. Original Research Article Food science and Technology

International Journal of Life science and Pharma Research

ISSN 2250-0480

VARIOUS PARAMETERS AFFECTING THE PRODUCTION OF DRIED TAMBAQUI (*Colossoma macropomum*) FILLET

NGUYEN PHUOC MINH

Faculty of Food Technology - Biotech, Dong A University, Da Nang City, Vietnam

ABSTRACT

Tambaqui (*Colossoma macropomum) has been* considered promising for fish farming in Mekong region. Tambaqui has a high output production in continental fish farming just after shrimp, catfish and tilapia. The industrial production of tambaquis for export markets is expected to increase, requiring the diversification of processed products from this fish. It's normally sold in retail fresh or frozen, whole, or gutted. Therefore present study was conducted to identify the effect of salt soaking time, salt concentration, dry temperature and stability of the dried tambaqui filler with prerservation time. Results of present study revealed that best quality of the dried tambaqui fillet could be obtained when dried tambaqui fillet treated with 1.0% salt for 1.5 hours and drying at 60^{o}C to 28% moisture content. This application could preserve the dried tambaqui fillet for 9 months in PA bag without any deterioration.

KEYWORDS: *Tambaqui, fillet, salinity, drying, soaking, preservation*

NGUYEN PHUOC MINH

Faculty of Food Technology - Biotech, Dong A University,
Da Nang City, Vietnam
minhnp@donga.edu.vn

Received on: 06-06-2018
Revised and Accepted on: 10-08-2018
DOI: http://dx.doi.org/10.22376/ijpbs/lpr.2018.8.4.L33-38

INTRODUCTION

Tambaqui (Colossoma macropomum) is one of the most commonly consumed species in Vietnam fish markets. Tambaqui has great potential for aquaculture in Vietnam due to its good husbandry and management qualities, such as good feed conversion, acceptance of processed food, resistance to long periods of hypoxia and excellent meat quality reported by Saint-Paul et al., Melard et al., Graef et al., Aride et al.1,2,3,4 Good yield of fillet without skin but its flesh is of good nutritional quality and its production cycle is short (six to eight months) are some of the characteristics which make it excellent source of income . It was reported by de Almeida et al that Muscular tissues of Tambaqui can be considered as a rich source of arachidonic (AA), eicosapentaenoic (EPA), and docosahexaenoic (DHA) acids.5 Fernanda et al.. confirmed that the large scale production of this species is due to the flavored fillet, which is largely composed by skeletal muscle white fibers, its good growth in captivity and the control of reproductive cycle 6 Several studies have been conducted to process this fish into convenient products. The physicochemical characteristics of tambaqui fish oil (Colossoma macropomum), grown in four localities in the state of Roraima were determined by Antonio et al.7 Quality parameters of gutted tambaqui and stored on ice for different periods were assessed by Borges et al. .8 Further, a fresh sausage of tambaqui fish through physicochemical, microbiological and sensory traits was developed and characterized by Fernando et al..9 An evaluation of the shelf life of tambaqui fillet processed by the sous vide method was elaborated by Kato et al.10 The quality of tambaquis slaughtered by asphyxia (the conventional industrial method, and hypothermia) was compared by Joana et al..11 For the purpose of commercial utilization, various technical parameters which can affect the dried salted tambaqui production were assessed during the present study. Further, present study was conducted to evaluate the effect of salt soaking time and concentration, drying temperature, and shelf-life of the dried tambaqui fillet under normal preservation

MATERIAL & METHODS

Material

Figure 1
Tambaqui

Tambaqui fishes were cultured from January to June of 2017 in Thot Not district, Can Tho province, Mekong river delta, Vietnam by following Global GAP culturing method without using antibiotic to ensure food safety. After harvesting, these fishes were stored in ice chest (< 4^{o}C) and carried to laboratory within 2 hours. Proteolysis and biochemical changes of muscle can take place to some degrees during iced storage. Knife was used to fillet the muscle out of bone. Along with muscle of tambaqui, other materials such as NaCl, monosodium glutamate (MSG), pepper, sugar, and garlic acid were also used during study. Lab utensils and equipments include knife, weight balance, thermometer, ice chest which were used for data collections.

Research Methods

Determination of salt soaking time to salinity and sensory favorites (color, flavor, aroma) of the dried tambaqui fillet

Tambaqui fishes were filleted by knife to remove bone. These fillets were washed by 0.3% acetic acid for 5 minutes to remove fishy smell. This was followed by the deep soaking of these fillets in

additive solution (salt 1%, MSG 0.2%, sugar 0.5%, pepper 2% and garlic 2.5%) as food ingredients. Different soaking time viz., 0, 0.5, 1.0, 1.5, 2.0 hours were tried to determine the effect of soaking time on salinity and sensory characteristics in the dried tambaqui fillet. These soaked fillets were dried till the moisture contents reduced to 28%. In order to verify the optimal salt soaking time, salinity and moisture content (%) of these dried tambaqui fillet were analyzed,drilled and tasted the dried tambaqui fillet for sensory evaluation

Determination of salt soaking concentration to salinity and sensory favorites (color, flavor, aroma) of the dried tambaqui fillet

In order to determine the effect of salt soaking concentration on salinity and sensory characteristics of dried tambaqui fillet, five salt soaking concentrations viz., 0, 0.5, 1.0, 1.5, 2.0% were used. Tambaqui fishes were filleted by knife, washed by 0.3% acetic acid for 5 minutes and deeply soaked in additive solution (MSG 0.2%, sugar 0.5%, pepper 2% and garlic 2.5%) for 1.5 hours. These soaked fillets were dried till the moisture contents were reached to 28 percent. In order to verify the optimal salt soaking concentration, we analyzed salinity and moisture (%) in the dried tambaqui fillet; drilled and tasted the dried tambaqui fillet for sensory (taste) evaluation by human volunteers.

Determination of drying temperature affecting sensory favorites (color, flavor, aroma) of the dried tambaqui fillet

Additive solution socked fillets were dryed at different temperature viz., 50, 55, 60 and 65^{o}C to determine the effect of drying temperature to sensory favorites in the dried tambaqui fillet. These soaked fillets would be dried to 28% moisture content. In order to verify the optimal drying temperature, dried tambaqui fillet were drilled and tasted for sensory evaluation.

Determination of shelf-life of the dried tambaqui fillet by preservation

The dried tambaqui fillets were kept in PA plastic (Polyamide) bag at normal room temperature for different durations (0, 1, 3, 6, 9, 12 months) to monitore the effect of storage time on the sensory favorites of Tambaqui fishes fillets.

Physico-chemical analysis

Various physico-chemical analysis such as moisture content (drying to basic weight), salinity (Mohr), protein (Kjeldahl), lipid (Soxhlet), and sensory evaluation (score, 1-5) were carried out in order to determine the effect of various salt concentrations, salt exposure durations and temperature on Tambaqui fishes fillets.

STATISTICAL ANALYSIS

The experiments were run in triplicate with three different lots of samples. Data were subjected to analysis of variance (ANOVA) and mean comparison was carried out using Duncan's multiple range test (DMRT). Data was statistically summarized by Statgraphics Centurion XVII.

RESULTS & DISCUSSION

Effect of salt soaking time to salinity of the dried tambaqui fillet

Common salt, sodium chloride (NaCl), is used as a preservative that penetrates the tissue; slows the bacterial growth and deactivates the enzymes. Some of the factors involved in salting of dried fish which play important role are purity of salt, concentration of salt, method of salting, and salt soaking time, favour of the product Farzana et al. [12]

Result of salt soaking time on dried tambaqui fillet salinity has been represented in table 1, by observing the salinity (%) it has been reported that acceptable salinity and sensory score was reported in the treatment containing 1 hr soaking time.

Table 1
Salinity and sensory score of the dried tambaqui fillet by salt different soaking time (hours)

Salt soaking time (hours) (counted on the wet basic)	Salinity (%) in the dried tambaqui fillet (counted on the dry basic)	Sensory score of the drilled dried tambaqui fillet
0	1.35±0.01^{e}	2.84±0.02^{c}
0.5	9.28±0.03^{d}	3.79±0.02^{b}
1.0	10.45±0.02^{c}	4.52±0.01^{a}
1.5	11.97±0.01^{b}	3.65±0.03^{b}
2.0	12.74±0.01^{a}	2.93±0.01^{c}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%), a was the highest and e was the lowest

In a reported studyby Uddin et al., silver jewfish (*Otolithes argentatus*) was soaked in 10% salt in 12 hour before drying performance. This soaking time (12 hour) is longer than the present study (1 hour) [13]

Effect of salt soaking concentration to salinity and sensory characteristics of the dried tambaqui fillet

The presence of sufficient salt in fish prevents or drastically reduces the action of bacteria. Salting involves the application of salt to fish either directly or as brine. It removes moisture by the process of osmosis, creating medium unsuitable for microbial growth Farzana et al.[12] Result of present study revealed a significant effect of salt concentration on percentage salinity of dried tambaqui fillet, among various tested concentrations highest sensory score was reported at 1.0% salt concentrations and this was followed by 05 and 1.5 percent.

Table 2
Salinity and sensory score of the dried tambaqui fillet by different salt soaking concentration (%)

Salt soaking concentration (%) (counted on the wet basic)	Salinity (%) in the dried tambaqui fillet (counted on the dry basic)	Sensory score of the drilled dried tambaqui fillet
0	1.35±0.01^{e}	2.84±0.01^{c}
0.5	7.29±0.01^{d}	3.49±0.02^{b}
1.0	8.13±0.03^{c}	4.57±0.01^{a}
1.5	9.45±0.02^{b}	3.42±0.02^{b}
2.0	10.69±0.01^{a}	2.92±0.03^{c}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above) , the difference between them was not significant (α = 5%), a was the highest and e was the lowest

The sausage common salt, onion, garlic, parsley, basil, black pepper, oregano, monosodium glutamate, citric acid, curing salts, emulsifier, and stabilizer was developed Fernando et al.[9] Notably in this research, 1.7% salt formulation was noted. A production of high quality salted fish-products from taki fish (*Channa punctatus*) with 16.06±.06% salt was revealed by Farzana et al.[12]

Effect of drying temperature to sensory characteristics of the dried tambaqui fillet

Drying has long been one the most popular method of fish processing. It has the benefit where the nutritional quality of the fish remains almost intact. Natural drying in the sun is not satisfactory due to contamination by blowfly and insect infestation - reported by Uddin et al.[13] Farzana et al reported that like salt concentration, drying temperature also affect the sensory characteristics of drilled dried tambaqui fillets, among the four tested drying temperatures (50-65 ^{o}C), optimal drying temperature was recognized 60^{o}C where highest sensory score was reported.[12]

Table 3
Sensory score of the dried tambaqui fillet by different drying temperature (^{o}C)

Drying temperature (^{o}C)	Sensory score of the drilled dried tambaqui fillet
50	3.74±0.01^{c}
55	4.01±0.03^{b}
60	4.62±0.01^{a}
65	4.05±0.02^{b}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%), a was the highest and c was the lowest

The influence of salt treatment on the drying performance of commercially important marine fish, silver jewfish (*Otolithes argentatus*) in a Hohenheim-type solar tunnel dryer was investigated. Uddin et al study confirms Temperature inside the dryer varied from 36 ºC to 55ºC with an average air velocity of 1.5 m/s. Moisture content of fish was reduced to 16% and it was found that the use of salt in silver jewfish significantly reduced the drying period in solar tunnel dryer to 34 hr compared to those of 40 hr for control fish. Moisture content of 10% salt treated

sample decreased rapidly compared to other salt treated samples where moisture content reduced to below 16% within 34 hr.[13] This indicates that addition of salt in raw material reduced drying time as well as improves the quality of the final product.The dried tambaqui fillets which were stored in PA bag at normal room temperature regularly monitored for the change in sensory characteristics with preservation time (0, 1, 3, 6, 9, 12 months). From table 4, result of study revealed that the products remains stable until the 9th month. At the 12th month, some changes in flavor and aroma was reported. From these results, it can be conclude that dried tambaqui fillet could be safely preserved in PA bag for 9 months without any deterioration.

Table 4
Sensory score of the drilled dried tambaqui fillet by preservation time (months)

Preservation time (months)	Colour score	Flavor score	Aroma	Mold appearance
0	4.62±0.01[a]	4.58±0.02[a]	4.49±0.03[a]	Not detected
3	4.62±0.02[a]	4.56±0.01[a]	4.49±0.02[a]	Not detected
6	4.60±0.01[a]	4.55±0.01[a]	4.47±0.01[a]	Not detected
9	4.59±0.03[a]	4.55±0.02[a]	4.46±0.02[a]	Not detected
12	4.58±0.01[a]	4.03±0.01[b]	4.12±0.01[b]	Not detected

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%), a was the highest and b was the lowest

Kato et al study showed that regarding product shelf-life, tambaqui processed into salted dried product having longer stability compared to other products such as tambaqui (*Colossoma macropomum*) soy sauce and basil sauce with 42nd and 49th days of shelf life, respectively.[10] Andersen et al reports that the high concentration of salt has been shown to prevent microbial spoilage in similar products.[14]

AUTHOR CONTRIBUTION STATEMENT

The industrial production of tambaquis for export markets is expected to increase, requiring the diversification of processed products from this fish. It's normally sold in retail fresh or frozen, whole, or gutted. Various technical parameters which can affect to the dried salted tambaqui production were assessed during the present study. Further, present study was conducted to evaluate the effect of salt soaking time and concentration, drying temperature, and shelf-life of the dried tambaqui fillet under normal preservation.

CONCLUSION

Tambaqui is one of the main fish species farmed in the Vietnam. It is produced at industrial scale and slaughtered in the field. During the present study, some technical parameters which can affect the quality of dried tambaqui fillet production were analyzed. From the results of study it can be conclude that sensory characteristics are affected by the salt concentration, salt soaking time and drying temperature. Further, it can be concluded that product could be consumed within 9 months on the normal preservation. To increase consumption, convenient products like this with good sensory attributes should be offered.

FUNDING ACKNOWLEDGEMENT

We acknowledge the resources and financial support for the study was provided by Dong A university, Vietnam.

CONFLICT OF INTEREST

Conflict of interest declared none.

REFERENCES

1. Saint-Paul U. The potential for *Colossoma* culture in Latin America. Infofsh International 1991;2:49-53.
2. Melard C, Orozco JJ, Uran LA, Ducarme C. Comparative growth rate and production of Colossoma macropomum and Piaractus brachypomus (Colossoma bidens) in tanks and cages using intensive rearing conditions. European Aquaculture Society 1993;4:433 442. Available from : http://www.vliz.be/en/imis?refid=14733
3. Graef EW. As espécies de peixe com potencial para criação no Amazonas. Instituto Nacional de Pesquisas da Amazônia 1995;29-43
4. Aride PHR, Roubach R, Nozawa SR, Val AL. Tambaqui growth and survival when exposed to different photoperiods. Acta Amaz. 2006;36(3):381–4. Available from: http://dx.doi.org/10.1590/s0044-59672006000300015
5. de Almeida NM, Bueno Franco MR. Determination of essential fatty acids in captured and farmed tambaqui (Colossoma macropomum) from the Brazilian Amazonian area. J Am Oil Chem Soc. 2006;83(8):707–11. Available from: http://dx.doi.org/10.1007/s11746-006-5027-9
6. Mello F De, Felippe D, Godoy LC, Lothhammer N, Guerreiro LRJ, Streit Jr. DP. Morphological and morphometric analysis of skeletal muscle between male and female young adult Colossoma macropomum (Characiformes: Serrasalmidae). Neotrop Ichthyol. 2016;14(2). Available from: http://dx.doi.org/10.1590/1982-0224-20150149
7. Antonio Alves de Melho Filho, Hamilton Hermes de Oliveira, Francisco dos Santos Panero, Ricardo Carvalho dos Santos. Physicochemical analysis of the oil of tambaqui fillet (Colossoma macropomum) cultivated in the state of Roraima, Brazil. Orbital: The Electronic Journal of Chemistry 2012; 4: 263-272. Available from : http://orbital.ufms.br/index.php/Chemistry/article/view/430
8. Borges A, Conte-Junior CA, Franco RM, Máralém ET, Freitas MQ. Quality parameters of pacu (*Piaractus mesopotamicus*) and tambaqui (*Colossoma macropomum*) gutted and stored on ice for different periods. Int Food Res J. 2014;21:589-96.
9. Sleder F, Cardoso DA, Savay-da-Silva LK, Abreu JS de, Oliveira ACS de, Almeida Filho ES de. Development and characterization of a tambaqui sausage. Ciência e Agrotecnologia. 2015;39(6):604–12. Available from: http://dx.doi.org/10.1590/s1413-70542015000600007
10. Kato HCA, Peixoto Joele MRS, Sousa CL, Ribeiro SCA, Lourenço LFH. Evaluation of the Shelf Life of Tambaqui Fillet Processed by the Sous Vide Method. J Aquat Food Prod Technol. 2017;26(10):1144–56. Available from: http://dx.doi.org/10.1080/10498850.2014.986593
11. Mendes jm, dairiki jk, inoue laka, jesus rs de. Advantages of recovery from pre-slaughter stress in tambaqui Colossoma macropomum (Cuvier 1816) agroindustry in the Amazon. Food Sci Technol. 2017;37(3):383–8. Available from: http://dx.doi.org/10.1590/1678-457x.14316
12. Farzana Binte Farid, Dr. Gulshan Ara Latifa, Dr. Subhash .et.al. Effects of dry, pickle and brine Salting on biochemical and mineral composition and bacterial load of freshwater snakehead fish Taki (*Channa punctatus*). Int. J. Adv. Res. 2016;4:150-6.Available from : http://www.journalijar.com/uploads/443_IJAR-8496.pdf
13. Uddin KB, Reza MS, Islam MN, Kamal M. Influence of salt on drying performance of silver jewfish (Otolithes argentatus) in a Hohenheim type solar tunnel dryer. J Bangladesh Agric Univ. 2014;12(1). Available from: http://dx.doi.org/10.3329/jbau.v12i1.21416
14. Andersen E, Andersen ML, Baron CP. Characterization of Oxidative Changes in Salted Herring (Clupea harengus) During Ripening. J Agric Food Chem. 2007;55(23):9545–53. Available from: http://dx.doi.org/10.1021/jf071369b