6-7-8-9] (Figures 2, 3, 4 and 5).

Results and discussion

In raw material, weren't found *Salmonella* spp. and Total Coliforms/*E. coli* and *Salmonella* spp. The Aerobic bacterias varied from 4,5 x 10 to values above 10^5 CFU/g, while the values of *S. aureus* varied from 0 to 1,0 x 10 CFU/g.

In the final product samples, the results were similar to raw material for *E. coli* e *Salmonella* spp. The values found for the count of Total Coliforms, *S. aureus* and Aerobic bacteria varied, respectively, from 0 a 1,5 x 10 CFU/g, 0 a 1,8 x 10 CFU/g e 1,2 x 10^2 a 6,48 x 10^2 CFU/g.

According to RDC nº 12, there isn't a standard for raw foods, which is the popular case of the salmon. However, the existing standards at the RDC n°12 for fresh, cold or frozen fishes not eaten raw, define for *Staphylococcus* coagulase positive a maximun count of 10^3 CFU/g and absence of *Salmonella* spp. in 25 g of sample [10].

ICMSF describe that the maximum level recommended for Aerobic count is 10^7 CFU/g and 5 x 10^2 CFU/g for *E. coli* [11].

Therefore, as stated by the both referenced documents, all the samples are in accordance with the recommended standards.

It was observed that, the average values found for Total Coliforms count in the final product was 4 ± 4,2 CFU/g, while in the raw material was not found total coliforms. This counting increase is suggestive of cross-contamination during the processing, for example, from unhygienically handling, improper use of water for fish washing or the use of contaminated utensils and surfaces during the process.

It was impossible to compare the Aerobic count, because the samples dilution was not high enough to proper count the colonies, so in some samples the result was estimated. However, the plates with countless values were obtained only from the raw material samples. This fact suggest that the chlorine used in wash water decreased the contamination.

Related to *S. aureus*, there was not significant variation between the average values encountered in raw material and final product, which were of 4,2 ± 3,2 CFU/g and 3,9 ± 4,8 CFU/g respectively.

In literature, articles are found corroborating with this study. In a research about microbiological characteristics of salmon marketed in São Paulo, Brazil, found not in accordance with the standards only 16,13% of the samples for Aerobic count and 6,44% for Thermotolerant Coliforms count. Also, it wasn't isolated *Vibrio parahaemolyticus*, *Salmonella* spp. and *E. coli* in the samples [12]. Another one with 39 samples of gutted cold salmon from retail markets of Belo Horizonte, Brazil, the researcher didn't got positive results for *Salmonella* spp. and *Staphylococcus* coagulase positive [13].

Conclusions

Based on the results in the presente research, the results from the cited authors and the bacteriological quality and identity standards (BRASIL, 2001; ICMSF, 1986), it can be concluded that is possible to obtain fish with enough bacteriological quality allowing its consumption *in natura* and/or products derived from raw fish ("sushi" and "sashimi").

[1] Brazil – Ministry of Fisheries and Aquaculture da Pesca e Aquicultura. *Boletim Estatístico da Pesca e Aquicultura - Brasil 2010*, MPA (2012).
[2] R.M. Barroso et al., INFOPESCA (2010).
[3] K.V.M. Vieira et al., *Revista Higiene Alimentar* (2000), 14-74.
[4] APHA. American Public Health Association, University of Toronto Press (1978).
[5] ICMSF, University of Toronto Press (1978).
[6] 3M FOOD SAFETY METHOD. 3M Petrifilm™ *Salmonella* Express System, São Paulo (2013).
[7] 3M PETRIFILM™. Aerobic count plate, São Paulo (2013).
[8] 3M PETRIFILM™. *E. coli* e Coliforms count plate, São Paulo (2013).
[9] 3M PETRIFILM™. Petrifilm™ *Staph* Express for express count of *Staphylococcus aureus*, São Paulo (2013).
[10] BRASIL – Ministry of Health. RDC nº 12, de 02 de janeiro de 2001, Brasília (2001).
[11] ICMSF, University of Toronto Press (1986).
[12] N.M. Nespolo, Paulista Estatual University (2009).
[13] A. Damasceno, Minas Gerais University (2009).