

Sensory quality and its economic losses for Freight Fish Consignments

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ABSTRACT

Fish, in international commerce, constitute an important food commodity due to the increasing demand for protein with high biological value. This study was conducted to evaluate the sensory quality of air freight fish at Kuwait Airport during a period from January 2019 to April 2020. The number of fish consignments reached 37193 packages, with a total weight of 7462332 kg. Considering source (A), zobaidy fish (*Stromateus linnaeus*) was imported with 251640 kg, while the imports of shrimp (*Peneaus japonicus*) were 8872 kg. For source (B), Arabian grouper reached 131760 kg; green snapper represented 50760 kg; imported small grouper was 9720kg; sobaity bream was imported with 39240 kg; red snapper with 96840kg; caranax with 135720 kg, and Spanish mackerel with 4100 kg. While, in the source (C), the imported grey mullet was 13680 kg. Fish packages were rejected based on the sensory criteria, such as odour, secretions, and rigidity, besides gills and eye characteristics. The rejected packages of zobaidy fish were 2096 (16.7 %); those of the Arabian grouper was 1941(29.5%); of green snapper was 253(10.0%); of small grouper was 46(8.2%); of sobaity bream was 18(1%), of red snapper was 36(0.7%), of caranax was 66 (1%), of Spanish mackerel was 26(6.5%), and of the grey mullet was 48(7.0%). With respect to sources, the rejected fish packages from source A were 2229; from source, B were 2380, and from source, C was 48. The total economic losses from different sources during the study period reached 571200 KD.

INTRODUCTION

Fish is one of the most important food items in human diet due to its high nutritional quality, providing a balanced dietary protein in addition to vitamins and mineral content essentially supporting good health with a relatively low caloric content (FAO/WHO, 2010). The estimates of global fish production reached approximately 179 million tons in 2018, and 156 million tons of which are used for human consumption, which is equivalent to an estimated annual supply of 20.5 kg per capita. The remaining 22 million tons are used for non-food purposes, mainly for the production of fishmeal and fish oil (FAO, 2020).

Fish tends to spoil rapidly during the post-mortem period, and their quality change occurs due to post-mortem biochemical changes in nitrogenous compounds of fish (Shahidi & Botta, 1994; Pal *et al.*, 2018). Eating fish is part of the cultural traditions of several human populations, noting that fish is the main food source rich in essential nutrients in many others (WSDH, 2019, 2020).

With the current increase of world population, the need to store and transport seafood has become urgently required. Moreover, since most consumers prefer the ice chilled preserved seafood, the civil aviation has grown necessary to assist fish trade

maintaining fish- shelf- life with nutritional value, and if measurements were correctly achieved, the loss which occurs in air flight fish consignments would presumably come to an end (UN Atlas of the Oceans, 2002, 2016).

Sensory assessment of aquatic sea food is done by using the four senses (sight, smell, taste and touch), which are used to judge the fish freshness, and some aspects of quality (Martinsdóttir, 2009; Alasalvar *et al.*, 2011a). For commercial trade, the fish freshness is essential to be accurately recorded. In addition, the sensory inspection of fish gives a direct measurement of the perceived attributes and provides complete knowledge which helps in better understanding of the consumer's responses (Alasalvar *et al.*, 2011b). Many methods have been tested to obtain a rapid and an accurate decision to determine the freshness and consistency of fish (Alasalvar *et al.*, 2011a; Bernardi *et al.*, 2013).

At the airport, the sensory evaluation of air freight fish consignments has a significant position to provide valid and reliable information to make sound business decisions relating to the final judgment of fish consignments (APEC, 1999). Food quality is a radical issue measured by many criteria, such as fish storage state, whether kept in ice or frozen, aligned with the right size, species and the presence of blemishes (Duarte *et al.*, 2020).

Therefore, fish sensory evaluation is still the most effective technique for the determination of the performance and freshness of fish changes. In this context, this study was conducted to evaluate the sensory quality of ice chilled imported fish at Kuwait Airport for a rapid assessment of the fish freshness, and hence estimate the economic loss due to the rejected and condemned fish consignments.

MATERIALS AND METHODS

Examination of the shipment protocols at Kuwait Airport

1-Examination of the documents attached to the shipment

Documents include the invoice, health certificate (examined under veterinary supervision), country of origin, name of import and export companies, number of cartons, and total and net weight of each carton, date of shipment, bill of lading, fish species and quality. Examination was carried out in the designated air condition area at Kuwait Airport warehouse during the period from January 2019 till April 2020.

2-Sampling

Ten cartons per hundred for sensory examination were randomly collected from different location to be examined. In case of proven corruption in the representative sample, each carton of the shipment was opened.

3- Sensory evaluations

3.1 Cartons were inspected by two food inspectors as stipulated by the **GCC Guide on Food Imports for the year (2016)** and **Kim *et al.* (2020)** from the outside to prove safety, and then the cartons were ordered to be opened. Approximately, 10 fish samples were taken from different five places of the carton.

3.2 The carton was carefully checked from the inner side. Examinations included: odour smelt at first opening, amount of ice present and its state.

3.3 The examination of fish samples ostensibly recorded the smell, textures, scale, eye and gills examination and finally pressure on the fish head was carried out to examine the

secretions in terms of form, colour, quality and smell. Sensual characteristics of fish were carried out on the following criteria:

- **Smell:** natural and acceptable.
- **Texture:** firm and does not leave a recessed mark with finger pressure.
- **The eyes:** shiny, visible, full, and not sunken in the case of whole fish.
- **Gills:** naturally bright red, free from any mucous or bloody exudates materials, or any unpleasant smell.
- **Appearance:** The fish are fresh, healthy and clean, and in the case of whole fish peels were hardly adhere (for peels fish) and not easily removed.
- **Rigidity:** the fresh flesh of fish is hard, firm under finger pressure and springer.

3.4 Examination of shrimp was carried out to detect the spoilage criteria, including: quality evaluation inspected criteria were; odour, color of the shell, presence of blackspot, condition of internal organs, adhesion of head, meat and finally firmness and colour of meat.

RESULTS AND DISCUSSION

Fish constitute an important food commodity in the international commerce due to the increasing demand of protein that has a high biological value. Sensory assessment of fish was closest to the consumers' attitudes, non-destructive technique, more rapid than other methods in addressing fish freshness and some other aspects of quality. Additionally, it is very sensitive and acceptable in litigation with no laboratory facilities required.

Data given in Table (1) show the total number of examined imported ice chilled fish consignments at Kuwait Airport imported from different sources. The total fish EPS (expanded polystyrene boxes) packages were imported during 2019 to April 2020 and reached 37193 in air tight fish EPS packages of different weights with 20, 24.8 and 30 kilograms, and each box was labelled with fish type/ EPS package with total weights of 7462332 kg.

To consider the imported source (A) packages/ weight; butter fish zobaidy (*Stromateus Linnaeus*) was imported with packages weight of 12582x20 (251640 kg.); shrimp (*Peneaus Japonicus*) with weight of 180x30 (5400 kg) and shrimp (*Peneaus Japonicus*) with weight of 140x24.8 (3472). For source (B), the weight of the imported arabian grouper (*Epinephelus tauvina*) packages was 6588x20 (131760kg.); for green snapper (*Lethrinus nebulosus*), it was 2538x20 (50760 kg); that of small grouper (Leopard Hind grouper) was 486x20 (9720kg); sobaity bream (*Sparidentex hasta*) packages' weight was 1962x20 (39240 kg); packages of red snapper (*Lutjanus campechanus*) weight was 4842x20 (96840kg.); for Carnax (*Caranx ignobilis*), weight of packages was 6786 x 20 (135720kg.), and weight of Spanish mackerel (*Scomberomorus Commerson*) was 405x20 (4100 kg). For source (C), the grey mullet (*Mugil cephalus*) was impoted with calculated whole weight of 684x20 (13680kg). The total number of EPS packages and weights of 37193 (7462332 kg) were imported from different sources during the period from January 2019 till April 2020.

The data presented in Table (1) show the number and type of the accepted and rejected imported fish packages subjected to the sensory inspection. For the imported zobaidy fish (*Stromateus linnaeus*), the rejected packages were 2096 (16.7 %); for the arabian grouper (*Epinephelus tauvina*), the rejected packages were 1941 (29.5%); the rejected packages of the imported green snapper (*Lethrinus nebulosus*) were 253 (10.0%); for the small grouper (Leopard Hind groupers), they were 46 (8.2%); for the sobaity bream

(*Sparidentex hasta*), 18 packages were rejected (1%), for the red snapper (*Lutjanus campechanus*), they were 36 (0.7%), for the rejected packages of *Caranx ignobilis*, 66 were identified (1%), for mackerel from Spain (*Scomberomorus commerson*) 26 packages were rejected (6.5%), and for the imported grey mullet (*Mugil cephalus*) packages, 48(7.0%) were rejected.

The resulted data obtained in Table (2) and Table (3) indicate that, the number of rejected and condemned fish EPS packages imported from different sources was according to the sensory evaluation carried out by the veterinary inspectors using the human senses criteria as odour, type of colour and smell of the secretions, rigidity of the muscle, characteristics of the eyes and colour and the pressure of the gills for different types of fish and odour, colour, body characteristic, eye and head for shrimp. The evaluation of fish quality revealed putrid or stale and other deteriorations in the specified criteria which are very simple with little difficulty and can be recognized either by sight and smell. This result coincides with those reported by **FAO (1989)**, **Archer (2010)** and **Bernardi *et al.* (2013)**. The rejected and condemned fish EPS packages from source (A) was 2229 EPS fish packages with different capacity. Whereas, from source (B), 2380 fish packages were condemned with 20 kg in each EPS package, and from source (C), 48 packages with 20 kg each was rejected.

The odour was of putrid smell, bloody secretions were detected over the body; flaccid in texture of the muscles was observed during finger pressure, the eyes were opaque, sunken and concave (O.S.C. E), the gills were dark grey with unpleasant odour, and bloody exudates was released by pressure (D.U.BE), in addition to presence of green or yellowish discoloration. The current observations concur with those of **GCC (2016)** who attributed the rejection of spoiled fish EPS packages of different types of ice chilled imported to the followings: bad manufacturing practice during harvesting and shipping; air freight risk associated due to two transits or more connections; delayed air freight uploading; loading and placing several fish packages on wooden pallets. In addition, according to the air freight density, the consignments staying for a long period in the very hot weather of Kuwait (50-55C in summer and 25-30 in winter) until being transferred to the inspection hall to be veterinarily inspected and evaluated is another fish spoiling factor. The above mentioned factors agree with the opinion reported by **Farida *et al.* (2014)**, **Humid and Jamal (2014)** and **Mahmud *et al.* (2018)**.

Consequently, it was noticed that the most condemned fish consignments were those of the shrimp, with weight packages of 30 kg, and the spoiled percentage in each shrimp package was 49.5, followed by shrimp with packages of 24.8 kg, and the spoiled percentage in each shrimp package was 30.7. The recorded high spoiled rates are attributed to the methods and condition of packing, amount of shrimp in the packing and handling process, storage temperature, amount and type of ice used and various quality control processes. The present findings agree with those of **FAO (2009)**, **Mai *et al.* (2012)** and **Zhuang *et al.* (2020)**.

The results given in Table (4) present the economic loss due to condemnation of the consignments of fish which reached a total loss of 571200 Kuwaiti Dinar currency. The highest recorded losses were those occurred in consignments imported from origin A, which included 2097 packages with total 41940 kg of zobaiddy fish and shrimp, and recording economic loss that reached 335520 K.D. In consideration with B source, the total packages were 2512 with weight of 11420 kg and economic loss of 233760 KD. As for source C, it contained 48 packages with 960 kg and recorded economic loss that reached 1920 KD. The cumulative amount of money lost, with respect to imported fish from different sources during the research period, reached 571200 KD.

Table 1. Number and weights of imported ice- chilled fish consignments at Kuwait Air Port showing rejected and accepted packages

Origin	Fish Species	No. of Packages x weight(kg)	Total weight (kg)	Accepted Packages		Rejected Packages	
				N0	%	N0	%
A	Zobaiddy	12582x20	251640	10485	83.3	2097	16.7
A	Shrimp	180x30	5400	91	50.5	89	49.5
A	Shrimp	140x24.8	3472	97	69.3	43	30.7
B	Arabian grouper	6588x20	131760	4647	70.5	1941	29.5
B	Green snapper	2538x20	50760	2285	90.0	253	10.0
B	Small grouper	486x20	9720	446	91.8	40	8.2
B	Sobaity Bream	1962x20	39240	1944	99.0	18	1.0
B	Red snapper	4842x20	96840	4806	99.3	36	0.7
B	Caranx	6786x20	135720	6720	99.0	66	1.0
B	Spanish mackerel	405x20	8100	379	93.5	26	6.5
C	Grey mullet	684x20	13680	636	93.0	48	7.0
Total		37193	7462332	32536	87.47	4657	12.53

Table 2. Sensory evaluation of examined ice- chilled fish types and cause of rejection criteria

Origin	Fish Species	Sensory Criteria				
		Odour	Secretions	Rigidity	Eye	Gill
A	Zobaiddy	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE
B	Arabian grouper	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE
B	Green snapper	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE
B	Small grouper	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE
B	Sobaity Bream	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE
B	Red snapper	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE
B	Caranx	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE
B	Spanish mackerel	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE
C	Grey mullet	Putrid	Bloody exudates	Flaccid	O.S.C.E	D.U.BE

A - C : Sources of fish importation

O.S.C. E : Opaque, Sunken and Concave eye

D.U.BE : Dark gray, unpleasant odour and bloody Exudates

Table 3. Sensory evaluation of examined ice- chilled shrimp and cause rejection criteria

Source	Fish	Odour	Colour	Body	Eye	Head
A	Shrimp	Pungent and sour	green and black spots on the tail and shell	lacerated, slimy, soft meat	Dry, shrunken or missing	Separated From the body

Table 4. Number and weights of rejected packages of imported ice- chilled fish after sensory inspection and their economic loss

Origin	Fish species	Weights (kg)	Price (K.D*/kg)	Economic loss (K.D)
A	Zobaidy	41940	8	335520
A	Shrimp	2670	6	16020
A	Shrimp	1066.4	6	6398.4
B	Arabian grouper	38820	5	194100
B	Green snapper	5060	3	15180
B	Small grouper	800	4	3200
B	Sobaity Bream	360	4	1440
B	Red snapper	720	3	2160
B	Caranx	1320	5	6600
B	Spanish mackerel	520	6	3120
C	Grey mullet	960	3	2880
Total		91596.4		570778.4

*K.D: Kuwait Dinar

CONCLUSION

In conclusion , it was remarkable that a great loss in ice- chilled fish air freight consignments were recorded during sensory evaluation at inspection departments at airport arrival. The sensory assessment of the represented packaging of air tight EPS fish packages samples revealed that it is a rapid and easy method for fish evaluation.

Additionally, the very hot environmental condition at Kuwait airport during the fish uploading until inspection (in summer reached 50⁰C) played an important role in the rejection of 13% of the total consignments during this study with economic loss that reached 570778.4DK.

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