Effect of Delayed Icing on the Microbiological Quality of *Hilsa Toli*

A. RAMACHANDRAN, RAJENDRA BADONIA and P. G. VISWANATHAN NAIR

Research Centre of Central Institute of Fisheries Technology, Veraval - 362 265

Effect of delayed icing on the microbial quality and shelf-life of *Hilsa toli* was studied. Fish iced in rigor condition had a shelf-life of 11 days irrespective of the state of rigor. Fish procured from the landing centre had a shelf-life of only 8 days. It showed the presence of coagulase positive staphylococci, faecal streptococci and *E. coli*. Total bacterial count was low in all the samples and it increased after spoilage.

One of the problems relating to the increased utilisation of tropical fish is its poor handling, storage and preservation. Preservation of fish in ice is still one of the simplest and efficient ways of retarding spoilage. A number of workers have studied the ice storage characteristics of marine and fresh water fishes (Joseph *et al.*, 1980; Garg & Stephen, 1982; Basu & Khasim, 1985; Surendran *et al.*, 1985; Bandyopadhyay *et al.*, 1986; Perigreen *et al.*, 1987). Vast variations were noted in the shelf life of fishes preserved in ice depending on the factors like species, method of capture, location of fishing grounds season of the year, size of fish etc. (Santos, 1981).

Delayed icing is a common practice under actual commercial conditions due to various reasons. Icing on board is done only in the case of selected varieties like prawns, lobsters etc. In some cases proper icing may not be done even at the landing centres but only at the processing plants or at the premises of fish traders.

Krishnakumar *et al.* (1985) found that oil sardine uniced on board and later iced after landing was least preferred compared with that iced or preserved in chilled sea water immediately after catch. Curran *et al.* (1980) studied the shelf life of gold lined sea bream at 0°C (in ice) and at 10°C and established that rate of spoilage at 10°C is approximately five times more than at 0°C. According to Nair *et al.* (1974), chilling of fish before the complete resolution of rigor was not found to affect the quality of fish to any greater extent during subsequent storage, but further delay affects the shelf life. Scientific data on the effect of delayed icing is scanty. This paper reports the effect of delayed icing on the quality and shelf life of *Hilsa toli*.

Materials and Methods

Fresh *Hilsa toli* of size 28–32 cm (uniced) was procured from gill netters at about 6 a.m. during winter (15 to 18°C). One batch (B I) was immediately iced in insulated box and a second batch (B II) was iced after it was kept outside for 5 h. A third batch (B III) was procured from Veraval fish landing centre and immediately iced. Icing was done in alternate layers of fish and ice. Melting of ice was compensated for with fresh ice, and reicing was done on every fourth day. The ice was procured from a commercial ice plant and the microbiological quality of the ice used was estimated

when icing and reicing was done. Samples were drawn periodically from all the batches to estimate the physical, organoleptic and microbiological quality of the fish during ice storage.

Visual and olfactory evaluations were made to assess the freshness of the fish by examining the colour of fish, eyes, gills, flesh, odour and texture. The fish was cut into pieces and cooked in boiling brine (3%) for 5 min. A five member taste panel recorded their opinion on cooked meat for flavour, texture and odour and gave an overall score on a 10 point hedonic scale, 10 being very good, 0 being very bad and 4 being just unacceptable.

Total bacterial count (TBC), *Escherichia coli*, faecal streptococci and coagulase positive staphylococci of muscle were estimated as per IS: 2237 (1971). The skin swabs from 25 cm^2 area of fish surface was collected in sterile bottle containing 100 ml phosphate buffer with sterile cotton swab and bacterial counts were determined as in the case of fish muscle. The total bacterial count and coagulase positive staphylococci count of ice used for ice storage was estimated with the same media and incubation temperature as described above.

Results and Discussion

The results of the visual and olfactory assessment of *Hilsa toli* of batches B I, B II and B III are given in Table 1. The results of the taste panel assessment of cooked meat of the above batches are given in Table 2.

Table 1. *Physical and olfactory changes of Hilsa toli stored in ice*

Days in ice	Fish uniced on board and iced immediately after landing BI	Fish uniced on board and iced after a delay of 5h B II	Fish uniced on board and at landing centre and iced immediately after procurement B III
0	Characteristic colour, bright eyes, bright red gills, muscle firm and in rigor state, characteristic odour	Characteristic colour, clear eyes, red gills, firm and in rigor state, characteristic odour	Slightly dull appearance, slightly opaque eyes, firm, characteristic odour
2	Characteristic colour, clear eyes, bright gills, firm muscle, rigor almost resolved, slight loss of characteristic odour	Characteristic colour, eyes slightly cloudy, slightly bleached gills, firm, rigor resolved completely, loss of characteristic odour	Slightly dull appearance, opaque eyes, bleached gills, firm muscles, rigor resolved, complete loss of characteristic odour
4	Slight loss of characteristic colour, opaque eyes, red gills, firm, rigor resolved completely, loss of characteristic odour	Slight loss of characteristic colour, slightly sunken and opaque eyes, brown gills, firm, no off odour	Appearance as before, sunken opaque eyes, bleached gills, firm muscle, no off odour

Table 1 (Contd.)

8	Slightly dull, slime at the head and fins, initiation of red discolouration, sunken and opaque eyes, gills further bleached, slight loss of firmness at the stomach, off odour	Slightly dull, slime on head and fins, discolouration at the caudal portion, sunken and opaque eyes, gills further bleached, slightly fruity odour	Dull, slime formation on the body, red discolouration extended upto middle of the body, sunken opaque eyes with mucus, slightly putrid odour
11	Red discolouration appeared at the caudal portion, slime on head and fins, sunken opaque eyes, gills further bleached, slighly fruity odour	Dull, slime on the body, red discolouration further extended sunken opaque eyes, gills further bleached, slightly putrid odour	Slime on the entire body, red discolouration on the body, soft and slightly putrid
13	Red discolouration, slime on the body, muscle slightly soft and slightly putrid odour	Discolouration, soft and slightly putrid	
14	Appearance as before, muscle soft and putrid		

Table 2. *Results of taste panel assessment of ice stored and cooked meat*

Days stored	Fish uniced on board and iced immediately after landing B I		Fish uniced on board and iced after a delay of 5 h B II		Fish uniced on board and at landing centre and iced immediately after procurement B III	
	Mean	Range	Mean	Range	Mean	Range
0	8.2	7–9	7.4	7–9	7.2	5–8
2	7.8	7–8	7.0	6–8	6.2	4–7
4	6.8	6–8	6.0	5–7	5.8	4–7
6	5.8	5–7	5.2	4–6	4.6	4–6
8	5.2	4–7	5.0	4–6	4.0	3–5
11	4.8	4–6	4.0	3–5	3.4	2–5
13	3.4	2–5	3.2	2–5	—	—
16	2.6	2–3	—	—	—	—

Batches B I and B II were in rigor state. The exposure of batch B II to atmosphere for five hours before icing had resulted in slight loss in initial brightness of eyes and skin. But still the fish was in rigor stage. Batches B I and B II were acceptable for the panel upto 11 days, eventhough B II had a marginal reduction in quality and acceptability score. Batch B III had an initial low score and was acceptable only upto 8 days. This shows that if fish is iced within the rigor state itself, there may not be much reduction in shelf life, but delay in icing beyond rigor state will reduce it considerably. Nair *et al.* (1974) had observed similar pattern of shelf life in carp. Dawood *et al.* (1986) also had reported similar finding about rainbow trout.

Changes in the total bacterial count of the fish muscle of batches BI, B II and B III are given in Fig. 1. The initial bacterial counts of all the batches were low. This

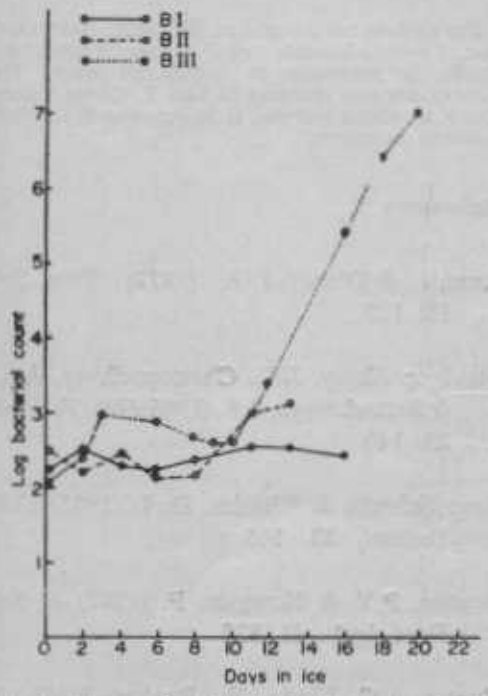

Fig. 1. Changes in total bacterial count of *Hilsa toli* during iced storage.

may be due to the very fresh nature of the samples. Moreover the temperature prevailed while procuring the samples was low (15-18°C). The bacterial count was also low till the fish was apparently spoiled. In batch B III a rapid increase in bacterial count was observed from 10th day onwards which almost coincided with the organoleptic unacceptability of the fish. In batches B I and B II observations were discontinued when the fish was apparently spoiled on 16th and 13th day respectively. Similar trend of low bacterial counts during the early stages of ice storage had been reported by several workers (Amu & Disney, 1973; Garg & Stephen, 1982; Poulter & Nicolaides, 1985; Basu & Khasim, 1985; Bandyopadhyay *et al.*, 1986 and Begona & Howgate, 1987). The total bacterial count of the muscle of batch B II showed an initial reduction. This batch was kept at room temperature for a period of 5 h before icing and this might have resulted in the multiplication of mesophilic bacteria which later on showed a sudden decline due to cold shock during ice storage unlike in other batches which were iced immediately after procurement.

The changes in the total bacterial count on fish surface of these batches are presented in Fig. 2. In the case of surface swab also the count was low till the fish got apparently spoiled. Coagulase positive staphylococci was present only in batch B III (Fig. 3). This may be due to the contamination of the fish at the landing centre. Coagulase positive staphylococci was also found to multiply rapidly after the fish became apparently spoiled. *E. coli* and fecal streptococci were present only in batch B III and initially their counts were 2.6×10^3 and 3.2×10^3/g respectively. This also indicates the unhygienic handling and poor sanitary conditions prevailed at the landing centre. During ice storage *E. coli* and fecal streptococci did not survive after 2nd and 4th day respectively.

The average total bacterial count of the ice used for the study was 3.7 x 10^2/ml with a range of 2.4 x 10^2/ml and 1.1 x 10^3 /ml. There was one incidence of the presence of coagulase positive staphylococci to the order of 2.0 x 10^2. The ice may be a source of contamination during ice storage of fish. Iyer & Choudhari (1966) while examining the effect of ice on the bacterial quality of processed fishery products found that in many cases ice was a source of contamination. However, the extent to which the bacterial load of the ice had affected the quality or bacterial count of fish is not clear from this investigation.

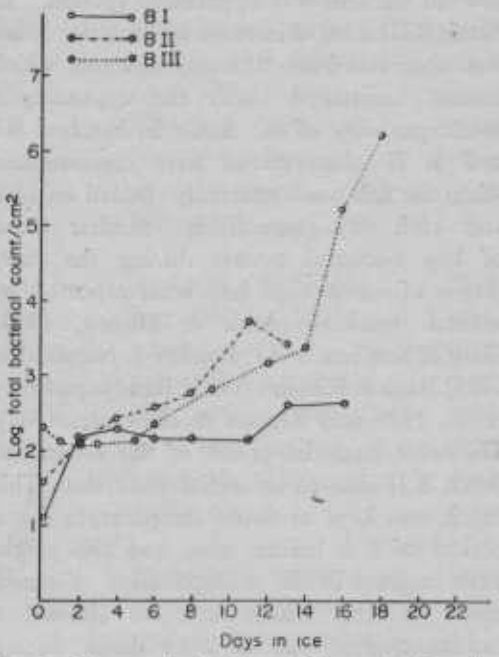

Fig. 2. Changes in total bacterial count of surface swab of *Hilsa toli* during iced storage.

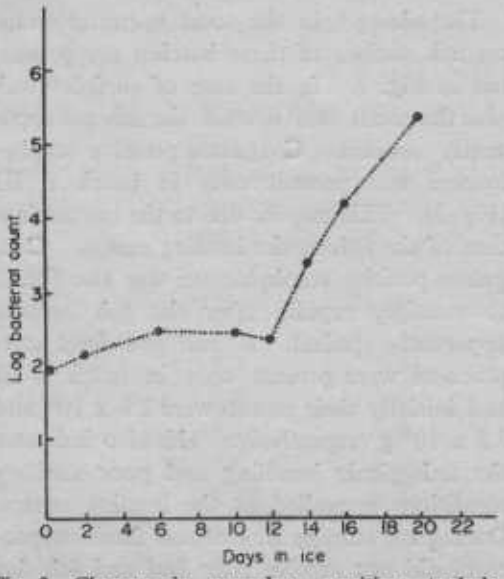

Fig. 3. Changes in coagulase positive staphylococci during iced storage (Batch B III).

This study has shown that the shelflife and micro-biological quality of *Hilsa toli* stored in ice depends on the initial freshness of the fish and its handling. There is some correlation between organoleptic changes in the fish and the microbiological quality. A delay of few hours in icing of hilsa after catch, i.e. when the fish is still in rigor state, may not considerably reduce its shelflife, but a delay beyond rigor state considerably reduces the shelflife.

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