QUALITY CHANGE OF SALTED MUGIL CEPHALOUS (BOURI FISH) SPECIES DURING STORAGE AT AMBIENT TEMPERATURE

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ABSTRACT

The present study was performed to investigate the influence of salt (25%) and storage time under room temperature on the sensory, nutritive value and microbiological analysis of salted Mugil Cephalous. Protein, crude fat, ash, pH, fiber and moisture content were analyzed in fresh fish and after salting. Sensory evaluations were improved with time until 3 months, after 3 months sensory evaluations were badly affected. Chemical composition was reduced during storage period and the reduction was statistically significant (p˂0.05) during 6 months of storage time. The average of Aerobic Plate Count (APC) at 0 week, month1, month2, month3, month4, month5 and month6 were 6.5X10⁰ ±1.62X10⁻³, 4.5X10⁻³ ±1.41X10⁻², 2X10⁻³ ±1.01X10⁻², 1.5X10⁻³ ±10⁻², <100, <100 and <100, respectively. While the Staph aureus counts were 2.5X10⁻² ±1.01X10⁻¹, 1.5X10⁻² ±1.13X10⁻¹, <100, <100, <100, <100 and <100 respectively, the APC and Staph aureus counts were reduced during the storage time. Yeast-mold and Anaerobic counts were absent. Cl. Botulinum cannot be isolated. The result of this study indicated that salted fish stored for 3 months had the best quality and shelf life for Mugil Cephalous Species.

Key words: Quality change, Mugil cephalous, Storage, Ambient temperature.

INTRODUCTION

Safety of fish product and their quality assurance is one of the main problems of food industry today. The presence or absence of food borne pathogens in a fish product is a function of the harvest environment, sanitary conditions, and practices associated with equipment and personnel in the processing environment (Food and Drug Administration, 2001 and Huss, 2003). The handling of fish product during process involves a risk of contamination by pathogenic bacteria such as Staph aureus causing food borne human intoxication (Shena and Sanjeev, 2007). Salting process is considered as one of the oldest methods of fish preservation, and this process is still been used in several places around the world. The effect of salt is to obstruct or destroy the growth of the microorganism, where in this way, the fish meat gets its way to durability. The preservation period of product is linked to the amount of salt added, therefore a straight proportion is present between the amount of salt used and the preservation period (Bahri et al., 2006).

Salted fish products are popular in many countries around the globe. Such product proved its safety for millenniums even in developed countries (Turan et al., 2007).

This study was to carry out the effect of salting process as well as storage temperature on sensory, chemical and microbiological analysis of the Mugil Cephalous.

MATERIALS AND METHODS

A- Collection of samples:
Samples of fresh Mugil Cephalou. fish were Collected from local fish market. In polyethylene bags with crushed ice and transported to the Mansoura lab where chemical and microbiological analysis were immediately carried out.

B- Salting Process:
The collected fishes were washed, eviscerated and thereafter for purpose of salting, a total weight of salt estimated 25% of the fish weight was used. The procedure used is called dry salting. In this method salt was applied by hand and brushed of the fish surface; the inner lining of eviscerated abdominal cavity and the gills chambers. This process was
conducted by separating the fish layers by coarse salt mattresses inside a plastic container. The stack of the fish and salt are left about 7 days to let the salt penetrate the muscles, followed by extracting the fish fluids through plasmolysis. The extracted fluid (Pickle) was allowed to drain continuously. Used salt was removed from the fish surfaces and the fish restacked with new dry salt between the layers once during the ripening process. Salted product, was packed in polyethylene bags and stored at room temperature for six months.

C- Sensory Evaluation:
For examination purposes, end products were submitted on 20 persons test panel. Comparison was carried out in terms of organoleptic characteristics, such as color, flavor, test, texture and general appearance. The panel was requested to rate each organoleptic feature of the end products according to a 10 point scale (10=excellent; 8-9 very good; 6.5-7.9 good; 5-6.4 fair; <5 bad), using the score method as reported by (Afolbi et al., 1984).

D- Sample preparation (AOAC, 2000)
Firstly the fish length and weight taken and after that the fish heads, scales, tails, fins, guts and inedible bones were removed and discarded. The fish were filleted to obtain all flesh and skin from head to tail and from top back to belly on both sides. The fillet were thoroughly homogenized in a sterile mortar and used for examination. Some parts of homogeneous selected randomly for chemical analysis and chemical indicates spoilage tests the other parts of the homogeneous subjected to proximate analysis.

E- Chemical Analysis:
The water was determined on approximately 5 g of minced muscle by oven drying at 105 ±3°C until a constant weight, following technique 950.46 [Association of Official Analytical Chemists (AOAC, 2000). Percent protein (Kjeldahl N X 6.25) was determined from a 1 g sample for each treatment by AOAC (2000). Lipid was extracted from samples with a mixture of chloroform, methanol, and water (Bligh and Dyer, 1959). Ash was determined by dry-ashing in a furnace at 550 ±5°C for 24 h (AOAC, 2000). The pH was measured as described by Ludorf and Meyer (1973) using a digital pH meter (Hanna Germany). Mohr method was used to determine salt content in fish muscle (AOAC, 2000)

Microbiological Analysis:
Preparation of samples:
The collected samples were prepared according to the technique recommended by (ICMSF, 1996). The prepared samples were subjected to the following examination:
- Determination of Aerobic Plate Count (APC) according to (APHA, 2001).
- Determination of Staph aureus count according to (Food and Drug Administration, 2001).
- Determination of yeast-mold count (ISO 21527, 2008).
- Enumeration of Anaerobic count according to (Pifco, 1974).
- Isolation of Cl. botulinum according to (Eyre, 2009).

RESULTS

Table 1: Chemical composition of fresh Mugil Cephalous (g/100g)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>63.23 ± 1.35</td>
</tr>
<tr>
<td>Ash</td>
<td>2.4 ± 0.19</td>
</tr>
<tr>
<td>Protein</td>
<td>18.40 ± 0.59</td>
</tr>
<tr>
<td>Lipid</td>
<td>14.63 ± 0.34</td>
</tr>
<tr>
<td>Fiber</td>
<td>1.34 ± 0.12</td>
</tr>
<tr>
<td>pH</td>
<td>6.6</td>
</tr>
</tbody>
</table>
Table 2: Sensory evaluation of salted *Mugil Cephalous* using taste panel

<table>
<thead>
<tr>
<th>Parameters</th>
<th>0 week</th>
<th>Month 1</th>
<th>Month 2</th>
<th>Month 3</th>
<th>Month 4</th>
<th>Month 5</th>
<th>Month 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>9 ±0.362</td>
<td>8.4±0.368</td>
<td>8±0.368</td>
<td>6.7±0.10</td>
<td>6±0.10</td>
<td>5.5±0.10</td>
<td>4±0.10</td>
</tr>
<tr>
<td>Taste</td>
<td>9.1 ±0.10</td>
<td>8±0.368</td>
<td>7.1±0.368</td>
<td>6.5±0.10</td>
<td>5.5±0.10</td>
<td>5.3±0.10</td>
<td>3.9±0.10</td>
</tr>
<tr>
<td>Colour</td>
<td>9.4±0.368</td>
<td>8.6±0.368</td>
<td>8.2±0.368</td>
<td>7.1±0.368</td>
<td>6.3±0.10</td>
<td>6±0.10</td>
<td>5.5±0.10</td>
</tr>
<tr>
<td>Texture</td>
<td>8.8±0.10</td>
<td>7.1±0.10</td>
<td>6.9±0.100</td>
<td>6.4±0.368</td>
<td>5.7±0.10</td>
<td>5.2±0.10</td>
<td>4.1±0.10</td>
</tr>
<tr>
<td>General Appearance</td>
<td>9.2±0.368</td>
<td>8.5±0.368</td>
<td>7.4±0.368</td>
<td>6.1±0.10</td>
<td>5.3±0.10</td>
<td>5±0.10</td>
<td>4.4±0.10</td>
</tr>
</tbody>
</table>

Table 3: Change in chemical composition of salted *Mugil Cephalous* during storage at room temperature (g/100g)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>0 week</th>
<th>Month 1</th>
<th>Month 2</th>
<th>Month 3</th>
<th>Month 4</th>
<th>Month 5</th>
<th>Month 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>56.43±1.25</td>
<td>49.84±1.05</td>
<td>31.44±1.002</td>
<td>18.73±0.10</td>
<td>15.92±0.10</td>
<td>13.02±0.10</td>
<td>12.53±0.10</td>
</tr>
<tr>
<td>Sodium Chloride</td>
<td>11.7±0.13</td>
<td>12.71±0.10</td>
<td>13.59±0.106</td>
<td>13.80±0.10</td>
<td>14.10±0.103</td>
<td>14.42±0.113</td>
<td>14.57±0.11</td>
</tr>
<tr>
<td>Protein</td>
<td>16.20±0.39</td>
<td>14.41±0.27</td>
<td>13.92±0.101</td>
<td>12.71±0.10</td>
<td>11.43±0.103</td>
<td>10.71±0.106</td>
<td>9.88±1.10</td>
</tr>
<tr>
<td>Lipid</td>
<td>14.20±0.14</td>
<td>14±0.10</td>
<td>12±0.100</td>
<td>11.83±0.113</td>
<td>11.712±0.104</td>
<td>11.512±0.103</td>
<td>11.41±0.10</td>
</tr>
<tr>
<td>Fiber</td>
<td>1.23±0.103</td>
<td>1.12±0.101</td>
<td>1.02±0.11</td>
<td>0.925±0.112</td>
<td>0.832±0.108</td>
<td>0.523±0.716</td>
<td>0.340±0.10</td>
</tr>
<tr>
<td>pH</td>
<td>6.6</td>
<td>6.5</td>
<td>6.2</td>
<td>6.1</td>
<td>5.9</td>
<td>5.6</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Table 4: Changes in microbiological quality of salted *Mugil Cephalous* during storage at room temperature

<table>
<thead>
<tr>
<th>Microbial counts (cfu/g)</th>
<th>0 week</th>
<th>Month 1</th>
<th>Month 2</th>
<th>Month 3</th>
<th>Month 4</th>
<th>Month 5</th>
<th>Month 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic Plate Count (APC)</td>
<td>6.5X10³±1.6X10³</td>
<td>4.5X10³±1.4X10²</td>
<td>2X10³±1.0X10²</td>
<td>1.5X10³±10²</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Staph, aureus</td>
<td>2.5X10²±1.0X10²</td>
<td>1.5X10²±1.1X10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Yeast-molds</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Anaerobic Count</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>
DISCUSSION

Currently, the moisture contents have recorded high value 63.23±1.35%. The ash content was 2.44±0.19% while protein and lipid contents were 18.40±0.59% and 14.63±0.34% respectively. The fiber content was 1.34±0.12%. These results agreed with those obtained by Mohamed et al. (2009).

Significant differences (p<0.05) in the sensory evaluation during storage period based on the panel's score. In the present experiment, scores are the average of 20 panel taste sheets. It could be noticed that salted samples at 0 (week) has received higher scores followed by 1 month. Samples has received lowest scores at 3 months and 6 months the product was rejected. This wide range indicated the diversity in the final quality and can be largely attributed to the effect of various conditions upon the salting agents and activities. It is seen that the main factor affecting the quality is time of storage.

The moisture content changes were determined to be decreased progressively during the six months storage period. The moisture contents of salted samples were determined as 56.43±1.25% and 12.53±0.100 at 0 week and 6 months respectively. The reduction in moisture contents during storage can be attributed to protein denaturation and consequent loss of water-holding capacity of examined fish samples. Dry salting produced considerable loss of constituent water due to heavy uptake of salt Martinez and Gomez (2006). The findings of present study are similar to the findings of Egbal et al. (2010). Changes of ash content of salted mugil cephalous samples were least 11.70±0.13% at 0 week, highest 14.57±0.113% at six months (Table 2). The relatively high ash content observed in salted samples can be attributed to the salt penetration into fish flesh during the curing process. The findings of present study nearly similarly to Farid et al. (2014).

The protein content of samples was determined least 9.88±1.06% at 6 months and highest 16.20±0.39% at 0 week as recorded. It is evident that the protein content of processed fish has decreased after the course of salting, loss of protein during processing is extremely variable. In our results the losses of protein during storage period was averaged to 6.32%. Salting of fish was usually accompanied by protein losses, as water is drawn out, some protein is dissolved into the brine (Clucas, 1981). Generally, the quantity of protein loss depends on the exact nature and duration of the salting.

Process and the conditions of fish when salted (Eltom, 1989). The lipid contents changes were determined to be at least 11.410 ± 0.101% at the end of experiment period, and highest 14.20 ± 0.14%. It was clear from the present results that lipid content was decreased. Also fat might be decreased due to oxidative deterioration, thereby affecting lipid extraction (Farid et al., 2014). Similar results obtained by El-Sebahy and Metwalli (1988).

Changes in fiber content of salted mugil cephalous samples were found at least 0.340 ± 0.104% and highest 1.23 ± 0.103%. The pH values of samples were determined least 5.5, highest 6.6. Similar results were reported by Bahri et al. (2006).

Concerning the APC in fresh fish used as raw material, ranged between 105 and 107cfu/g, the fish is more susceptible to microorganisms after catching. The number of bacterial counts may be possibly explained by contamination of fish during catching, handling, transportation and exposure to the surrounding environment (Gram, 1989). The bacterial flora on newly caught fish depends on the environment in which it was caught rather than on the fish species (Liston, 1980). The APC of salted samples were varied during storage time. The mean value at 0 week was 6.5X103 ± 1.62X103cfu/g (table 3). There was marked increase of APC in zero week, then after that the counts begin to decrease as salting proceeded. The early increase occurred while fish was wet and the provision of salt promoted the growth of halotolerant and halophilic bacteria in the fish. As the fish became drier there was decrease in water activity and this together with the accumulated salt in the flesh, resulted in suppression of bacterial growth. As chloride ions present in salt considered to be toxic for the microorganisms.

In this work 105cfu/g of the APC was used as the limit for the evaluation of microbial spoilage. When the aerobic plate count reach 107cfu/g the food product was assumed to be near spoilage (Ozogul et al., 2004).

In this study, the microbial growth was lower in salted samples and hasn’t reach 107cfu/g, however by the end of storage period growth was not detected. Staph. aureus count was determined in the samples. Small number of Staph. aureus in water products don’t cause any health problems, however this microorganism can reach high level (>5 log10cfu/g) in products prepared by hand under bad conditions leading to food poisoning (Varnam and Evans, 1991). In this study the values of Staph. aureus was begin with 2.5X104± 1.01X103 in the zero week and disappear in the 3rd month. No yeast or mold or anaerobic were detected in our fresh or salted samples. Also Clostridium Botulinum can’t be detected in both fresh and salted samples. The quality of the product can be largely attributed to the effect of various conditions upon the salting agents and activities. It’s seen that the main factor affecting the quality is time of storage.
CONCLUSION

From the result of the present study, the sensory evaluation proximate analysis and pH value showed that dry salted product have greater nutritive value in terms of percentages crude protein and experimentally it has been proved that this product has longer shelf life and has found better way for preservation at laboratory condition.

REFERENCE


Tغيرات الجودة لأسماك البوري المملح أثناء تخزينها في درجة حرارة الغرفة

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أجريت هذه الدراسة لمعرفة تأثير إضافة الملح بنسبة 25% والحفظ في درجة حرارة الغرفة على القيمة الغذائية والحالة التكنولوجية لأسماك البوري لمدة ستة أشهر. لذا فقد تم تحليل العينات كمياً وكميًّا لمعرفة التأثير على المكونات من البروتين، الدهون، أملاح، رطوبة، أليف مع قياس نسبة الامتصاص الهيدروجيني (pH) ووجد أن المكونات تقل بزيادة درجة الحفظ كما تقل تحليل العينات لمعرفة العد الكلي للمكروبات وعدد المكور المتقندي ووجد أن قيمة العد تقل بزيادة درجة الحفظ إلى أن تتلاشى نهائيًا من العينات. من خلال الفحص لم نجد خباخ أو فطريات أو ميكروبات لاهاوية أو ميكروب الكولسترول بيتولينوم. من نتائج هذه الدراسة أن أسماك البوري المملحة المخزنة لمدة ثلاثة أشهر هي الأفضل في الجودة والصلاحية.