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Original article

Study on freshness quality and post-harvest loss of Hilsa (*Tenualosa Ilisha*) during marketing in Mymensingh town, Bangladesh

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Abstract

An investigation was conducted to know the freshness quality and associated post-harvest loss of hilsa, if any, transported to Mymensingh from the major landing centers through Cox's Bazar-Chittagong (route A) and Barguna-Chandpur (route B) routes for a period of July to October 2012. The average environmental temperature of the wholesale and retail markets was 30.7 °C and 30.6 °C where the body temperature of hilsa was 4.5 °C (route A) and 4.7 °C (route B), respectively. The Freshness quality of hilsa was assessed using sensory defects points (DPs) that eventually gave rise to numerical values '1' being the freshest and '5' being the worst quality. The DPs of hilsa were found 2.0, which reveal that the fishes were in excellent conditions, i.e., there was no significant post-harvest loss even during retail sale. DPs on arrival and at wholesale in July, September and October were significantly different after auction and during retail sale ($p<0.05$), and in August differed significantly only during retail sale ($p<0.05$). It was observed that hilsa transported to Mymensingh from Barguna-Chandpur were better in quality than those transported from Cox's Bazar-Chittagong. The reason behind this finding was not studied and this needs to be elucidated through further research.

Keywords: Freshness quality, post-harvest loss, *Tenualosa ilisha*, fish marketing, hilsa

INTRODUCTION

Fish is one of the important sources of quality animal protein and availability and affordability for fish is better in comparison to other animal protein sources. *Tenualosa ilisha* (Hamilton 1822) of the subfamily Alosinae, family Clupeidae, order Clupeiformes, is one of the most important tropical fishes of the Indo-Pacific region and has occupied a top position among the edible fishes owing to its taste, flavor and culinary properties (Nowsad *et al.* 2012). Hilsa serves as a health-food for the affluent world owing to the fish oils which are rich in polyunsaturated fatty acids (PUFAs), especially omega-3 PUFAs and at the same time, it is a health-food for the people in other extreme of the nutritional scale owing to its proteins, oils, vitamins and minerals (Mohanty *et al.* 2011). The major part of hilsa stocks are concentrated in the coastal waters, estuaries, and some river systems of Bangladesh, Burma, India and Pakistan (Jafri and Melvin 1987). The largest portion of hilsa is harvested from the coastal areas of Bangladesh, but 75% of total ilish is consumed outside of the coastal areas (Ahmed 2007). Hilsa constitutes the largest single fishery in Bangladesh and more than 11% of the country's fish production comes from hilsa (DoF 2014). It has been estimated that production of hilsa from marine water is 252,575 MT and from the inland waters is 98,648 MT (DoF 2014). There is a huge demand of Ilish in both national and international markets. In 2012-2013, Bangladesh earns 3.13 million

USD by exporting of frozen and chilled hilsa (DoF 2014). Recent estimates have suggested that, in Bangladesh alone, about 500,000 fishers catch hilsa; there may be another 2-2.5 million people indirectly involved in the distribution, sale and other ancillary activities like net and boat making, ice production, processing and export (Nowsad *et al.* 2012). Fisheries sector in Bangladesh suffers from serious post-harvest loss every year due to ignorance and negligence of the people involved in different stages from the harvest to retail distribution. Studies revealed very high level of post-harvest loss during pre-processing, processing, storage and transportation of fishery products (Nowsad 2005). Previous research focused on estimation of local losses in wet fish distribution chain found about 20% of the marine fish landed in Cox's Bazar was deteriorated up to 80% of its original quality before it was loaded on the truck for distanced transport (BCAS 2003; Nowsad 2004). About 28% fish lost 60 - 70% of freshness quality before it reached the consumer in local retail wet fish trader's shop (Nowsad 2010). Being a high lipid fish, the post-harvest loss of hilsa is also thought to be significant; and also being a rapidly perishable tropical fish, proper handling is necessary to control and slow down spoilage of this valuable species. Hilsa are transported by plastic drum, steel made half - drum, country boat, sac made of *hogla* and polythene sheet, wooden, fiber glass or plastic craters, styrofoam box and ideal ice box. Post - harvest losses are found to be heavy during handling on-board vessel and in landing centers (Nowsad 2010). Two major catches are recognized, one is the marine catch, landed in Cox's Bazar - Chittagong area and the other is esturine - riverine catch, landed in Barguna to Chandpur area. These two types of landed hilsa are transported to the retail markets of the country through two major distribution routes: one is from Cox's Bazar-Chittagong to final destination and the other is from Patharghata (Barguna)-Chandpur to final destination. Considering the above facts, the present study was conducted to know the freshness quality and associated post-harvest loss of hilsa, if any, marketed in Mymensingh from either Cox's Bazar-Chittagong or Barguna-Chandpur routes.

METHODOLOGY

Study area and sampling period: For the present study, two markets such as Mechua Bazar and Nutun Bazar were selected among the different markets available in Mymensingh town. Both marine and riverine hilsa were received by Mechua Bazar wholesale market. After auctioning in Mechua Bazar, hilsa were either transported to Nutun Bazar or Mechua Bazar retail market for sale. For quality assessment of hilsa in this study, the data were collected from 1st July to 31st October, 2012. The Mymensingh town were received hilsa delivery from both the harvesting routes one is form Cox's Bazar-Chittagong and another is from Barguna- Chandpur (Figure 1).

Determination of sensory quality in hilsa: Quality loss of hilsa in different stages of distribution channels were assessed according to the modified method of (Nowsad 2010). The method was based on fish freshness test model initially developed by Torry Research Institute, UK (Howgate *et al*. 1992), undergone series of revisions by many authors (Connell 1990; Sakaguchi 1994). Five lots of hilsa and 5 individual measurements for each lot were assessed. The sensory defect points of the hilsa were determined on arrival to wholesale market, at wholesaling, after auction and during retail sale at both the markets. The freshness quality data (mean value) of hilsa of two routes were compared with simple T-test (Rashid *et al.* 2007) using the equation given below:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{Sp\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \qquad Sp = \frac{(n_1 - 1)s_1^{\,2} + (n_2 - 1)s_2^{\,2}}{n_1 + n_2 - 2}$$

Here, Sp = Estimate of pooled variance; $\bar{x}_1$ = Mean for sample one; $\bar{x}_2$ = Mean for sample two; n_1 and n_2 = No. of sample; $s_1^{\,2}$ = Variance for sample one; $s_2^{\,2}$ = Variance for sample two; $n_1 + n_2 - 2$ = Degrees of freedom

Figure 1: Map showing the two transportation routes of hilsa ot Mymensingh. A, Cox's Bazar to Chittagong route; B, Bargura to Chandpur route

RESULTS AND DISCUSSION

Handling conditions of hilsa during transportation in Mymensingh from two routes (A and B) are shown in Table 1.

Table 1: Handling condition of hilsa monitored in wholesale and retail markets, Mymensingh

Route	Temperature (°C)		Container used			Icing condition/fish to ice ratio		
	Environment	Fish body	During transport	After auction	During retail sale	During transport	After auction	During retail sale
A	30.7 ± 0.9	4.5± 0.5	Plastic box, Cork sheet, Bamboo basket	Plastic Box, Bamboo basket	Bamboo basket	1 : 1	No re-icing	1:1.5
B	30.6 ± 0.8	4.7± 0.4	Wooden box	Plastic Box, Bamboo basket	Bamboo basket	1 : 1	No re-icing	1:1.5

The average environmental temperature of the wholesale and retail markets were recorded as 30.7±0.09 °C and 30.6±0.89 °C respectively. The average body temperature of hilsa from two routes was 4.5±0.5 °C and 4.7±0.4 °C, respectively which indicates that the fishes were adequately iced during transportation. During transportation plastic box, cork-sheet insulated box, bamboo baskets were used in route A and wooden box was used in route B. Ice to fish ratio of both the routes during transportation was 1:1. During retail sale ice to fish ratio was maintained 1:1.5. Floors in both wholesale and retail markets were made of concrete. The handling conditions of hilsa in Mymensingh were found quite satisfactory. It might be due to high market price and good profit; the fish traders were not hesitate to spend money for maintaining adequate freshness quality of hilsa during transportation to retail sale. Freshness quality of hilsa from the two routes received in Mymensingh was assessed through sensory based indicators (Nowsad 2010).

The DPs of hilsa in July through two routes on arrival, at whole sale, after auction, and during retail sale were found at 1.4±0.0, 1.51±0.1, 1.65±0.1, 1.8±0.01 for route A and 1.4±0.0, 1.45±0.05, 1.52±0.07 and 1.64±0.05 for route B, respectively (Figure 2). On arrival and at wholesale defect points did not differ significantly but after auction and during retail sale in both route A and B DP differed significantly ($p < 0.05$). According to (Howgate *et al.* 1992) fish having DP in <2 are excellent, highly acceptable which is very alike to the findings of the present study. In another study (Nowsad *et al.* 2012) determined the sensory quality breaking point of fish at DP 3.3 which is slightly higher than the findings of the present study. In the present study, the quality DP of hilsa in Mymensingh wholesale market and retail markets did not exceed 2.0.

Table 2: Quality defect points of hilsa received at different distribution channel in Mymensingh

Monthly duration	Route	N	Quality defect points			
			On arrival	At wholesale	After auction	During retail sale
July	A	50	1.4±0.0	1.51±0.1	1.65±0.1^{a}	1.8±0.01^{a}
	B	60	1.4±0.0	1.45±0.05	1.52±0.07^{ab}	1.64±0.05^{ab}
August	A	50	1.45±0.0	1.54±0.09	1.61±0.1	1.7±0.1^{a}
	B	35	1.45±0.0	1.51±0.03	1.6±0.07	1.62±0.08^{ab}
September	A	30	1.48±0.0	1.54±0.08	1.7±0.02^{a}	1.80±0.03^{a}
	B	40	1.48±0.0	1.51±0.03	1.6±0.08^{ab}	1.62±.0.08^{ab}
October	A	35	1.5±0.0	1.6±0.04	1.7±0.08^{a}	1.8±0.02^{a}
	B	30	1.5±0.0	1.55±0.05	1.54±0.01^{ab}	1.63±0.05^{ab}

A=Fish from Cox's bazaar-Chittagong route received in Mymensingh
B= Fish from Barguna-Chandpur route received in Mymensingh
N= No. of Observations, Values with different superscripts letters in the same row indicate a significant difference at (p<0.05)

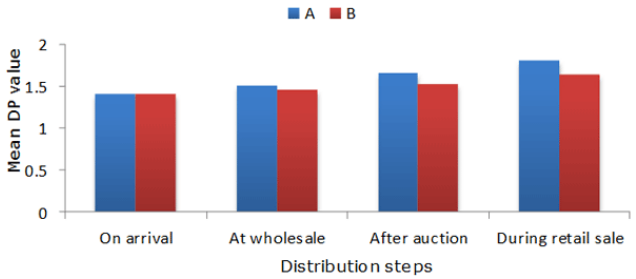

Figure 2: Quality defect points of Hilsa in July 2012 received in Mymensingh

In August, the defect points through two routes on arrival, at whole sale, after auction and during retail sale were found at 1.45±0.0, 1.54±0.09, 1.61±0.1 and 1.7±0.1 for route A and 1.45±0.0, 1.51±0.03, 1.6±0.07 and 1.62±0.08 for route B, respectively (Figure 3). DPs on arrival, at wholesale and during auction was not differ but significantly different during retail sale ($p < 0.05$). Hossain *et al.* (2012) found that defect point of Punti badly crossed DP 3 in retail sale, mrigle (*Cirrhinus cirrhosus*) and Bata (*Labeo bata*) also had DP 3 in retail sale which was not similar to the findings of present study.

The quality DPs of hilsa in September through the two routes on arrival, at whole sale, after auction and during retail sale were found at 1.48±0.0, 1.54±0.08, 1.7±0.02

and 1.80±0.03 for route A and 1.48±0.0, 1.51+±0.03, 1.6±0.08 and 1.62±.0.08 for route B, respectively (Figure 4).

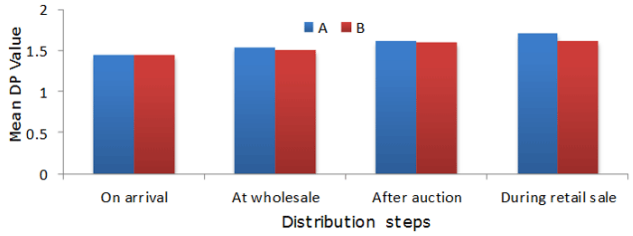

Figure 3: Quality defect points of hilsa in August 2012 received in Mymensingh

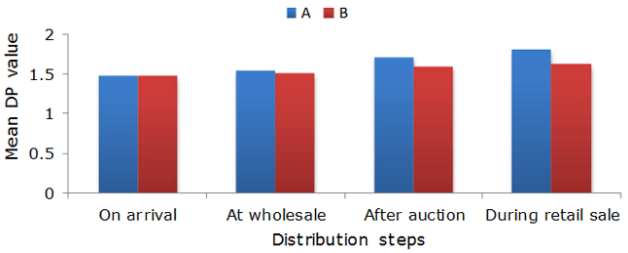

Figure 4: Quality defect points of hilsa in September 2012 received in Mymensingh

DPs values of the fishes brought through the two routes differed after auction and during retail sale ($P<0.05$). (Nowsad *et al*. 2012) found defect points 3.04, 3.13, 2.50 and 3.10 in *Labeo rohita*, *C. mrigala, Pangasius sutchi and Hypopthalmichthys molitrix,* respectively which was very higher than the findings of the present research.

In October, the defect points of hilsa through two routes on arrival, at whole sale, after auction and during retail sale were found at 1.5±0.0, 1.6±0.04, 1.7±0.08 and 1.8±0.01 for route A and 1.5±0.0, 1.55±0.05, 1.54±0.01 and 1.63±0.05 for route B, respectively (Figure 5). Hossain *et al.* (2012) found that tilapia and pangas was in very good condition in retail market (defect points 1.85 and 2.0) which seems alike to the findings of the present study. The mean DPs values of two routes were significantly different after auction and during retail sale. Adequate icing was the key important phenomenon as observed in the present study that kept the preservation conditions of hilsa fresh even after long transportation up to Mymensingh and at retail sale after 4 to 7 days of harvest.

Comparative analyses (Mean±SD) on freshness quality of hilsa in different markets of Mymensingh during study period are shown in Table 3.

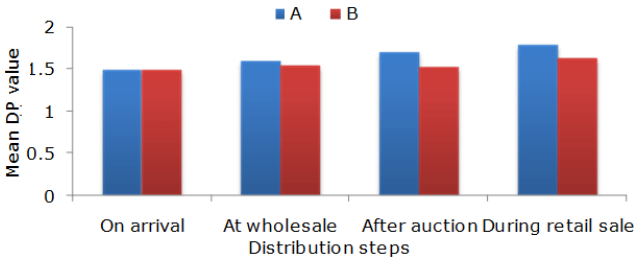

Figure 5: Quality defect points (DPs) of hilsa in October 2012 received in Mymensingh

Table 3: Mean values (±SD) of freshness quality of hilsa in different distribution steps in Mymensingh

DS	*Route*	*N*	*Mean±SD**	*Std. error mean*
Wholesale (MB)	A	70	1.52 ± 0.11^{b}	0.013
	B	70	1.34 ± 0.14^{a}	0.017
Retail market (MB)	A	50	1.6 ± 0.14^{b}	0.019
	B	50	1.46 ± 0.15^{a}	0.021
Retail market (NB)	A	45	1.73 ± 0.01^{b}	0.013
	B	45	1.56 ± 0.01^{a}	0.014

** Values with different superscripts letters in the same row indicate a significant difference at (p<0.05);*
DS, Distribution step; MB, Mechua Bazar; NB, Nutun Bazar

70 observations were made for hilsa from each of the routes to Mechua Bazar wholesale market. On the other hand, 50 and 45 observations respectively were made for each route in Mechua Bazaar retail market and Nutun Bazar retail market. Although the average DP value were less than the quality breaking points of DP 3.3, the DP between the two routes differed greatly ($p<0.05$) in both wholesale and retail markets. Study suggests that hilsa coming to Mymensingh from Barguna-Chandpur were better in quality than those from Cox's Bazar-Chittagong.

CONCLUSION

From the present study, it was clearly understood that post-harvest hilsa transportation were well-taken care of, *i.e.*, they were preserved very well in iced condition during transportation from Cox's Bazar-Chittagong or Barguna-Chandpur to Mymensingh. This might be happened due to use of adequate ice in fish during different stages of handling, since fish body temperature was found to be around 4.5 °C. Estuarine hilsa (from Barguna-Chandpur) were found to be better in quality than marine hilsa (from Cox's Bazar-Chittagong). The reason behind this finding was not studied and this needs to be elucidated through further research.

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