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FISH SENSORY AND QUALITY LOSSES IN *OREOCHROMIS NILOTICUS* OBTAINED FROM BENDU RIVER, KEBBI STATE, NIGERIA

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ABSTRACT

The study was carried out to evaluate the sensory and quality losses associated with Orechromis niloticus purchased from River Bendu. The Tilapia fish samples were preserved in Refrigerator during assessment of quality losses. Four fish were randomly sampled on 0, 3, 6, 9, 12 and 15 days respectively for sensory Evaluation (Demerit Score) and Biochemical Analysis using pH and TVB-N. One – way analysis of Variance and correlation analysis revealed that there were changes in the correlation and demerit scores of all fish sensory parameters which significantly increased ($p>0.05$) as a result of increase in number of days and time of storage meaning that fish spoilage and nutritional losses increased with the length of fish storage. There were also significant differences ($p>0.05$) in the mean pH and TVB-N of the fish sold around Bendu River. The fish nutritional losses had been attributed to poor storage facilities, bad handling and inadequate refrigeration. Good fishery policy to improve declining fishery resources of Bendu River was therefore recommended.

INTRODUCTION

Post-harvest losses in fish products are problematic in the Nigerian fish industry particularly at the artisanal level. Post-harvest nutritional losses happen at various points from capture to marketing. Although captured fisheries takes over 60 % of total domestic production per annum, the magnitude of losses in this sector has been estimated at 30-50 % of total catches [1].

This range of figure is alarming considering the fact that Nigeria presently meets only 60 % of her total fish need and spends scarce foreign exchange in importing fish to augment the shortfall. Fish is a highly perishable commodity. The fish spoilage rate is generally caused by high ambient temperature. Apart from the subsistence operation in catching fish, in most cases bacterial infection set in on the fish flesh as a result of injuries sustained and also to stress from struggling. The time space between catching and preparation for preservation further complicates the problem [9]. Freshness is one of the most significant things to look for in fish of good quality. Sensory methods (e.g. quality index method) and instrumental methods (e.g. chemical, physical and bacteriological analysis) are usually employed to measure the degree of fish quality. All these methods have their operational limits. Sensory analysis is suitable and indeed inevitable for enhancement of fish product. But the services of highly trained panel will be required which is often costly to employ. Fish is often considered to be a good supplier of protein needed for normal body growth and maintenance of good health [2]. However the fact remains that it is easily spoiled, very susceptible to oxidation and often developing off-flavours due to wrong handling or poor storage. The preservation of fish high nutritional quality is usually affected by several parameters such as the fish diet, handling and storage. Nutritional losses can take place in fresh fish. Fish processing is no exclusion and in conventional techniques, the losses may be severe [14]; [8]. As fish spoils, it will result to loss in its nutritional value. It has been observed that there are indications of fish nutritional losses in fishery sector most especially in the fishery resources of Bendu River (12]. These happen at almost all the stages from capturing to marketing points as fishing activities are carried out by fishermen, fish sellers and fish processors in and around the river but information on different stages of fish post harvest losses in terms of quality and quantity are not adequate. This knowledge is necessary for effective policy and management of fishery resources of Bendu river and Nigeria as a whole. The Research was carried out to find out the stages of serious nutritional losses in order to pay attention to the reduction of losses at these stages and in addition to provide recommendations that would enhance formulation of policy guidelines for utilization and exploitation of the declining fishery resources of Bendu river. It is therefore justified that fish nutritional losses occur in all aspect of fish production from the capturing to marketing point.

MATERIALS AND METHODS

Description of the Study Area

Bendu river is located in Bendu, Suru Local Government Area; in the Dakingari district. It is the major source of water supply to people of Bendu community. The activities of people within the river environment are mainly farming and fishing.

Fish sampling and Preparation

24 fresh Tilapia were procured from fishermen around 3.p.m at Bendu river area of Kebbi State and was immediately conveyed in Polythene Bag filled with water to the Laboratory belonging to the Department of Science Laboratory Technology,

Kebbi State Polytechnic, Dakingari. Upon arrival at the laboratory, the Polythene Bag with fish was stored in a refrigerated chamber (0–2^{0}C) for 15 days. During storage, the draining and addition of ice were conducted every 24 h. Four fish were removed for sampling at 0, 3, 6, 9 12, and 15 days of storage and used for chemical and sensory analyses.

Sensory Evaluation

Sensory analyses were performed by a panel of ten experienced assessors, as samples were obtained at selected time intervals. Four fish were randomly sampled on 0, 3, 6, 9, 12, and 15 days respectively. During the storage period, any melted ice was replaced. Organoleptic assessment was carried out using the Quality Index Method (QIM) by [13]. The only information provided to the assessing members was that they were to evaluate four samples of the whole fish at a session using the scale provided. The scheme employed the main three quality parameters which include appearance, eyes, and gills against: skin colour, belly, and smell, eye clarity and gills colour and smell respectively (Appendix III). The excellent freshness quality fish ranked with Quality Index demerit score between 0 – 1, fish of good quality 1 – 2 and deteriorated fish would have the scores of 2 -3. The scores of the separate characteristics were added to give an overall sensory score (Total QIM score).

Biochemical Analyses

pH

This was carried out according to the procedures described by [6]. Ten grams of fish muscle were homogenized in 50 ml of distilled water and the mixture filtered using Whatman filter paper. The pH of the filtrate was measured using a pH meter at which ambient temperature was used to read measurements accurately to ±0.01 pH units.

Total Volatile Base Nitrogen (TVB-N)

TVB-N content were expressed as mgN/100g of fish flesh. TVBN = (V × C × 14 × 100) /10, where V was the volume of hydrochloric acid added and its concentration (C), 10 represented the weight of the sample while 14 was the molecular weight of nitrogen [6].

Statistical Analysis

The results of the Research were presented in Tables and Bar Charts. Numerical results were subjected to one-way ANOVA, Duncan Multiple Range Test and Correlation Analysis

RESULTS

The demerit score of the fish skin colour, stiffness, belly, smell, eye clarity / colour, shape, gill colour and gill smell significantly increased in the time (in days) order: 0 > 3 > 6> 9 > 12 > 15. The correlation between the time in days and the demerit score

for all the fish sensory parameters were strong, highly significant and positive which also implied that as the time increased, the demerit score significantly increased. The changes in the score of Tilapia obtained from river Bendu were shown in Figure 4.1, 4.2 and 4.3 respectively. During the 15 days of post mortem storage, the fish underwent noticeable changes in general appearance (skin colour, stiffness, Belly, and smell), eyes (clarity/colour, shape) and Gills (gill colour and smell). Table 4.1 showed that after 9 days of storage, the total QIM score was above 2 point, with this value, the fish was considered unacceptable by the members of the panel. During this period, the skin colour changed from bright with iridescent pigment to discoloured and dull. In the same period, the eyes changed from convex with black and bright pupil to slightly sunken, opaque and gray pupil. The gills, which were initially rose-red changed to pale pink with brownish zones and some unpleasant odours. At the end of storage, all fish showed eyes completely sunken with gray pupil and milky cornea and brownish-yellowish gills with very unpleasant odour.

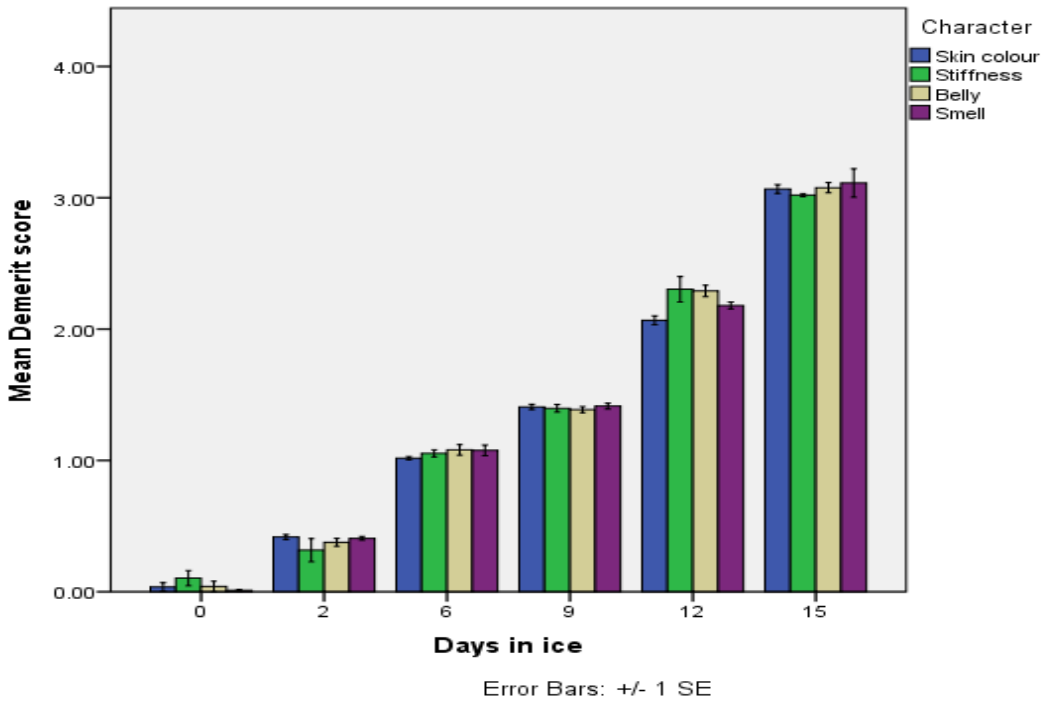

Figure 4.1: Demerit Score for the General Appearance of Fish

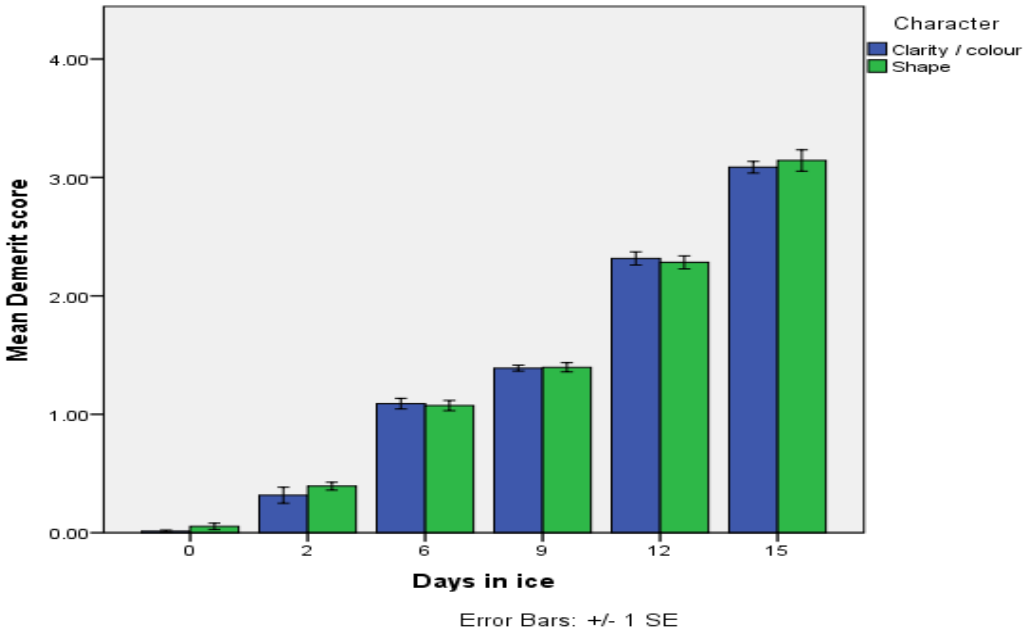

Figure 4.2: Demerit Score for the Eye of Fish

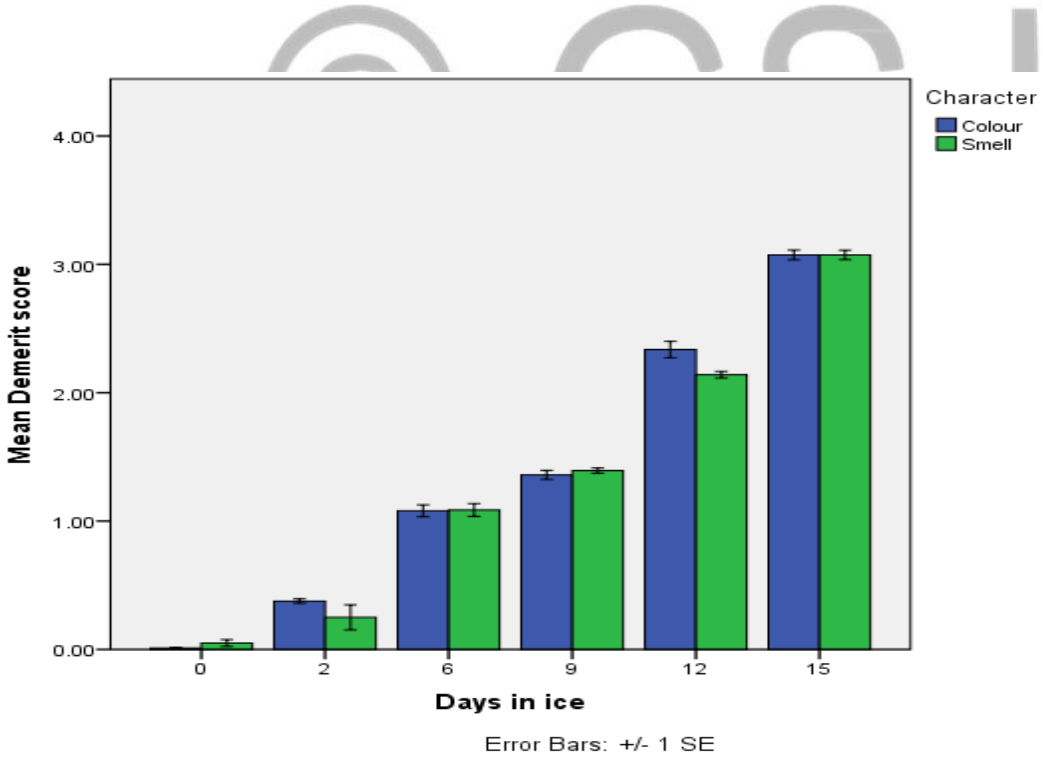

Figure 4.3: Demerit Score for the Gill of Fish

Biochemical Evaluation of Fish sold around Bendu River

There were significant differences in the mean pH and TVB – N of the fish sold around Bendu river ($p < 0.05$). The pH and TVB – N of the fish had strong, highly significant and positive correlation with time of storage which implied that the pH and TVB – N increased as the time after catching the fish increased from 0 to 15 days. From Table 4.2a, ANOVA revealed that the pH at 15 days was statistically comparable to that of the 12th day but was significantly higher than those of the 9th, 6th, 3rd days and the fresh (0 day). Those of the 12th, 9th and 6th days were statistically comparable but the pH at the 12th day was significantly higher than those of the 3rd day and fresh (0 day). The pH of fish at days 9, 6 and 3 were not significantly different from each other but were significantly higher than that of the fresh. The TVB – N of the fish significantly increased as the test time increased except those of the fresh and 3rd day which were not significantly different from each other.

Table 4.1: Demerit score of fish stored for 15 days

Days	Skin colour	Stiffness	Belly	Smell	Eye clarity / colour	Shape	Gill colour	Smell	Significance at 95% CI
0	0.04^{f}	0.10^{f}	0.04^{f}	0.01^{f}	0.01^{f}	0.05^{f}	0.01^{f}	0.05^{f}	*
3	0.42^{e}	0.32^{e}	0.38e	0.41e	0.32e	0.39e	0.38e	0.25e	*
6	1.02^{d}	1.05^{d}	1.08^{d}	1.08^{d}	1.09^{d}	1.07^{d}	1.08^{d}	1.09^{d}	*
9	1.41^{c}	1.40^{c}	1.39^{c}	1.41^{c}	1.39^{c}	1.40^{c}	1.36^{c}	1.39^{c}	*
12	2.07b	2.03b	2.29b	2.18b	2.32b	2.28b	2.34b	2.14	*
15	3.07^{a}	3.02^{a}	3.08^{a}	3.11^{a}	3.09^{a}	3.14^{a}	3.07^{a}	3.07^{a}	*
Correlation coefficient (with days)	0.984**	0.985**	0.987**	0.985**	0.988**	0.984**	0.986**	0.985**	
Correlation coefficient (Days vs. QIM scores for sensory quality)	0.985**	0.984**	0.986**	0.987**	0.989**	0.986**	0.988**	0.986**	

Means on the same column with different superscript are significantly different ($p < 0.05$)

*Significant at 5% level

**Correlation is significant at 1% level

Table 4.2a: pH and TVB – N of fish for the period of 15 days

Days	pH	TVB – N
0	6.53^{d}	6.95^{e}
3	6.82^{c}	$8.41d^{e}$
6	6.85^{bc}	8.55^{d}
9	6.87^{bc}	11.43^{c}
12	6.9^{ab}	13.60^{b}
15	6.94^{a}	15.40^{a}

Means on the same column with different superscript are significantly different ($p < 0.05$)

Table 4.2b: Correlation matrices between days, pH and TVB – N

	Days	pH	TVB - N
Days	1		
Ph	0.798**	1	
TVB – N	0.949**	0.757**	1

**Correlation is significant at 1% level

Discussion

During the 15 days of post mortem storage, the fish underwent noticeable changes in general appearance (skin colour, stiffness, Belly, and smell), eyes (clarity/colour, shape) and Gills (gill colour and smell). After 9 days of storage, the total QIM score was above 2 point, with this value, the fish was considered unacceptable by the panel. According to [12], the increase in the scores for the sensory parameters considered in the QIM scheme shows loss of freshness hence deterioration in fish quality. It was apparent from this study that the (skin colour, stiffness, Belly, and smell), eyes (clarity/colour, shape) and Gills (gill colour and smell) determined the sensory quality of this fish since the scores given by the panel for these parameters were in most cases more than half the total value expected at the point when a significant increase in the chemical parameters was detected**.** According to the results of study there is an increase at pH content because of nitrogenous substances that fish include depends on storage duration. The pH is the negative logarithm of hydrogen ion concentration. The pH is one of the factors that determines the survival and growth of micro-organisms during storage, processing and distribution of fish [15]. According to the literature, the pH is about 6.0–6.5 for fresh fish, and it increases during storage. The limit of acceptability is usually 6.8–7.0. Increase may also be due to an increase in volatile bases from the decomposition of nitrogenous compounds by endogenous or microbial enzymes [5]. However, post-mortem pH can vary considerably depending on the season, the species, and other factors [16]. According to [7], fish is a low acid food; the pH values obtained from this study is an indicator of fish being a low acid food. The initial lower levels of TVBN observed could be attributed to lower levels of endogenous ammonia due to slower microbial breakdown of proteins during the first 9 and 12 days of storage in ice [15]. The formation of TVBN is associated with the activity of micro-organisms and tends to be high at high microbial populations as observed by [3] and [4].

Conclusion

The biochemical test result in terms of pH and TVB – N of fish at different day interval for 15 days and relationship using correlation as the day increased shows the demerit score of fish and its relationship with QIM score. There were also significant differences in the mean pH and TVB-N of fish sold around Bendu river ($p<0.05$) as the storage days increased. With the increasingly low domestic fish production in Nigeria, any management blueprint for Bendu river fishery must include improvement in the existing conventional handling, preservation/processing and marketing practices in the river in order to make the much desired impact on fish availability.

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