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# Study of Physical and Chemical Composition and Quality of *Hoplias malabaricus* and *Leporinus friderici* (Bloch, 1794) Fillet Collected in Pirativa River -Santana-AP

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***Authors' contributions***

*This work was carried out in collaboration between all authors. Authors JPMJ and SSMDSDA planned all experiments. Authors JPMJ and RDSR supported the study of physical and chemical composition and quality of fillet. Authors JPMJ and SSMDSDA wrote the first draft of the manuscript. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aims:** The purpose of this research was to perform the physical and chemical study of the composition and the quality of the fillet of *Hoplias malabaricus* (Traíra) and *Leporinus friderici* (Bloch, 1794) collected in Pirativa River-Santana-Ap.

**Study Design:** This study was chosen in the areas on the banks of Pirativa river in anthropized and non-anthropized areas in the city of São Raimundo, at coordinates N 00 02'08,9 "W 051 15 '32.3" in Santana-AP.

**Place and Duration of Study:** the research was conducted in Pharmacognosy and Phytochemical Laboratory of the Course of Pharmacy from January to September of 2014, and in the Fish Processing Laboratory of the Federal University of Amapá (UNIFAP), from July to September of 2014.

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**Methodology:** The physical and chemical parameters adopted in this research were pH, humidity, Waste from Incineration (Ash), Lipids and Total Volatile Bases. All the tests were carried out according to standards in the Adolfo Lutz Institute.
**Results:** The yield values were 48.30 and 46,632% respectively for *Hoplias malabaricus* (Traíra) and *Leporinus friderici* (Aracu). Regarding the physical and chemical parameters, the species *Hoplias malabaricus* (Traíra) and *Leporinus friderici* (Aracu) presented, respectively, pH 6.80 and 7, humidity 70 004±4:57 and 2:44±65.55%, ash 2.88±0.74 and ±3:50 1:51%, lipid values of 10:50 and 11.90% indicating high molecular weight lipids, and volatile bases ±0.01 1.76±1.69 and 0:03.
**Conclusion:** Attention should be paid to the proper packaging and treatment of fillet, because external factors, from the fish catch to the market of its by-products, influence the quality and nutritional value.

*Keywords: Physical chemistry; fish; Hoplias malabaricus; Leporinus friderici.*

## 1. INTRODUCTION

The importance of fish in the human diet is due to its high content of protein, essential amino acids, and good protein digestibility of its flesh (90-98%), which is higher than beef and pork. Fish is a highly perishable food because of its complex chemical composition, pH close to neutrality, high water activity, high content of nutrients easily usable for the microorganisms, the unsaturated lipid content, the enzymatic action and the high metabolic activity of the microbiota [1].

In fact, there is no disagreement with the visible qualities of fish as raw material. However, as occurs with other foods, it can act as a carrier of a disease, causing many pathogens [2]. Because they have fresh or chilled, intrinsic characteristics that are essential to the development and survival of many pathogens, such as pH close to neutrality, high water activity in the tissues (not less than 0.98), and high amount of nutrients available [3,4].

Most often, the poor handling, storage and transportation of fresh fish greatly contribute to the loss of quality and even deterioration of the fish landed. In Brazil, the situation is precarious in almost all of fish landing sites, the traditional practices of the passage of fresh fish through one or more intermediaries. On its trip from the angler to the final consumer, also contributes decisively to the loss of quality and deterioration of fresh fish offered to consumers in street fairs, markets, fishmongers, and supermarkets in the country. Changes that most characterize the deterioration of fish are those related to odor and flavor, determining the improper state for consumption, since they affect the condition of edibility [5].

Data related to the chemical composition of fresh fish are important in the product conservation and preparation processes while the data relating to yield identifies the amount of edible part and nutrients that make up the fillet. From yield the producer can plan, the amount of fish that will be needed to deliver to the slaughter.

The standardization of filleting techniques and the definition of economically feasible size are parameters that need to be established for obtaining higher fillet yields. Therefore, there is a need for studies to evaluate the processing yields, as well as the percentages by-products that may be used for industrialization, in function of the fish slaughter weight [6].

Both species *Leporinus friderici* (Aracu-head-fat or three pints), belonging to Anostomidae family, and *Hoplias malabaricus* (Traíra), of the Erythrynidae family, are considered long of distance migratory in Brazilian river basins, and predominate in lotic environments, performing reproductive upward migration and tragic downward migration [7]. Moreover, species were chosen due to some peculiar characteristics, as a greater acceptance of these fish by the consumer market and to being found in abundance in the rivers, dams, and lakes distributed throughout the state of Amapá. Therefore, the aim of this research was to perform the study of the physicochemical composition and of the quality of the fillet of *Hoplias malabaricus* (Traíra) and *Leporinus friderici* (Bloch, 1794) collected in Pirativa River, Santana-AP.

## 2. MATERIALS AND METHODS

### 2.1 Field of Study

This study was conducted in the areas along the Pirativa river in anthropized and non-anthropized areas of the city of São Raimundo, with coordinates **N** 00 02'08.9" **W** 051 15' 32.3", in Santana-AP, as shown in Fig. 1.

## 2.2 Obtaining of Fish

The fish were obtained in Pirativa River in both disturbed and intact areas in the city of Pirativa-Santana-AP, duly informed to the competent bodies. The fish were used in three stages of development: young, developing and adult. Specimens were captured in a traditional way with fishing nets, and gill nets, and were after identified, measured and classified for cataloging.

## 2.3 Study of Yield

In the Laboratory of Processing and Fish Technology of the Amapá State University, the obtained specimens were weighed: total weight (TW) with the aid of electronic precision scale accurate to 0.001 g, eliminating the excess water, and measured the standard length (SL), between the end forward of the muzzle and the lower perimeter of the caudal peduncle, using a tape according to [8].

Then the fish filleting was performed, the process in which were removed the head, the viscera, skin, cervical, carcass and then the fillet of tambaqui and pintado according to what is recommended by [9], seeking the method which gives a higher yield of the fish. After the above procedure, they were weighed separately for yield calculation. The analyzes were performed in triplicate.

In order to avoid individual differences the yield of cuts, the procedure was performed by a single person as proposed by [10].

Then, they were washed to remove any element that is not derived from the raw materials and which can have eventually been obtained during processing, in accordance with the standards proposed by [11]. Subsequently, they were stored in polypropylene recipients. To prevent the formation of ice crystals on the surface of the fillets, the recipients were covered with plastic bags.

Thus, one can get the values of the Whole Fish Gutted (W.F.G), the Fillet Yield (F.Y.) and by-products. It was considered as by-products some fish parts as fins, skin, head, bones and spine. The ventrecha was considered as part of the fillet.

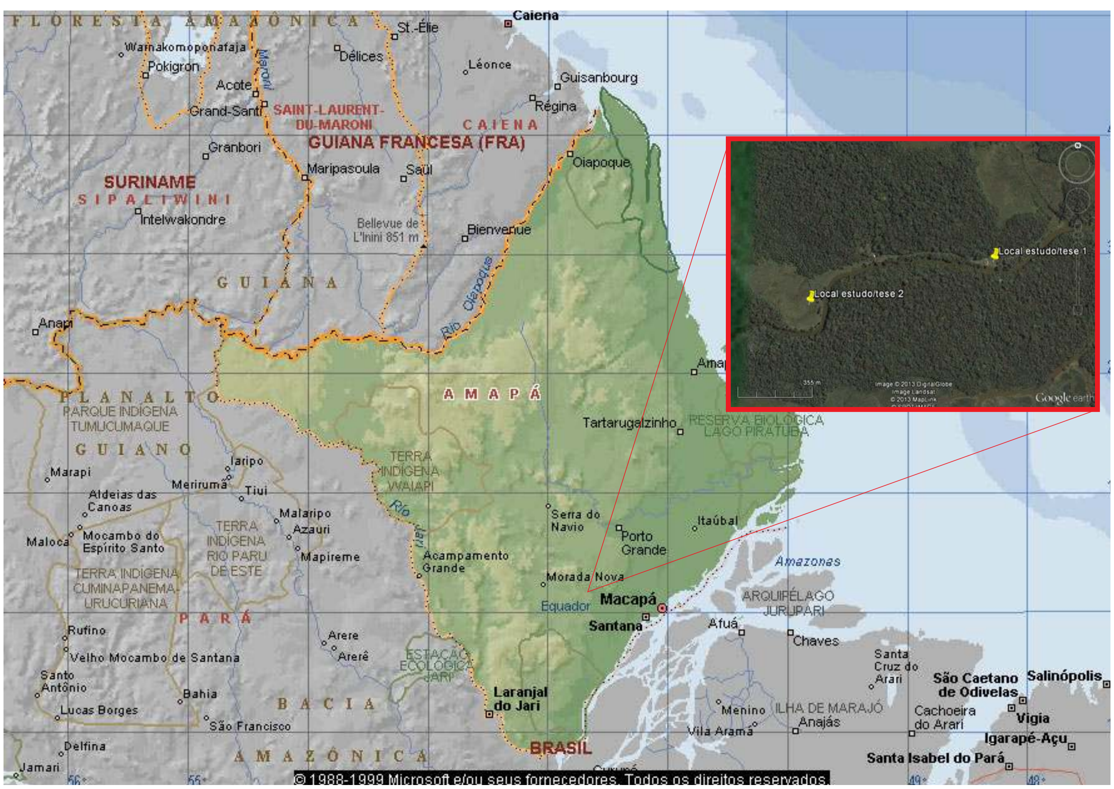


**Fig. 1. Location of the area of study - collection points – Santana / AP**
*Source: Google maps 2012*

The yield calculations were performed as proposed by [10], and thus, the assessed yields were a yield of by-products and fillet yield. For this purpose the formulas described below were used:

$$\%\ \text{by products} = \frac{\text{By-products weight}}{\text{Total weight of fish}} \times 100$$

$$\%\ \text{fillet} = \frac{\text{Fillets weight}}{\text{Total weight of fish}} \times 100$$

### 2.4 Physical and Chemical Analysis

The physical and chemical parameters adopted in this research were pH, Humidity, Waste from Incineration (Ash), lipids and total volatile bases. All the tests were carried out according to standards of [12].

## 3. RESULTS AND DISCUSSION

From the analysis of data, the fillet average yields were 48.30 and 46.632%, respectively, for *Hoplias malabaricus* (Traíra) and *Leporinus friderici* (Aracu). Santos et al. [13] determined similar fillet yield results to traíra with a value of 44.33±9.51.

The filleting method also influences the yield for the species *L. friderici* (Aracu-fat-head or three pints) and *H. malabaricus* (Traíra), with differences in the form of skin removal and the type of cutting head (decapitation). In the first case, removing the skin with pliers and then the fillet, one obtains the largest fillet yield (36.67%), compared to filleting then removing the skin with the aid of a knife (32, 89%) [14]. The results found in this study for the fillet yield are in agreement to the research of [14].

According to Pinheiro [15], several factors influence the yield of filleting, among which mainly include the degree of mechanization, filleting method (skin or fillet order of removal, removal or not the head and fins, type of cut made on Beheading) and, the most important, skill of who performs filleting.

The values determined in the physical and chemical analysis of fillet composition of *Hoplias malabaricus* (Traíra) and *Leporinus friderici* (Aracu) are shown in Table 1.

The hydrogenionic potential (pH) values found for *Hoplias malabaricus* (traíra) is 6.8 and the *Leporinus friderici* (aracu-comum ou piau-três pintas) 7, samples showed a value of pH greater than 6.5 on the inner flesh, being outside the limits recommended by RIISPOA [16]. This regulation proposes a pH limit for various species, but some species of fish after "*rigor mortis"* already have high pH values, which can even be equal to or greater than 6.5, after the end of the experiment. This fact suggests that the pH is not always an appropriate tool for quality control, since it may be associated with increased resistance to capture by using fishing nets, decomposition, and oxidizing action of amino acids and urea, fish species, type of microbial load, handling, packaging and excessive use of polyphosphates after filleting.

The measured pH values exceeded the limit set by federal law to *Hoplias malabaricus* (traíra) and *Leporinus friderici* at 4.6% and 7.7% respectively, thereby good use of fishing techniques and reduction of stress when the fish is caught, are suitable for the maintenance of pH of the fish internal flesh [11].

Determined moisture values were 70.004±4.57 and 65.55±2.44% to *Hoplias malabaricus* (traíra) and *Leporinus friderici* (piau-três pintas) do not comply with the standards required by RIISPOA which states that the moisture content does not exceed more than 35%. The high degree of moisture found in both species, influence directly on a lower shelf life, because high levels of water activity give a conducive environment to proliferation of microorganisms and associated enzymatic actions that may modify its natural properties. These results are similar to those of the survey by Santos et al. [13] in the study of the chemical composition and fillet yield of Traíra, in which average values found for moisture, it was 77.71. In the study of Burket et al. [10] the determined average values of 64.83±2.35 of moisture of the side fillet of *Pseudo platystoma* sp (surubins) fed with three different commercial food are close to fillet yield values of *Leporinus friderici* (piau-three pints) found in this search.

The fixed mineral residue determined for the species were 2.88±0.74 and 3.50±1.51 to *Hoplias malabaricus* (traíra) and *Leporinus friderici* (piau-três pintas), respectively. According to Contreras-Guzmán [17] and Machado and Foresti [18] report that the fraction of ash in freshwater fish shows variations in amounts ranging from 0.90 to 3.39%. These values are consistent with those found in Traíra and Piau-three pints. In the nutritional sense, the fish meat

**Table 1. Chemical composition of the fillet samples of *Hoplias malabaricus* (Traíra) and *Leporinus friderici* (Aracu)**

| Parameters | *Hoplias malabaricus* | *Leporinus friderici* |
|---|---|---|
| pH | 6.80 | 7.00 |
| Humidity (% m/m) | 70.004±4.57 | 65.55±2.44 |
| Ash (% m/m) | 2.88±0.74 | 3.50±1.51 |
| Lipids (% m/m) | 10.50 | 11.90 |
| Total volatile bases (mg N/%) | 1.76±0.01 | 1.69±0.03 |

is a rich and valuable source of nutrients, such as calcium (Ca) and phosphorus (P), and also provides reasonable quantities of sodium (Na), potassium (K), manganese (Mn), copper (Cu), iron (Fe) and iodine (I) [19].

The values found in the extraction of lipids to *Hoplias malabaricus* (Traíra) and *Leporinus friderici* (piau-três pintas) were 10.5 and 11.9%, respectively. However, the residue obtained in the extraction are not comprised only by lipids, but for all compounds that, under the conditions of the determination, can be extracted by the solvent, therefore it becomes necessary a more rigorous analysis for qualitative determination in identifying and hence its quantification. For Cecchi [20], the lipid content can vary greatly depending on the type of food, and fish have values of 0.1% to 20%. Lipids are highly energetic organic compounds.

According to Jacquot (1961) cited Torres et al. (2012) [21] fish of the same species, depending on the capture site, could get different ratings based on their fat. He also classifies the fish as thin when the determined maximum fat content is 2.5% and semi-fat when these levels are in the range of 2.5% to 10%. Thus, the species fall within the semi-fat rating.

The fat of fish is nutritionally important because it is a natural source of unsaturated fatty acids; however, it may have an inverse relationship with the conservation time if it is packaged in inadequate conditions [22]. According to some authors, the fish generally are more palatable before spawning, this period in which the fish deposit fatter and glycogen to be used as energy sources [23-25].

The Volatile Tertiary Nitrogen Bases (N-BVT) and Trimethylamine (TMA) is a parameter recommended by national law for assessing the degree of freshness of fish and fish products, but the limit established for this parameter does not seem to be suitable for all kinds of fish. It was assumed that the limits below 30 mg N-BVT/100 g meat to BVT and 4 mg N-TMA/100 g of meat to tertiary volatile bases, according to the Technical Regulation of Industrial and Health Inspection of Animal Products – RIISPOA [16]. The results are in accordance with the standard set, as the values are lower, allowing a long period of storage and preservation of nutritional value, slowing the actions of antioxidants, enzyme activities and microorganisms.

Several countries, such as Brazil, Germany, Argentina and Australia, have adopted this parameter to freshness criteria. However, the use of this parameter for freshwater fish is questioned, because they have minimal amounts of trimethylamine oxide, which yields by microbial action trimethylamine. Thus, unlike the saltwater fish, freshwater fish usually have low values of BVT [25].

## 4. CONCLUSION

The studied species have a high nutritional value which ensures a good quality of the steak conservation and of their physicochemical properties. Thus, the research is confirming and highlighting these species. They are commonly consumed by traditional communities and marketed in pairs of fish since the they are part of the daily diet that is serve as food and ensure the survival of these populations.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Ashie INA, Smith JP, Simpson BK. Spoilage and shelf-life extension of fresh fishand shellfish. Critical Reviews in Food Science and Nutrition. 1996;36(182):87-21.
2. APHA. Standard methods for examination of water and wastewater. Washington: APHA; 2001.

3. Frazier WC, Westhoff DC. Food microbiology them. 4th En. Zaragoza, Acribia. 1993;681. (Spanish).
4. Martins LHP, Miranda IPA, Nunes CDN. Pollen morphology of Amazonian populations of *Elaeeis oleifera*. Acta amaz. 2002;33(2):159-166.
5. Ordonez AO. Food technology. St. Paul, ed. Artmed, v.2, Chap. 12. 2005;299-228. (Portuguese).
6. Souza MLR, Macedo-Viegas EM. Comparison of four filleting methods used for the Nile tilapia (*Oreochromis niloticus*) on the throughput. Infopesca International, Montevideu. 2001;7:26-31.
7. Rego FF, Alcantara LC, Moura NetoJP, Miranda AC, Pereira OS, Goncalves MS, Galvao-Castro B. HTLV type 1 molecular study in Brazilian villages with African characteristics giving support to the post-Columbian introduction hypothesis. AIDS Res Hum Retroviruses. 2008;24(5):673-677.
8. Crepaldi MA, Böing E, Moré ICLOC. Pesquisa com famílias: aspectos teórico-metodológicos, Universidade Federal de Santa Catarina, Florianópolis-SC, Brasil, 2008;18(40):251-266.
9. Souza MLR. Comparação de Seis Métodos de Filetagem, em Relação ao Rendimento de Filé e de Subprodutos do Processamento da Tilápia-do-Nilo (*Oreochromis niloticus*). R. Bras. Zootec. 2002;31(3):1076-1084.
10. Burkert D, et al. Yield processing and chemical composition of catfish fillets grown in cages. Brazilian Journal of Animal Science. 2008;(7):1137-1143. (Portuguese).
11. BRAZIL. Ministry of Agriculture, Livestock and Supply. Industrial Inspection Regulation and Health of Animal Products - RIISPOA. Approved by Decree No. 30691 of March 29, 1952 and amended by Decree No. 1255 of 25/06/62, No. 1236 of 02/09/94, No. 812 of Decree No. 08-0296 and 2444 of 04/07/97 (Portuguese).
12. Adolfo Lutz Institute. Methods for chemical and physical analysis of food. London: IMESP; 2008. (Portuguese).
13. Santos AB, et al. Chemical composition and fillet yield of betrayed (*H. malabaricus*). Uruguaiana. 2001;7-8(1): 140-150. (Portuguese)
14. Souza MLR, et al. Influência do método de filetagem e categorias de peso sobre rendimento de carcaça da tilápia do Nilo (*Oreochromis niloticus*). Rev. Bras. Zootec., Viçosa. 1999;28:1-6.
15. Pinheiro LMS, Martins TR, Pinheiro LAS, Pinheiro LEL. Rendimento industrial de filetagem da tilápia tailandesa (*Oreochromis* spp.). Arq. Bras. Med. Vet. Zootec. 2006;58(2):257-262.
16. Contreras-Guzmán ES. Biochemistry derivatives y fish. FUNEP. Jaboticabal. 1994;409. (Portuguese).
17. Machado MRF, Foresti F. Yield and chemical composition of *Prochilodus lineatus* fillet of Rio Mogi das Cruzes, Brazil. Archives Animal Science. 2009; 58(224):663-670. (Portuguese).
18. Simões MR. Physico-chemical composition, microbiological and fillet yield of Thai tilapia (*Oreochromis niloticus*). Food Science and Technology, 2007; 27 (3): 608-613. (Portuguese)
19. Cecchi HM. Theoretical and practical foundations in food analysis. 2nd edition Magazine. Publisher Unicamp; 2003. (Portuguese).
20. Torres LM. Composition of fatty acids Traíra (*Hoplias malabaricus*) and Pintadinho (unrated) come from southern Rio Grande do Sul and India Life in Uruguay. Agricultural Sciences. 2012; 33(3):1047-1058. (Portuguese)
21. Costa APR, et al. Red-piau fillet smoking (*Leporinus copelandii*) with the use of liquid smoke. CERES. 2008;55(4):2251-257. (Portuguese).
22. Costa APR. Income and processing red-piau *Leporinus copelandii* Steindachner, 1875, collected from the wild. Thesis. 92f. 2005. Agricultural Science and Technology Center of the North Fluminense State University Darcy Ribeiro; 2005. (Portuguese).
23. Mendonça PP. Influence of photoperiod on the development of juvenile tambaqui *Colossoma macropomum*. Thesis. 69f. 2007. Agricultural Science and Technology Center of the North Fluminense State University Darcy Ribeiro; 2007. (Portuguese)
24. Polese MF. Ration of corn particle size of the effect on performance and composition of pacu juveniles housing, Piaractus

mesopotamicus Holmberg, 1887. Dissertation. 72f. 2009. Agricultural Science and Technology Center of the North Fluminense State University Darcy Ribeiro; 2009. (Portuguese)

25. Gomes LM. Influence of conditions of handling and conservation in the quality of the fish. Specialization. 43f. 2006. Qualittas Institute of Postgraduate Diploma in Veterinary Medicine; 2006. (Portuguese).



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