

**COMPARATIVE STUDIES ON SOME UNDESIRABLE QUALITY CHANGES DURING FREEZING PRESERVATION OF TILAPIA (*OREOCHROMIS NILOTICUS*, HAMILTON-BUCHANAN, 1822) AND BELE FISH (*GLOSSOGOBIOUS GIURIS*, LINNAEUS, 1766) AT LABORATORY CONDITION.**

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**ABSTRACT**

The comparative studies of Tilapia and Bele fish were investigated during freezing preservation at -18°C for a period of 240 days. The overall acceptability score and proximate composition of Tilapia and Bele fish were studied during this period. Overall acceptability score of Tilapia and Bele fish increased from 9 to 5.5 and 9 to 4.8. The protein content (%) of frozen stored Tilapia and Bele fish dropped from 19.59 ± 0.05 to 18.31 ± 0.06 and 17.58 ± 0.03 to 16.14 ± 0.03. The fat content (%) of frozen stored Tilapia and Bele fish dropped from 4.57 ± 0.09 to 3.41 ± 0.04 and 3.75 ± 0.03 to 2.90 ± 0.04 respectively. Moisture content of Bele fish is higher than Tilapia fish. With the increasing days of storage, moisture content of these fish is decreased. Water holding capacity, Drip loss and TVN value were used as parameter for the determination of the extent of spoilage changes of these preserved fish. Water holding capacity of Tilapia fish was 350g H<sub>2</sub>O/100g of fish but it gradually decreased to 315g H<sub>2</sub>O/100g. Simultaneously, in Bele fish initial value of WHC was 350g H<sub>2</sub>O/100g and final value was 287g H<sub>2</sub>O/100g. Percent drip loss of Tilapia and Bele fish were found to increase from 0 to 14 ml/100g fish and 0 to 16ml/100g fish, respectively. Total volatile Nitrogen (TVN) of Tilapia and Bele fish increased from 4.1 to 22.18 mg N/100g of fish and 6.5 to 27.72 mg N/100g of fish. From the preservation of frozen stored Tilapia and Bele fish observed that the Tilapia fish have a better shelf life than Bele fish.

**KEY WORDS:** Bele Fish, Drip loss and Total volatile nitrogen, Freezing preservation, Overall acceptability score, proximate composition, Tilapia fish, Water holding capacity.

**INTRODUCTION**

The quality of highly perishable flesh food like fish continuously changes during storage. During post-harvest period especially the fish of the tropical countries including Bangladesh undergo deteriorative changes very quickly due to enzymatic and bacterial action. Among the various techniques of preservation, freezing is considered to be the only long term method which can preserve a fish with a minimum change in its quality. Freezing and cold storage can play a vital role in retarding deteriorative changes to a certain period of time (Dyer and Dingle, 1961). The deteriorative change in fish during freezing preservation occurs slowly and many influencing factors have direct or indirect effects on fish during frozen preservation (Clucas *et al.*, 1960). Some characteristic type of deteriorative changes including freezer burn, rancidity, protein denaturation, product dehydration, loss of water holding capacity, drip loss and product leaching which can have an overall effect on the frozen foods (Ahmed *et al.*, 1990; Kropf and Bower, 1992).

Several reports on changes in levels and types of micro flora affecting quality of several species of temperate and tropical criteria have been used to measure bio-chemical changes occurring during enzymatic breakdown of fish muscle at cold storage. Tilapia is a popular food fish all over the world and it has been an important source of protein. Bele fish is also common species for subsistence. Its flesh is tasteful. It's have potential for freezing preservation both for export and internal consumption. These species were therefore, selected for present investigations. The present investigation was designed to comparative studies on some undesirable quality changes of Tilapia and Bele fish during freezing preservation.

**MATERIALS AND METHODS**

Tilapia and Bele fish were purchased from local market in Dhaka city in the early hour of the day in very fresh and highly acceptable condition. The fish samples were then brought to the fish technology research section, IFST, BCSIR, Dhaka for conducting the experiment. The duration of study period was July 2008- February 2009. The fish were cleaned with tap water and graded and kept in polythene pack in freezing condition at -18°C. The sensory variables of the preserved fish were assessed by a panel of five judges based on 9-point hedonic scale in taste, color, slime, texture, mucus, smell etc. used by Peryan and Pilgrim (Peryan and Pilgrim, 1957). The fish were analyzed at different time periods for the determination of proximate composition to study the changes in the composition during the frozen storage period. The moisture and ash contents of the fish were determined by AOAC method (1975). The protein

content of the experimental fish samples were determined by Kieldahl method. The fat contents of fish samples were determined by Bligh and Dyer method (1959). WHC (water holding capacity) of the fish samples were determined by a method developed by Borrensen (Borrensen, 1980). The results were expressed as mean+SD and difference between the treatment groups and were analyzed by one way ANOVA test using SPSS.11.5 statistical programme.

## RESULTS AND DISCUSSION

The effects of packaging on biochemical composition of frozen Tilapia fish up to 240 days are shown in Table 1. The effects of packaging on biochemical composition of frozen Bele fish up to 240 days are shown in Table 2.

**Table 1. Biochemical composition of frozen Tilapia fish**

Freezing period in days	Moisture	Protein	Fat	Ash
0	77.37 ± 0.09	19.59 ± 0.05	4.57 ± 0.09	1.09 ± 0.06
15	77.35 ± 0.03	19.47 ± 0.52	4.38 ± 0.05	1.08 ± 0.06
30	77.34 ± 0.04	19.42 ± 0.03	4.29 ± 0.06	1.16 ± 0.03
45	77.27 ± 0.04	19.39 ± 0.05	4.26 ± 0.03	1.32 ± 0.05
60	76.53 ± 0.09	19.35 ± 0.05	4.15 ± 0.03	1.19 ± 0.03
90	76.38 ± 0.06	19.09 ± 0.05	4.13 ± 0.07	1.18 ± 0.04
120	76.31 ± 0.06	18.60 ± 0.06	3.80 ± 0.05	1.28 ± 0.04
150	76.29 ± 0.05	18.50 ± 0.06	3.56 ± 0.08	1.35 ± 0.03
180	76.22 ± 0.05	18.38 ± 0.04	3.43 ± 0.04	1.43 ± 0.05
210	76.19 ± 0.06	18.33 ± 0.07	3.42 ± 0.06	1.36 ± 0.03
240	76.17 ± 0.05	18.31 ± 0.06	3.41 ± 0.04	1.32 ± 0.04

**Table 2. Biochemical composition of frozen Bele fish**

Freezing period in days	Moisture	Protein	Fat	Ash
0	80.20 ± 0.04	17.58 ± 0.03	3.75 ± 0.03	1.15 ± 0.03
15	80.19 ± 0.03	17.51 ± 0.03	3.60 ± 0.04	1.48 ± 0.03
30	80.15 ± 0.03	17.26 ± 0.04	3.50 ± 0.03	1.41 ± 0.12
45	80.10 ± 0.03	17.16 ± 0.04	3.40 ± 0.10	1.28 ± 0.15
60	80.09 ± 0.03	16.25 ± 0.03	3.19 ± 0.03	1.56 ± 0.13
90	80.07 ± 0.04	16.24 ± 0.03	3.14 ± 0.03	1.57 ± 0.18
120	79.91 ± 0.03	16.20 ± 0.03	3.12 ± 0.05	2.09 ± 0.05
150	79.75 ± 0.03	16.19 ± 0.03	3.07 ± 0.05	1.25 ± 0.03
180	79.59 ± 0.03	16.16 ± 0.03	3.06 ± 0.03	1.60 ± 0.07
210	79.55 ± 0.03	16.15 ± 0.03	3.05 ± 0.03	1.74 ± 0.14
240	79.53 ± 0.03	16.14 ± 0.03	2.90 ± 0.04	1.61 ± 0.13

From the Table 1 and 2 shows that moisture content of Bele fish is higher than Tilapia fish and protein content of tilapia fish is higher than Bele fish. With the increasing days of Storage, moisture content of these fish is decreased. The results of the present investigation show that the protein and fat contents of the frozen stored Tilapia and Bele fish in packaging conditions decreased significantly ( $p < 0.001$ ) with the increase of storage period.

The decline of protein content would be connected with the denaturation of fish protein that is associated with frozen fish (Reay, 1933). The change in fat content during freezing preservation could be associated with the oxidation of fat (McGrill *et. al.*, 1974; Josephson and Lindsay, 1987). The organoleptic evaluation of stored Tilapia and Bele Fish was done using the sensory variables such as external appearance, odour, freeze burn, flavour, toughness, fibrousness etc. Fig. 1 shows the decreasing trend of overall acceptability score value of Tilapia and Bele fish with the progress of frozen stored period. The changing pattern of WHC in keeping condition is shown in Fig. 2. Initially the WHC value of Tilapia fish was 350g H<sub>2</sub>O/100g of fish but it gradually decreased to 315g H<sub>2</sub>O/100g. Simultaneously, in Bele fish initial value of WHC was 350g H<sub>2</sub>O/100g and final value was 287g H<sub>2</sub>O/100g. WHC of the fish muscle may be used as a parameter to assess the quality of fish during freezing preservation (Muslemuddin *et al.*, 1986). Similar effect on change of WHC in Cod, haddock, mullet, ruhi, pabda etc fish stored in different keeping condition were observed by others.

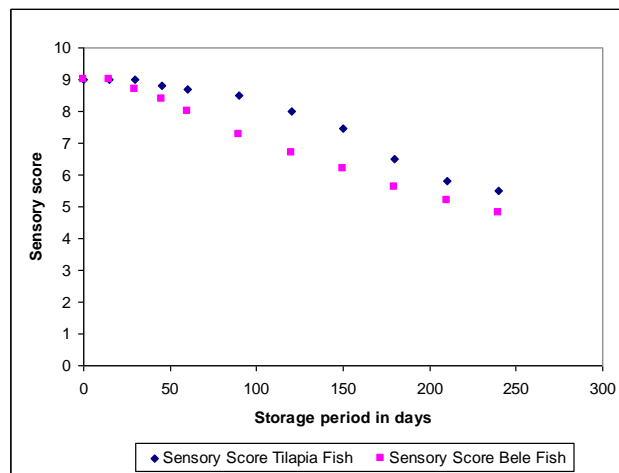


Figure 1. Overall acceptability score of Tilapia and Bele fish under packaging condition during freezing preservation of 240 days.

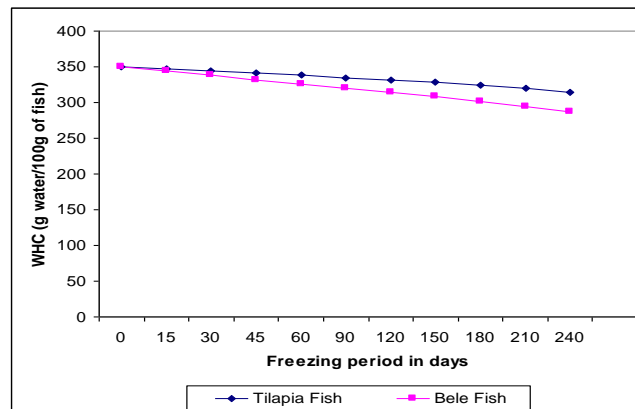


Figure 2. Line diagram showing decreasing trend in the WHC of Tilapia and Bele fish due to freezing preservation at -18°C.

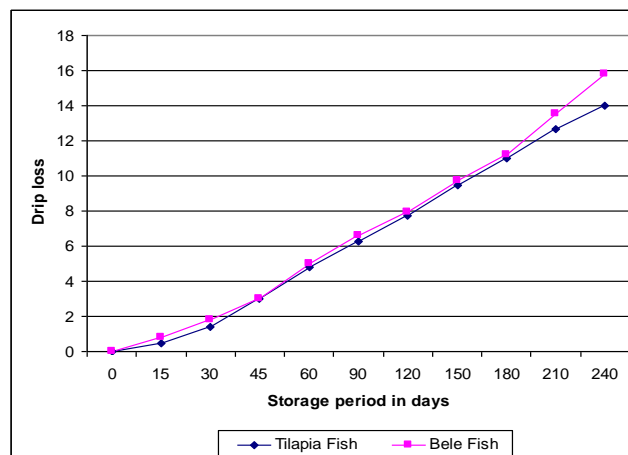
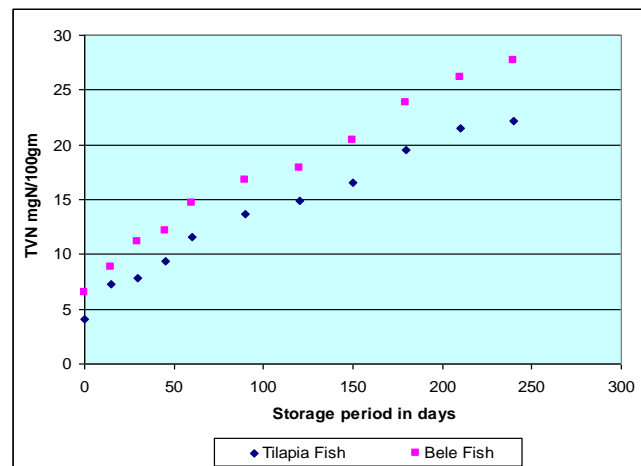


Figure 3. The increase of Drip loss of frozen stored Tilapia and Bele fish while kept at -18°C.



**Figure 4.** The changing pattern in increasing value of TVN of frozen stored Tilapia and Bele fish while kept at -18°C.

Figure 3. shows that the drip loss of Tilapia and Bele fish in packaging conditions also gradually increased loss under packaging conditions during storage period differs significantly ( $p < 0.001$ ). The drip loss is higher in Bele fish than Tilapia fish. This means drip

Figure 4. shows that the TVN value of Tilapia and Bele fish in packaging conditions also gradually increased. The TVN value is higher in Bele fish than Tilapia fish. The main component of TVN is trimethylamine and ammonia which are produced by the post mortem change of fish. The concentrations of these compounds in the tissues indicate the degree of spoilage, particularly in the later stage of spoilage (Clucas et al., 1960). The TVN value should not exceed 35 mg N/100g of fish (Fagan et al. 2003). According to this result, it is found that Tilapia fish was more acceptable than Bele fish.

## CONCLUSION

Overall findings of the present study on freezing preservation of the frozen stored Tilapia and Bele fish observed that the Tilapia fish have a better shelf life that is 240 days at -18°C than Bele fish.

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