IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, March 2022
Impact Factor: 6.252

Organoleptic Changes in Trichiurus SPP. During Frozen Storage

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Abstract: *Studies were conducted to evaluate the organoleptic changes in Trichiurus spp. (ribbon fish) during frozen storage. Ribbon fishes of 75-85cms standard length and weighing about 470-500 gms were procured in absolutely fresh condition from the local fish-landing centre at Colaba. Samples were analysed at 2 weeks intervals upto 10 weeks and thereafter at 4 weeks intervals upto 30 weeks. Fishes were assessed organoleptically based on general appearance, colour, flavour, texture and an arbitrary hedonic scoring scale of 10 to 1 was used in which '4' was considered as the border line of acceptance. The organoleptic score was '10' which decreased gradually and remained in the acceptable margin score of '4' at the end of 22nd week of frozen storage at –18°C. Therefore, organoleptically the fish is acceptable upto 22 weeks of frozen storage. The fish retains its quality upto 14 weeks afterwards it shows the sign of deterioration.*

Keywords: Trichiurus spp, Organoleptic, Frozen Storage

I. INTRODUCTION

Fish is a cheap source of animal protein. World per capita apparent fish consumption increased from an average of 9.9 kg in the 1960s to 20.1 kg in 2014. This impressive development has been driven by a combination of population growth, rising incomes and urbanization, and facilitated by the strong expansion of fish production and more efficient distribution channels (FAO, 2016). However, fish is one of the most highly perishable commodities due to its biological composition. The spoilage process begins just after the fish dies. Spoilage of fresh fish can be attributed to a series of metabolic processes that cause the fish to be undesirable and unacceptable for human consumption due to changes in sensory and biochemical characteristics (Ndome *et al.,* 2010). Spoilage causes loss of essential fatty acids, fat-soluble vitamins, protein functionality and production of biogenic amines and formation of off-odors should be considered. Therefore, fishes need to be preserved. Fish quality deteriorates very rapidly at high temperature while low temperature storage is the method of preservation recommended to retard microbial spoilage of fish (FAO, 2008). The concept of frozen storage relies on the lowering of the product temperature to slow down spoilage so that the thawed fish can retain the freshness for a longer time (Kolbe *et. al.*, 2004). It is a usual method to preserve commercial fish since it stops chemical and microbiological degradation, and is an excellent method of preserving the organoleptic attributes of fish flesh during prolonged periods of time (Careche *et. al.*, 1999). Freezing and frozen storage have largely been employed to retain the sensory and nutritional properties of fish although enzymatic and non-enzymatic rancidity is known to develop strongly under such conditions (Nielsen J and Jessen F, 2007). *Trichiurus spp* are coastal species of cosmopolitan distribution, with commercial importance in different regions of the world. It is ranked in the sixth place of landing volume worldwide.

Sensory evaluation is defined as the scientific discipline used to evoke, measure, analyse and interpret characteristics of food as perceived by the senses of sight, smell, taste, touch and hearing. Freshness of the fish is judged by the general appearance of the fish and also by the odour, colour of the gills, condition of the eyes and firmness of the flesh. Shiny and brilliant skin in fresh fish becomes dull with lack of luster and faded appearance as the spoilage progresses (Laxmanan, 2002). All visible signs of deterioration can be detected efficiently with some practice. The whole pattern of changes from very fresh fish to spoiled fish can be differentiated easily and rapidly by sensory means. Quantification of the sensory data requires the use of a scale where the person can assess the deteriorative changes that occur smoothly and continuously through varying degrees of intensity i.e. graded series of changes. Scoring is the most commonly used

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scientific method for assessing freshness of chilled fish. The deterioration in the fish quality is followed with the aid of a set of a score sheet covering each of the main aspects of quality such as appearance, odor, flavour and texture in a standard manner. Separate descriptive scales are used for each aptitude and the range is 10 to 0. The scale of "10" is absolutely fresh and zero is completely putrid. Anything below "4" is unacceptable. Since the assessment of quality depends upon these senses, these factors are called sensory or organoleptic parameters. In order to find out the deterioration of the frozen fish muscle tissue in *Trichiurus spp.* organoleptic characters were studied.

II. MATERIALS AND METHOD

The ribbon fish (*Trichiurus spp*) of 75-85 cms standard lengths and weighing about 470-500 gms were procured in absolutely fresh condition from the local fish-landing centre at Colaba. Fishes were washed and packed in insulated boxes with crushed ice and were transported to the laboratory within 1hr. In the laboratory the fish were eviscerated, beheaded, washed thoroughly with water, were cut into pieces of about 20 cm length and washed again. After draining, the fish were frozen as blocks and stored at -18°C in a freezer. Samples were analyzed at 2 weeks intervals upto 10 weeks and thereafter at 4 weeks intervals upto 30 weeks. The fishes were assessed organoleptically based on general appearance, color, flavour, texture and an arbitrary hedonic scoring scale of 10 to 1 was used in which '4' was considered as the border line of acceptance.

Samples were examined at intervals for organoleptic qualities of the cooked fish. Odor and flavour of the material were evaluated of the thawed samples after cooking. The thawed fish was cut transversely and a portion was dipped in 2% common salt solution and was steamed for 10 minutes. The cooked samples were judged for their organoleptic acceptability, which was graded according to the flavour score given by Torry Research Station (UK), 1998.

Table 1: Freshness assessment system for finfish (Torry Research Station (UK), 1998)

Characteristics of Frozen Fish	Equivalent Eating Qualities	Score
Frozen appearance: No freeze burns or ice crystals on the surface. **Thawed appearance**: Skin colours with fresh bloom distinct, flesh not translucent. **Texture of flesh**: Firm and elastic to touch	Sweet flavor characteristic of species	8 and above
Frozen appearance: Could have a slight freezer burn and few ice crystals on the surface. **Thawed appearance**: Fading and lost bloom. **Texture of flesh:** Feels softer and less elastic	Natural flavours Cold storage flavour just detectable	8 to 6
Frozen appearance: Obvious freezer burns with larger quantities of ice crystals on the surface. **Thawed appearance**: Skin lost colour and looks bleached, yellow discoloration **Texture of flesh**: Flesh soft and inelastic, finger indentations remain	Sour, bitter, rancid flavours. Well-developed cold storage flavour, texture tough and dry	5 to 3

III. RESULTS AND DISCUSSION

In order to define changes in quality during frozen storage, a 10-point hedonic scale has proved useful in comparing or screening samples. The term hedonic is defined as "Having to do with pleasure". Here, the panelist expresses his degree of like or dislike. In order for the method to be used in a consistent, scientific and meaningful way, attempts are made to put a number or a score against the changes that occur during storage, as different fish spoils at different rates and different markets have different requirements. Hence, it is very difficult to produce a standard scoring system that covers all the fish. As the fish begins to spoil, various changes occur in the muscle tissue of the fish, affecting the degree of freshness. Several earlier reviews on the evaluation of freshness of seafood as well as on the spoilage of the fish are available, including those of note are Hjorth-Hansen (1943), Reay and Shewan (1949), Shewan and Ehrenberg

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(1956), Tomiyasu and Zenitani (1957). Anderson (1908) studied criteria associated with freshness of fish. He accurately and carefully described the various criteria and recognized among other signs, condition of the eye, and texture of the flesh, odor and appearance of the abdominal walls. Stansby (1944) has also studied the various aspects of organoleptic evaluation of fish. Allison (1948) pointed out the importance of sensory judgement as a primary standard with which to compare the other tests. Joseph *et al.,* (1980) reported the organoleptic changes in fish muscle during frozen storage. They observed that, the storage period in the ice prior to freezing decreases the acceptability of the fish in a shorter time suggesting that there exists an inverse relation in the time of storage in ice prior to freezing and acceptability of the fish. Badonia and Devadasan (1980) while studying frozen stored characteristics of minced meat of ribbon fish reported that, organoleptically it was acceptable upto 12 weeks only, after which it showed marked signs of deterioration. Perigreen *et al.,* (1988) while working on *Psenopsis cyanea* reported that, organoleptically the fish was acceptable upto 32 weeks at –22°C and the samples did not show any signs of development of rancidity or off flavours upto 22 weeks of storage. Further, they observed a slight rancid flavour and yellow discoloration of the fish meat during 28 to 32 weeks of storage. Arannilewa *et al* (2005) reported that, there were changes in all the sensory parameters during frozen storage with slight change in color and significant changes in taste, in fresh water tilapia. From the foregoing it appears that, acceptability of frozen fish can be decided by studying changes in the organoleptic parameters, as the organoleptic parameters show alterations with respect to time of storage and fish species.

Table 2: Organoleptic changes in *Trichiurus spp*. during frozen storage at –18°c

Storage Period (In Weeks)	Appearance	Texture	Odour And Flavour	Score
0	Eyes convex bright and clear, gills bright and characteristics odour, very distinct silvery colour and bright appearance.	Very firm elastic and cannot be pressed.	Fresh characteristic odour and sweet flavour characteristic of species.	10
2	Bright appearance with distinct silvery colour.	Firm elastic.	Some loss of odour and sweetness.	9
4	Loss of brightness.	Firm	Lack of odour and flavour good to fine.	8
8	Loss of bloom and colour not distinct.	Firm, finger impression disappears slowly.	Neutral odour Cold storage flavour just detectable	7
10	Loss of bloom Freezer burn and few ice crystals on surface.	Feels little softer and less elastic	Cold storage flavour detectable	7
14	Loss of Brightness	Very slightly soft.	Slight strengthening of the odour but no sour or stale odour and definite loss of flavour but no off flavour.	6
18	Slightly dull colour.	Slightly soft and leaves finger impression when pressed.	Slight rancid flavour and traces of off flavour.	5
22	Slightly dull colour and discoloration of meet.	Soft and leaves finger impression when pressed.	Slightly rancid and cold storage flavour.	4
26	Dull colour and discolouration.	Soft thump impression retains.	Rancid odour and some bitterness.	3
30	Dull colour and discolouration.	Soft thump impression retains.	Sour, bitter and rancid flavour	3

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From table 2, it is evident that during frozen storage spoilage of the fish occurs in an orderly manner. The initial appearance of the skin of the fish was silvery, bright and fresh with natural shiny luster. However, around 22 weeks of frozen storage, the skin appeared dull. The texture of the fresh fish was very firm and elastic that gradually changed to soft and retained the impression when pressed over a period of 22 weeks of storage at –18°C. Further, as the storage period increased rancidity also increased, resulting in the development of stale and sour odor. The samples did not show any sign of development of rancidity or off flavour upto 18 weeks but later after 22-weeks slight rancid flavour and discoloration of the meat was observed.

Initially, the organoleptic score was '10' which decreased gradually and remained in the acceptable margin score of '4' at the end of 22nd week of frozen storage at –18°C. Therefore, organoleptically the fish is acceptable upto 22 weeks of frozen storage. The fish retains its quality upto 14 weeks afterwards it shows the sign of deterioration. The organoleptic changes occurring in the fish, during frozen storage are due to deteriorative changes taking place in the muscle tissue of the animal under investigation. Further, freezing leads to disruption of chromatophores. As a result, carotenoids are released; these carotenoids migrate to the subcutaneous fat layer causing yellowing or discoloration of the flesh (Lakshmanan, 2002). Aldehydes and ketones formed due to decomposition of peroxides interact with proteins and other constituents of the tissue forming complex molecules, which may also lead to yellowing/discoloration in frozen fish in extreme cases of oxidation. Accumulation of free fatty acids may also result in further deterioration of fish quality.

Perigreen *et al.,* (1988) while working on *Psenopsis cyanea* reported that organoleptically the fish was acceptable upto 32nd week at –22°C. Further, they observed slight rancid flavour, and yellow/discoloration of fish meat during 28th to 32nd weeks of storage. Badonia and Devadasan (1980) while studying frozen stored characteristics of minced meat of ribbon fish reported that, organoleptically it was acceptable upto 12 weeks. Similar evidences have been reported by Devadasan *et al*., (1978), Joseph *et al*., (1980), Varma *et al.,* (1994), Bandyopadhyay *et al.,* (1986), Lakshmanan *et al* (1991), Arannilewa *et al* (2005).

IV. CONCLUSION

In order to define changes in quality during frozen storage, a 10-point hedonic scale has proved useful in comparing or screening samples. Acceptability of frozen fish can be decided by studying changes in the organoleptic parameters, as the organoleptic parameters show alterations with respect to time of storage and fish species. Organoleptic score was '10' which decreased gradually and remained in the acceptable margin score of '4' at the end of 22nd week of the frozen storage at –18°C. Therefore, organoleptically the fish is acceptable upto 22nd week of frozen storage. The fish retains its quality upto 14th week afterwards it shows the sign of deterioration.

ACKNOWLEDGEMENTS

Encouragement and support provided by Dr. Ganesh A. Thakur, Principal, Mahatma Phule Arts, Science and Commerce College, Panvel, Dist.– Raigad, Navi Mumbai - 410 206 is gratefully acknowledged. Thanks are due to the Head, Department of Zoology and faculty members for cooperation and fruitful discussion on the present study.

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