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Quality assessment of torpedo SCAD (*Megalaspis cordyla*) stored in gel ice and crushed ice

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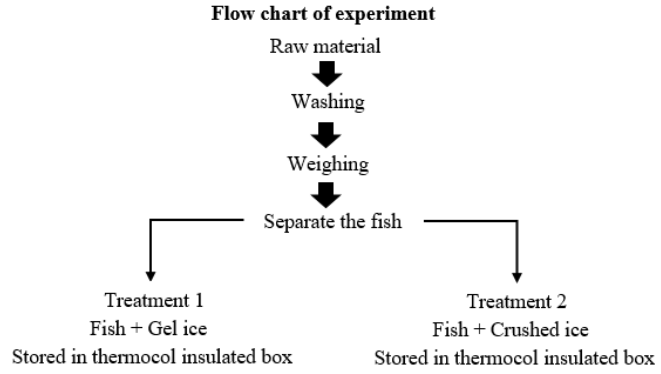
Abstract
The present study was conducted to assess the changes in the quality of Torpedo SCAD (*Megalaspis cordyla*) using gel ice and crushed ice preservation techniques for 4 days. Results indicated that fish preserved under crushed ice were spoiled at the end of 4th day of preservation and lose its freshness and sensory quality attributes. On the other hand fish preserved under gel ice exhibited significantly higher freshness values and good acceptable sensory quality attributes. Present study also indicated that melting rate of gel ice is comparatively slower compared to crushed ice which preserve the quality of fish for longer period of time. With this results, we can suggest that gel ice can be an excellent and alternative method of fish preservation, which will increase the selling capacity of the fish vendors and retailers by preserving the fish for longer period of time. Also gel ice is easy to use, no need to crush and can be reused as compared to crushed ice.

Keywords: Crushed ice, freshness, gel ice, *Megalaspis cordyla*, Torrymeter

1. Introduction
Fish is one of the protein foods that needs careful handling [1]. Total marine fish landings of India in 2018 was 3.49 million tonnes [2]. Also fish is one of the highly perishable commodity that needs to be preserved or consumed immediately once it gets caught to avoid the loss of nutritional value [3]. Different methods are used for quality assessment based on the criteria. Methods like biochemical analysis or sensory evaluation are used for assessment of the quality loss in fishes. Sensory quality evaluation is easy and simple because it is totally based on the judgment of experts or on panels of hedonic scale [4].
Ice is one of the cheapest and efficient method of fish preservation method practiced on board the vessel. But the shelf life of fish preserved under ice is generally 3-15 days depending on the species condition and shape [5]. The purpose of processing and preserving fish is to provide a high quality fish to the consumer. There are different chemicals and preservatives are used for the preserving and extending the shelf life of the fish and fishery products. 10 days storage study on STTP treated shrimp samples was carried out for physical, chemical and sensorial quality analysis [6]. An alternative method of ice preservation is by using ice packs or gel packs. Gel pack is a handheld plastic pouch like filled with water, refrigerant gel or liquid. Gel packs are frozen in freezer prior to use. To extend the quality of perishable foods (especially fish, meats, dairy products, eggs, etc.) without any refrigeration storage gel packs are used. Thus the aim of this study was to determine freshness and sensory quality difference between fish samples stored in gel ice and crushed ice.

2. Materials and Methods
2.1 Sample preparation
The present study was conducted at College of Fisheries Science, Junagadh Agricultural University, Veraval, Gujarat, India in the year 2018. Initially, 2 Kg large size (100-125 g/fish) Torpedo SCAD (*Megalaspis cordyla*) was purchased from Jaleshwar fish market located near Veraval, Gujarat, India. Fishes were caught using local gill net operated through OBM craft. Then fishes were brought to the laboratory and cleaned & washed properly with the tap water for several times, then divided into two equal groups and immediately cooled on ice before being treated in different ice boxes. The mean and standard deviations of the weight and total length of the fish studied were 115.8 ± 10.99 g and 23.3 ± 1.38 cm, respectively. Fishes were divided into 2 groups, one group of samples was packed in thermocol insulated box containing fish with gel ice (Treatment 1 – T1) and another group of samples was packed in thermocol

insulated box containing fish with crushed ice (Treatment 2 – T2). After that boxes were kept at room temperature for further analysis. Samples of gel ice packed and crushed ice packed were analyzed daily up-to 4 days.



2.2 Analytical methods

Torpedo SCAD fish samples were analyzed before chilling (zero day), after 1 day, 2 days, 3 days and 4 days of storage for their freshness and sensory evaluation. The temperature of fish muscle was also analyzed using Digital Food Thermometer. Freshness of fish was determined using instrumental method and Quality Index Method (QIM).

a. Instrumental method for assessing fish quality: Freshness meter: (Table 1)

Freshness of fish was assessed by recording the electrical resistance of skin and muscle flesh by using the Distell fish freshness meter, which has been developed at Torry Research Station (U.K.) known as Torrymeter. Readings were taken by placing the base of the meter firmly on the fish so that it lies flat against the surface and parallel to the lateral line at a thick, fleshy part of the fish. Distell fish freshness meter has reading from 0 to 16. In this meter, highest value (16) is obtained for very fresh and the reading decrease with spoilage of fish.

Table 1: Freshness meter score sheet

Raw odor description	Freshness meter score	State of spoilage
Fresh sea weedy odor	16	Very fresh
Shellfish odors and loss of fresh sea-weediness	14	↓
No odors, natural odors	13	
Slightly musty, mousy, milky or caprylic, garlic, peppery	11	
Bread, malt, beer, yeasty odors	10	
Lactic acid, sour milk, or oily odors	8	
Grass, old boots, slightly sweet, fruity or chloroform-like odors	7	Nearly spoiled
Stale cabbage water, turnip, sour sink, wet matches, phosphine like odors	5	↓
Ammonia, strong “byre-like” odors	<3	
Strong ammonia, bad eggs (hydrogen sulphide)	<3	
Putrid, sulphides	<3	Putrid

Organoleptic charts for commercial fish species [7]

b. Sensory evaluation by quality index method (QIM)

During the sensory evaluation of fish freshness, fish samples were evaluated at each time of sampling by three expert panelists. The Quality Index Method (QIM) developed by Larsen was used in this study [8]. QIM gives scores of zero for very fresh fish and scores increases with spoilage of fish (Table 2).

Table 2: Quality index method (QIM) score sheet

Quality parameter	Character	Score (ice/seawater)
General Appearance	Skin	0 Bright, Shining
		1 Bright
		2 Dull
	Bloodspot on gill cover	0 None
		1 Small, 10-30%
		2 Big, 30-50%
		3 Very Big, 50-100%
	Stiffness	0 Stiff, in rigor mortis
		1 Elastic
		2 Firm
		3 Soft
	Belly	0 Firm
		1 Belly burst
	Smell	0 Fresh, seaweed/metallic
		1 Neutral
		2 Musty/sour 3 Stale meat/rancid
Eyes	Clarity	0 Clear
		1 Cloudy
	Shape	0 Normal
		1 Plain
		2 Sunken
Gills	Colour	0 Characteristic, red
		1 Faded, discolored
	Smell	0 Fresh, seaweed/metallic
		1 Neutral
		2 Sweaty/slightly rancid
		3 Sour stink/stale rancid
Sum of scores		(Min. 0 and Max. 20)

Quality assessment scheme used to identify the quality index demerit score [8].

2.3 Statistical analysis

All the statistical analysis were performed under Microsoft Excel Ver. 2013.

3. Results and Discussions

3.1 Freshness assessment

A decrease in Torrymeter readings for T1 and T2 from 0 day to 4th day was observed as shown in Fig. 1. Initial values of fish samples for T1 and T2 were 11.0 ± 0.17 and 11.8 ± 0.09 respectively. The highest rate of decrease in Torrymeter values was obtained in crushed ice preserved fish (T2) i.e. from 8.5 ± 0.31 (1st day) to 3.2 ± 0.08 (4th day). However, the lowest value of 6.88 ± 1.53 for *Otolithes cuvieri* caught by Multi-day fishing vessels off Veraval fish landing center was reported [9]. In case of gel ice preserved fish (T1) torrymeter values decreased from 10.4 ± 0.41 (1st day) to 8.6 ± 0.09 (4th day). Thus it shows that there is not much difference in the values and indicates that fish preserved under gel ice shows high freshness quality compared to crushed ice. Also fish preserved under crushed ice shows that the fishes were spoiled in 4 days whereas in case of gel ice preserved fishes are still in good condition. Fish body temperature also showed a wide fluctuation in T2 compared to T1 (Fig. 2). This is because of the faster melting rate of crushed ice compared to gel ice.

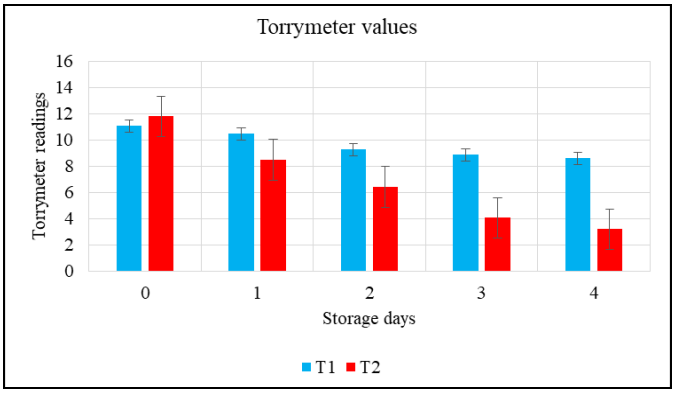


Fig 1: Tormenter values of Torpedo SCAD under gel ice (T1) and crushed ice (T2) storage

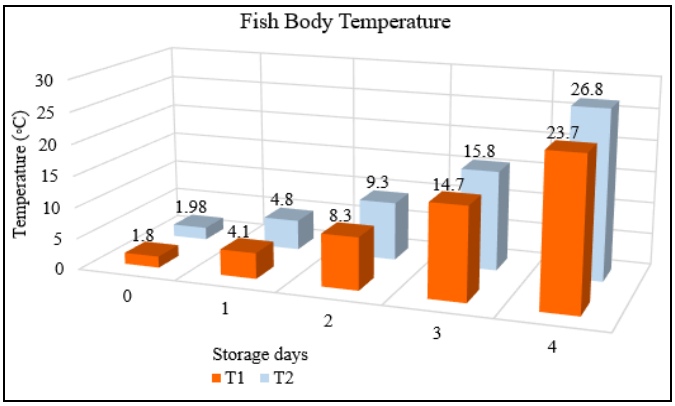


Fig 2: Temperature values of Torpedo SCAD muscle under gel ice (T1) and crushed ice (T2) storage

Sensory evaluation

Freshness scores of fish samples before storage and after 1st, 2nd, 3rd and 4th day of storage attributed by panelists during the gel ice and crushed ice storage are shown in Table 3. Sensory analysis is concerned with measuring physical properties by psychological techniques [10]. It is observed that sensory scores of fish samples on day 1 to day 4 varied from excellent and very good to moderate in case of T1, while in case of T2 scores increases from 3.2 ± 0.89 to 16.0 ± 1.08 which clearly indicates that the fish has spoiled in crushed ice storage condition.

Similar results were observed for super chilled cod fish non-chilled cod fish after 4th to 6th day of storage [11]. Thus there is a significant difference in the scores of T1 and T2. QIM scores for different marine fishes landed by single-day and multi-day fishing vessels were reported in the range of 2.09 to 9.00 [9]. However there was only a little deterioration was found apart from some slight loss of natural flavour and characteristic odour in several marine fish of Bangladesh upto 4-6 days of ice storage [12]. The obvious sign of spoilage in marine fish preserved under ice along Bangladesh coast was found after 10-13 days of storage [12].

Table 3: QIM sensory panel scores of T1 and T2.

Storage days	T1	T2
0	3.3 ± 0.78	3.2 ± 0.89
1	4.2 ± 0.62	5.3 ± 0.99
2	4.7 ± 0.18	9.1 ± 1.27
3	5.5 ± 0.67	13.46 ± 1.63
4	5.8 ± 0.32	16.0 ± 1.08

Conclusion

From the results it is apparent that gel ice is an alternative and excellent method of preservation of fish and fishery products. It helps in the maintenance of the functional properties of the seafood proteins. Fish preserved under gel ice showed higher shelf life compared to crushed ice. Also QIM scores showed a good results in gel ice preserved fish compared to crushed ice. Body temperature values showed gel ice packs takes longer time to melt than crushed ice and are more sustainable. Thus introduction gel ice as new cooling solutions can increase the selling capacity of fish vendors by preserving the fish for a longer period of time, allowing them to sell the fish in both the morning and afternoon.

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