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

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**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 fillet with preservation 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°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

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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 conditions.

MATERIAL & METHODS

Material

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°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 soaked fillets were dried at different temperature viz., 50, 55, 60 and 65°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 monitor 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**

<table>
<thead>
<tr>
<th>Salt soaking time (hours)</th>
<th>Salinity (%) in the dried tambaqui fillet (counted on the dry basic)</th>
<th>Sensory score of the dried tambaqui fillet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.35±0.01&lt;sup&gt;e&lt;/sup&gt;</td>
<td>2.84±0.02&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>0.5</td>
<td>9.28±0.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.79±0.02&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>1.0</td>
<td>10.45±0.02&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.52±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>1.5</td>
<td>11.97±0.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.65±0.03&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>2.0</td>
<td>12.74±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.93±0.01&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

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 study by 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).

**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. 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 0.5 and 1.5 percent.

**Table 2**

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

<table>
<thead>
<tr>
<th>Salt soaking concentration (%) (counted on the wet basic)</th>
<th>Salinity (%) in the dried tambaqui fillet (counted on the dry basic)</th>
<th>Sensory score of the drilled dried tambaqui fillet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.35±0.01&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.84±0.01&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>0.5</td>
<td>7.29±0.01&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3.49±0.02&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>1.0</td>
<td>8.13±0.03&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.57±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>1.5</td>
<td>9.45±0.02&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.42±0.02&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>2.0</td>
<td>10.69±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.92±0.03&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

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. 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 °C), optimal drying temperature was recognized 60°C where highest sensory score was reported.12

**Table 3**

**Sensory score of the dried tambaqui fillet by different drying temperature (°C)**

<table>
<thead>
<tr>
<th>Drying temperature (°C)</th>
<th>Sensory score of the drilled dried tambaqui fillet</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>3.74±0.01&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>55</td>
<td>4.01±0.03&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>60</td>
<td>4.62±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>65</td>
<td>4.05±0.02&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

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 °C to 55°C 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. 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**

<table>
<thead>
<tr>
<th>Preservation time (months)</th>
<th>Colour score</th>
<th>Flavor score</th>
<th>Aroma</th>
<th>Mold appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.62±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.58±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.49±0.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not detected</td>
</tr>
<tr>
<td>3</td>
<td>4.62±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.56±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.49±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not detected</td>
</tr>
<tr>
<td>6</td>
<td>4.60±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.55±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.47±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not detected</td>
</tr>
<tr>
<td>9</td>
<td>4.59±0.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.55±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.46±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not detected</td>
</tr>
<tr>
<td>12</td>
<td>4.58±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.03±0.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.12±0.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

*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. Andersen et al reports that the high concentration of salt has been shown to prevent microbial spoilage in similar products.

**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.

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**CONFLICT OF INTEREST**

Conflict of interest declared none.
REFERENCES


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