

## Profile of Fish Consumers and Consumer Risk Factors in the Itajaí Fish Market, Santa Catarina, Brazil

Nathália Lamim<sup>1</sup>  
Carlos Efrain Stein<sup>2</sup>  
Thaís Helena Szabo Castro<sup>1</sup>  
Bruna Helena Kipper<sup>1\*</sup>

<sup>1</sup>Department of Veterinary Medicine, Regional University of Blumenau – FURB, Blumenau, SC, Brazil

<sup>2</sup>Department of Mathematic, Regional University of Blumenau – FURB, Blumenau, SC, Brazil

## Abstract

Fish meat is an excellent source of protein of high nutritional and biological value, which increases its consumption by the Brazilians. However, there are also some risks associated with fish consumption, known as foodborne diseases. In order to avoid this problem, it is important to know that fish must only be consumed in good conditions of freshness and storage. This work aimed to evaluate the degree of consumer awareness to risk factors of fish consumption and the sanitary aspects of these products in the Fish Market of Itajaí, Santa Catarina, Brazil. Data collection was performed throughout two questionnaires: one applied for 400 consumers and other applied in the 25 boxes of commercialization based on observations of the hygienic-sanitary conditions. The data were analysed with  $\chi^2$  test and the frequencies were compared within each distribution. Most of the studied population preferred to buy shrimp (59.75%), and did not know the possibility of fish causing foodborne diseases (67.5%) and usually buying fish that had not yet undergone cooling (52%). The main determinant that led the consumer to buy the fish was the aspect of the product (75.5%). The majority of consumers evaluated the freshness of the fish through the brightness of the eyes (56.75%) and the colour of the gills (40.75%). Regarding the hygienic-sanitary conditions of the marketing boxes, it was observed that all the products were exposed for sale without ice, while also being handled without gloves. Consumers were mostly unaware of the risk factors associated with fish consumption, mainly related to foodborne diseases, and that handling by traders should be improved, providing good practices as wearing hands protection or frequent hand washing and also storing the products at appropriate temperature.

## Keywords

Fish; Zoonoses; Foodborne diseases

## Introduction

Brazil is a country that stands out worldwide for the high demand for fish exports, a term that covers fish, crustaceans, molluscs, amphibians, reptiles, echinoderms and other aquatic animals used in human food [1]. In 2017, Brazil produced about 690 thousand tons of fish from only extractive fishery [2], presenting the capacity to raise these figures, since 12% of the world's freshwater is in the Brazilian territory and also, more than seven thousand kilometres of coastal extension [3]. Also, about 75% of the world's fish is destined for human consumption [4].

The Brazilian population reached a seafood consumption level of 14.5 kg/person/year, higher than the minimum recommended by the World Health Organization (WHO), which are 12 kg/inhabitant/year [5]. Seafood is an excellent protein source of high nutritional and biological value, rich in vitamins A and D, omega-3, calcium and phosphorus, with low levels of lipids, although of considerable quality [6,7]. In order to have a more balanced and healthy diet, change in eating habits has leveraged the consumption of fish meat. According to the American Heart Association (AHA) and several other international organizations, omega-3 present in the various species of fish are beneficial for cardiac functioning, reducing the formation of thrombi, as well as preventing and reducing cholesterol and help to keep the body functioning in perfect condition. Being one of the many reasons why the AHA recommends that healthy adults should eat at least two servings of fish per week [8-10].

However, there are also risks in this consumption, as for instance foodborne diseases caused by the consumption of food or water contaminated by microorganisms that are infectious, toxic or by physical agents [11]. They are caused by pathogenic microorganisms and can affect both humans and animals, giving way to risks to public health and economic damages. In Brazil, 2363 outbreaks of foodborne diseases and 25 deaths were reported between 2007 and 2010 [12], demonstrating the impact of these diseases on public

## Article Information

**DOI:** 10.31021/ijvam.20181110  
**Article Type:** Review article  
**Journal Type:** Open Access  
**Volume:** 1 **Issue:** 2  
**Manuscript ID:** IJVAM-1-110  
**Publisher:** Boffin Access Limited

**Received Date:** 21 July 2018  
**Accepted Date:** 07 August 2018  
**Published Date:** 25 August 2018

### \*Corresponding author:

**Bruna Helena Kipper**  
Department of Veterinary Medicine  
Regional University of Blumenau – FURB  
Blumenau, SC, Brazil  
Tel: +55 47 999688078  
E-mail: brunakipper@hotmail.com

**Citation:** Kipper BH, Lamim N, Stein CE, Szabo Castro TH. Profile of Fish Consumers and Consumer Risk Factors in the Itajaí Fish Market, Santa Catarina, Brazil. *Int J Vet Anim Med.* 2018 Aug;1(2):110

**Copyright:** © 2018 Kipper BH, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 international License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

health and the need for more information to the consumer. There are agents that do not alter the colour, odour, texture and flavour of contaminated food, such as *Vibrio* spp., which leads the less informed consumer unaware of the risk factors when acquiring and consuming this type of product [13].

Helminthoses, bacterioses and other etiological agents from fish consumption are highlighted by their increasing incidence in various parts of the world, being transmitted through ingestion of raw, undercooked or uncooked fish, incorrectly stored and infected. Many of these diseases can be prevented by cooking for a certain time and temperature [14].

To avoid foodborne diseases it is important to consume fish in good conditions of freshness and storage [15]. For considering fish fresh, some physical and organoleptic characteristics should be observed, such as a bright and moist looking body, salient eyes, proper and mild odour, fish with shiny scales and rosy gills. Molluscs and shellfish, for example, must be live exposed [1].

Due to the risks related to fish consumption, the present work aimed to evaluate the level of consumer knowledge about the risk factors related to fish consumption and to evaluate the sanitary aspects involved in the handling of these products in the Fish Market of Itajaí, Santa Catarina, Brazil.

## Materials and Methods

This is a cross-sectional study carried out in the Fish Market located in the municipality of Itajaí, Santa Catarina, Brazil. This market operates from Monday to Saturday, excluding holidays. The fish trade at this market is carried out in a covered shed style structure, and there are twenty-five individual boxes, where each trader exposes his merchandise to the public.

The data were collected through a questionnaire applied to a convenience sample of four hundred consumers. People who never bought fish in the place and under eighteen years were considered as a factor of exclusion. The questionnaire was composed of twenty-one questions adapted from Almeida et al. [16] and showed variables such as gender, age group, education level, income, frequency of purchase, consumption, hygienic conditions, product conditions and knowledge about possible diseases transmitted through consumption.

A questionnaire with 12 observational questions applied for the manipulators of the 25 boxes of commercialization was carried out to evaluate the sanitary aspects of fish handling. Hygienic-sanitary aspects such as the use of hair protections, gloves, cleaning,

manipulation of money and product by different people, the presence of garbage or animals in the place, hygiene of the utensils and, finally, the protection of exhibited food.

The interviewees were given educational folders informing the criteria for identification of fresh fish, fish production in Brazil, the importance of fish in a healthy diet and alerting the main risk factors associated with consumption.

The data were organized into a Microsoft Excel version 2010 software worksheet and analysed in frequency table formulas containing absolute, relative and frequency estimates. The  $\chi^2$  test was used to compare frequencies within each distribution. The present study was approved by the Ethics Committee on Research in Human Beings under the number 1 644 420.

## Results and Discussion

It was verified that the predominant consumers in the Fish Market of Itajaí were men (51.5%), similar to that found by Costa, Almeida and Oliveira [17] in the state of Pará, who obtained 60% in their research. The most frequent age group was over 45 years (53.3%) (Table 1). As for the education level, a very positive percentage was observed, since most of the interviewees had completed high school (31.3%) and higher education (34%) (Table 1), which was also observed by Figueira [18] in Belém do Pará with 43.09% of the 123 consumers interviewed with a full degree. In relation to salary, consumers can be classified in the Fish Market of Itajaí with a salary of five or more minimum wages/month (value considered for the beginning of 2018 of R\$ 954.00) (Table 1) which differs from other Brazilian locations, such as Belém do Pará with salary greater than a minimum wage [18].

Most consumers have visited the market once per month (41.3%) and classified the commercialization of seafood adequate (84.3%). Of the 15.8% that classified the market as inadequate mostly pointing the absence of hygiene as the main factor (9.5%, 38/63%) ( $P < 0.001$ ) (Table 2).

As for the others who classified it in a different way, pointed out as main problems the lack of hygiene of traders and inadequate refrigeration of the products (Table 3). Fresh fish, according to the Brazilian legislation, must have ice added on it or fish has to be preserved by methods that keep temperature close to that of the melting ice [1]. According to the legislation, cooled fish is the one that is packaged and maintained at refrigeration temperature, while the frozen one must be subjected to fast freezing processes with internal temperature of  $-18^{\circ}\text{C}$  [1].

Characteristics		Interviewed (n=400)	Confidence interval (95%)	P
Gender	Male	206 (51.5%)	(46.6 - 56.4)	<0.001
	Female	194 (48.5%)	(43.6 - 53.4)	
Age group	18 to 25 years	45 (11.3%)	(8.15 - 14.35)	<0.001
	25 to 35 years	81 (20.3%)	(16.31 - 24.19)	
	35 to 45 years	61 (15.3%)	(11.73 - 18.77)	
	over 45 years	213 (53.3%)	(48.36 - 58.14)	
School level	Incomplete elementary	34 (8.5%)	(5.77 - 11.23)	<0.001
	complete Elementary	29 (7.3%)	(4.71 - 9.79)	
	Incomplete High school	20 (5%)	(2.86 - 7.14)	
	Complete High school	125 (31.3%)	(26.71 - 35.79)	
	Incomplete college Graduation	56 (14%)	(10.6 - 17.4)	
	Complete college Graduation	136 (34%)	(29.36 - 38.64)	
Income	1 to 3 Brazilian minimum wage	131 (32.8%)	(28.15 - 37.35)	0.0056
	3to5 Brazilian minimum wage	100 (25%)	(20.76 - 29.24)	
	5or more Brazilian minimum wage	151 (37.8%)	(33 - 42.5)	

**Table 1:** Sociodemographic and economic characteristics of fish consumers from the fish market of Itajaí, Santa Catarina, Brazil. Source: Data obtained by the authors.

Characteristics		Interviewed (n=400)	Confidence Interval (95%)	P
Frequency	Once a week	115 (28.8%)	(24.31-33.19)	<0.001
	Once a month	165 (41.3%)	(36.43-46.07)	
	Once a year	67 (16.8%)	(13.09-20.41)	
	Twice a year	37 (9.3%)	(6.41-12.09)	
	More times	15 (3.8%)	(1.89-5.61)	
Commercialization	Adequate	337 (84.3%)	(80.68-87.82)	<0.001
	Inadequate	63 (15.8%)	(12.18-19.32)	

**Table 2:** Frequency of purchase, consumer opinion and indicated problems regarding the way of commercialization of fish in the Fish market of Itajai

Characteristics		Interviewed (n=63)	Confidence interval (95%)	P
Related Problems	Inadequate Cooling	32 (8%)	(5.34-10.66)	<0.001
	Lack of hygiene	38 (9.5%)	(6.63-12.37)	
	Precarious structure	14 (3.5%)	(1.7-5.3)	
	Bad quality of products	13 (3.25%)	(1.51-4.99)	
	Others	15 (3.75%)	(1.85-5.61)	

**Table 3:** Problems indicated by consumers regarding the inadequate marketing of fish in the Fish Market of Itajai

Characteristics		Interviewed (n=400)	Confidence interval (95%)	P
Purchased seafood*	Shrimp	239(59.75%)	(54.94 - 64.56)	<0.001
	salmon	134 (33.5%)	(28.87 - 38.13)	
	Mullets	117 (29.25%)	(24.79 - 33.71)	
	Acoupa Weakfish	52 (13%)	(9.7 - 16.3)	
	Smooth hound	44 (11%)	(7.93 - 14.07)	
	Meagre	44 (11%)	(7.93 - 14.07)	
	Squid	37 (9.25%)	(6.41 - 12.09)	
	Anchovies	33 (8.25%)	(5.55 - 10.95)	
	Tuna	32 (8%)	(5.34 - 10.66)	
	Shellfish	24 (6%)	(3.67 - 8.33)	
	Mahi Mahi	1 (0.25%)	(0 - 0.74)	
	Others	149 (37.25%)	(32.51 - 41.99)	
Seafood purpose	proper consume	395 (98.8%)	(97.66 - 99.84)	<0.001
	Trade	5 (1.3%)	(0.16 - 2.34)	
Form of purchase	No packaging/off ice	208 (52%)	(47.1 - 56.9)	<0.001
	No packaging/with ice	182 (45.5%)	(40.62 - 50.38)	
	Packaging/cooled	7 (1.8%)	(0.46 - 3.04)	
	Frozen	3 (0.8%)	(0 - 1.6)	
Refrigeration	Immediate Consumption	266 (66.5%)	(61.87 - 71.13)	<0.001
	One hour	43 (10.8%)	(7.71 - 13.79)	
	Two or more hours	91 (22.8%)	(18.64 - 26.86)	

**Table 4:** Species and form of consumed fish, destination and cooling time of the product after the purchase at the Fish Market of Itajai. Source: Data obtained by the authors. \*Multiple choice questions.

Almeida et al. [16] reported in Pernambuco market a higher frequency of unsatisfied consumers than those found in the present study, that is, 88.5% (177/200), which also reported the inadequate cooling as the main negative factor.

When the hygiene of the place was asked, 82.5% classified as adequate and 79.8% as satisfactory, resembling the results reported in Pernambuco by Almeida et al. [16] which obtained 78% (156/200) of the interviewed with this same opinion. However, some places, such

as the free trade fairs of the Garanhuns municipality in Pernambuco, report that only 40% (162/400) of the interviewees classified hygiene as good or regular [19]. Comparing the cited results, it can be said that the hygienic conditions in the Fish Market of Itajai presented a positive highlight when compared to other regions in Brazil.

The most consumed seafood were shrimp (59.75%), followed by salmon (33.5%) and mullets (*Mugil liza*) (29.25%), being most products for their own consumption (98.8%). Most of the

Characteristics		Interviewed	Confidence interval (95%)	P
Frequency of Consumption	Once a week	210/400 (52.5%)	(47.61 - 7.39)	<0.001
	Twice a week	111/400 (27.8%)	(23.36 - 32.14)	
	Three time a week or more	79/400 (19.8%)	(15.85 - 23.65)	
Way of consumptions	Raw	112/400 (28%)	(23.6 - 32.4)	<0.001
	Cooked, baked or fried	386/400 (96.5%)	(94.7 - 98.3)	
Observed aspects*	Price	167 (41.75%)	(36.92 - 46.58)	<0.001
	Appearance	302 (75.5%)	(71.29 - 79.71)	
	Taste	61 (15.25%)	(11.73 - 18.77)	
	Others	57 (14.25%)	(10.82 - 17.68)	

**Table 5:** Frequency and form of fish consumption by consumers of the Fish market of Itajai and aspects observed at the time of purchase. Source: Data Obtained by the authors. \*Multiple choice questions.

Illness	Consumers
Food intoxication	30 (23.07%)
Gastroenteritis	17 (13.07%)
Parasitoses	9 (6.92%)
Escherichia coli	7 (5.38%)
Mercury	6 (4.61%)
Allergy	3 (2.30%)
Toxoplasmosis	1 (0.76%)
No previous specific knowledge	57 (43.84%)

**Table 6:** Illness pointed out by the consumer of the fish market of Itajai with knowledge of fish foodborne diseases

interviewees had a preference to buy fish without packaging and without ice (52%), since the product would be immediately consumed (66.5%) (Table 4).

In a study carried out in São José do Rio Preto/São Paulo, Dezani [20] observed that preference are for sardines (28%), hake (23%) and salmon (13%). However, the most consumed seafood by the southern Brazil population are shrimp, mullets, preserved sardines, fresh and frozen fish fillets and several other fresh fishes [21], which is similar to the results obtained in this study. For the consumption of the fish purchased in the Fish Market, the cooked, roasted or fried form stood out with 96.5% (Table 5). Similar results were observed by Lopes et al. [22] who demonstrated in their study that the Brazilian population (1093 interviewed) also has the preference to consume fish in this way and only 29.5% prefer to consume raw fish. Therefore, the majority of the population consume fish in a safe way, because the intake of raw fish meat is a risk factor for possible foodborne diseases [14].

The majority of respondents stated that they were able to identify fresh fish (77.5%) and 56.75% identified freshness from the observation of the fish eyes, which should be protruding and shiny, followed by observation of the gills (40,75%) that should be rosy and having meat consistency (23.75%). As in our study, Vasconcellos [23] indicated that fish consumers in the municipality of Santo André, São Paulo, have also observed the same characteristics of product freshness (eyes, rosy gills, meat consistency), as well as other factors. Results provide evidence that consumers have a significant awareness and knowledge about what should be the determinants when buying fresh fish, that are, fish must show a firm and elastic flesh in consistency with the original color of the species, with pink to red gills, while eyes should be transparente, shiny, protruding, and occupying the orbit perfectly [1].

When questioned about the possibility of seafood causing foodborne diseases, only 32.5% did know about this relationship and among the most cited were bacterial infections (food poisoning, gastroenteritis and *Escherichia coli*) and parasitoses (Table 6). This finding is consistent with Diniz [19] previous report, when addressing the subject foodborne diseases with the meat consumers of the free

markets of the Pernambuco region, observed that 40% were aware of the information. These results are unsatisfactory and proves that the lack of knowledge of the population is a risk factor for the occurrence of foodborne diseases.

Regarding the hygienic-sanitary conditions and the manipulators, it was observed the total absence of ice in the products and also handled without gloves. These factors were not recognized by the population as critical points for transmission of possible foodborne diseases ( $P < 0.05$ ). The positive points found in the merchants and individual boxes of the Fish Market of Itajai were the absence of domestic and/or synanthropic animals and 0.5% of the products were unprotected stored. On the other hand, in the public markets of Pernambuco, 4% (3/160) of the boxes have the presence of domestic animals [24] and the most common form of fish exposure observed were hung on hooks without adequate refrigeration [19].

The negative points observed in the market were the absence of ice in the products that were in the windows with the doors open, which do not maintain fish refrigerated according to the regulations. Lettuce leaves (Figure 1) are used for decoration of the products, bringing another risk factor, because they can generate more contamination since the hygiene was not known. The utensils used to handle the products were in good condition and sanitized, but some were in direct contact with the product, while the hygienic conditions of the utensils used in the public markets of Pernambuco were irregular, as cited by Lino et al. [24].

## Conclusion

Consumers are mostly unaware of the risk factors associated with fish consumption, mainly related to foodborne diseases, and that handling by traders should be improved in order to adopt good practices such as wearing gloves or frequent hand washing and product at the appropriate temperature. The hygienic conditions adopted by the Fish Market of Itajai can be considered satisfactory when compared to others in Brazil, although some practices should be improved.

Most of the interviewed from the Fish Market of Itajai, even with a high education level, were unaware of the norms established by



**Figure1:** Fishes exposed for sale with the presence of lettuce for decoration in the Fish market of Itajai, Santa Catarina, Brazil.

the regulations agencies to obtain a safe and healthy product. The results suggests that the population should be warmed with public campaigns about of the risk factors that may interfere in the quality of fish and the care that they should have for buy, handle and eat fish with quality providing the adequate characteristics of healthy fish.

### Funding Sources

The study did not have financing and was approved by the Ethics Committee on Research in Human Beings under the protocol number 1 644 420.

### Acknowledgments

The authors thank the Secretary of the Fishing of Itajai, Agostinho Peruzzo, for the authorization and aid for the accomplishment of the collections of data, and Marina Beatriz Borgmann da Cunha for reviewing English.

### References

1. Ministry of Agriculture, Livestock and Supply. Regulation of the Industrial and Sanitary Inspection of Products of Animal Origin – RIISPOA; 2017;Rio de Janeiro, Brasília.
2. Aquaculture Brazil. Fisheries Yearbook;2018.
3. IBGE. Brazilian Institute of Geography and Statistics;2016.
4. Lozano BS, Forest R, Wosgrau F, Forest M, Binotto E. Quality and safety agriculture: the influence of transport in the quality of fish. University magazine Vale do Rio Verde. 2014;12(1):238-247.
5. Ministry of Agriculture. Livestock and Food Supply. 2016;Brazil.
6. Domingo JL. Omega-3 fatty acids and the benefits of fish consumption: is all that glitters gold?. Environ Int. 2007; 33(7):993-998.
7. Neiva CRP. Interest in the nutritional aspects of fish is growing. Fishing Institute; 2009; Santos, Brazil.
8. Krauss RM, Eckel RH, Howard B, Appel LJ, Daniels SR, et al. AHA dietary guidelines: revision 2000: A statement for healthcare professionals from the nutrition committee of the American Heart Association. Circulation. 2000 Oct;2284-2299.
9. Silva, Adriana F DA. Omega-3: Main benefits to Human Health. 2015; Repins Faema.
10. Kris E, Penny M, Harris, William S, Lawrence J. Omega-3 fatty acids and cardiovascular disease new recommendations from the American Heart Association. Arterioscler Thromb Vasc Biol. 2003 Feb;23(2):151-152.
11. Pavanelli GC, Eiras JC, Yamaguchi MU, Takemoto RM. Human Communicable Zoonoses by Fish in Brazil;2015; Maringá-PR, UniCesumar, Brazil:13-24.
12. Ministry of Health. National Health Surveillance System (Situation Report); 2011; Brasília.
13. Ribeiro PA, Costa LS, Logato PV. Probiotics in aquaculture. Nutritime Magazine. 2008;6(1):837-846.
14. Masson ML, Pinto RA. Potential hazards associated with the consumption of foods derived from raw fish. B.CEPPA, Curitiba.1998;16(1):71-84.
15. Fontes MC, Esteves A, Caldeira F, Saraiva M, Vieira P, et al. State of freshness and hygienic quality of the fish sold in a city in the interior of Portugal. Arq Bras Med Vet zootec. 2007;59(5):1308-1315.
16. Almeida RB, Diniz WJS, Silva PTV, Andrade LP, Diniz WPS, et al. Hygienic and sanitary conditions of the sale of meat in street markets Paratama, PE. F Nutri Araraquara. 2012;22(4):585-592.
17. Costa AD, Almeida IC, Oliveira JS. Market and consumer profile of fish in the State of Pará. In Congress of the Brazilian Society of Economy, Administration and Rural Sociology; 2009; Porto Alegre, Anais Porto Alegre: UFRS. P.1-13.
18. Figueira YLV. Consumer profile of fish in supermarkets at Fish Week in Belém / PA. Brazil Nutri. 2016;14(4).
19. Da Silva Diniz WJ. Consumer profile and its perception on the hygienic aspects of the commercialization of meat in fairgrounds. Acta Vet Brasilica. 2012;6(3):223-229.
20. Dezani AA, Batista JCV, Theodoro RN, Dezani R. The Perception of the Elderly Regarding the Determinants in Fish Consumption. Fatea's Management Magazine. 2015;9(09).
21. 2008-2009 Household Budget Survey: Household food purchase per capita. IBGE. Rio de Janeiro;2010.
22. Lopes IG, Oliveira RG, Ramos FM. Profile of fish consumption by the brazilian population. Biota Amazônia. 2016;6(2):62-65.
23. Vasconcellos JP. Determinants of fish consumption in the population that attends free trade shows in the municipality of Santo André, SP. 2010. 102 f. Dissertação (Mestrado em Ciências)– Faculty of Veterinary Medicine and Animal Science, University of São Paulo, São Paulo.
24. Lino GC. Hygienic-sanitary conditions of meat marketing establishments in the Public Markets of Jaboaão dos Guararapes,PE. J Vet Med. 2011;3(4);1-6.