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FISH QUALITY ASSESSMENT AND PARASITOLOGICAL STUDIES OF SOME SELECTED IMPORTED FROZEN FISHES AT KANO STATE, NIGERIA

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ABSTRACT

The aim of this work is to investigate fish quality assessment and parasites of some selected imported frozen fishes. A total of one hundred and ninety eight specimens of six selected species were assessed and examined, weekly for a period of three months from September 2016- November 2016. The quality of the fishes was assessed using sensory evaluation; Quality index method and physical method pH using standard procedure. The quality index points; mean values of each species were as follows: Herring 12.64, Horse Mackerel 14.24, Atlantic Mackerel 11.70, Hake 12.36, Tilapia 8.48, Croaker 8.41. The result shows that croaker (*Micropogonias furnieri*) has the lowest quality index range, and Horse Mackerel (*Trachurus trachurus*) having the highest quality index range. The same also applies for pH, with mean values for Herring 7.2, Horse Mackerel 7.5, Atlantic Mackerel 6.9, Hake 7.2, Tilapia 6.6 and Croaker with 6.4. The result for the pH also reveals croaker having the lowest value of 6.4 and Horse Mackerel of 7.5. This indicates that there is a correlation between the quality index points and pH of the fishes. The quality of the fish samples were of moderate to low quality and a few of very low quality according to the typical sensory scores as determined by the QIM scheme. The occurrence of parasites during study in all fish species were a total of seventy nine. *Anisakis simplex* had the highest prevalence of 41 (51.8%), it was found to parasitize a number of three species which are *Clupeah arengus*, *Scomber scrumbus* and *Trachuru strachurus*. The direct consumption of fish imported into the country calls for thorough verification, due to possible expose to health risk hazards.

INTRODUCTION

Nigeria is endowed with many large rivers, man-made lakes, creeks and about 200 nautical miles of marine water in the Exclusive Economic Zone (EEZ). The Fishery industry has however, not attained the desired level of self-sufficiency in local fish production (Idachaba,

1991). Fish and seafood constitute an important food component for a large section of world population. They come after meat and poultry as staple animal protein foods where fish forms a cheap source of protein (Wafaa *et al.*, 2011).

Like other animals, fish have endo and ectoparasites, especially protozoans and helminths causing heavy mortality of fish and transfer to humans. Parasitic diseases of fish are of importance in the tropics, parasites usually exist in equilibrium with their host as a survival strategy (Martins, 2000).

Frozen state condition is also important since most fishes consumed in Nigeria are imported and usually come in frozen state. Fish begins to spoil immediately after death. This is reflected in gradual developments of undesirable flavours, softening of the flesh and eventually substantial losses of fluid containing protein and fat. By lowering the temperature of the dead fish, spoilage can be retarded and, if the temperature is kept low enough, spoilage can be almost stopped (Martins, 2000).

There are various species of frozen fish being imported into Nigeria i.e. Tilapia, herring, Horse Mackerel, Mackerel, Croaker, Sardinella, Blue Whiting etc., and species like Mackerel, Horse Mackerel and Croaker are expensive compared to the other species. The EU is the dominant supplier of frozen seafood products with more than 70% of market share in the country. Other supplying countries include China, Korea, Brazil, Paraguay, Uruguay, USA & Gambia, Mauritania, Namibia, Angola, Morocco, etc. The major portion of frozen fish is sold at traditional open markets. Wholesalers or retailers are located at these markets but they are purchased from importers/distributors cold storage facilities.

In Kano city, the major frozen fish market is the Kano Cooperative Fish Market also known as Sallanta Market. There are a lot of wholesalers and dealers having different cold rooms and cold store facilities. Supplies often enter usually within three days and a whole lot of species are available at the market which includes: Titus (Atlantic Mackerel), Herring (Sawa), Horse Mackerel (Kote), Sardines and Sardinella, Kampala, Croaker, Argentine, Hake (Panla) and Stock, bonito etc.

The Quality Index Method (QIM) is based on a structured scaling for quality measurements and provides accurate and precise information concerning the freshness and a prediction of the remaining shelf-life for species-specific fishes. It was developed initially for whole fishes stored in ice but currently it is also applied, among other products, to frozen fishes and fillets (Martinsdóttir 2002). Actually, QIMs are available for a large range of fish and crustacean species, both wild and farmed. Most of the scoring systems are based upon the changes taking place during the storage in melting ice (Martinsdóttir 2002).

MATERIALS AND METHODS

Description of the Study Area:

This study was carried out in Kano State. The state lies on latitude $10^{\circ}33'N$ to $12^{\circ}37'N$ and Longitude $7^{\circ}40'E$ to $9^{\circ}29'E$. It is within the Sudan Savannah zone. The total land area of the State is 20,709 square kilometres. The mean daily maximum and minimum temperatures are $33.1^{\circ}C$ and $15.85^{\circ}C$, respectively. Kano State is bordered to the north and northwest by Katsina State, to the east and northeast by Jigawa State, to the south by Bauchi State and to the southwest by Kaduna State (KNARDA 2001).

Sampling Techniques

Fish were bought from Kano cooperative fish market, weekly for a period of three months, from September 2016 to November 2016. Altogether 198 fish samples of six selected imported frozen fish were used in this study. For each species three pieces were bought on a weekly basis. Specimens were transported to the laboratory in coolers to prevent defreezing quickly.

Fish samples were first identified using tools for identification guide by FAO (2007), the quality of the fishes were assessed using the quality index method (QIM method) as described by Larsen (1992) Table 1

Table1: Quality assessment scheme used to assess quality Index or demerit score.

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 Soft 2 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, discoloured	
	Smell	0 Fresh, seaweed/metallic 1 Neutral 2 Sweaty/slightly rancid 3 Sour stink/stale, rancid	
Sum of scores		(min. 0 and max. 20)	

Source: Howgate *et al.* 1992

Table 2: Typical evolution of sensory scores for quality as determined by a QIM scheme.

	Score	Quality Evaluation
1	Zero to 5	High quality
2	6 to 9	Moderate quality
3	10 to 14	Low quality
4	Over 14	Rejected

pH Measurement

The pH values of fish muscle was determined directly using pen type digital pH meter calibrated at pH 4.00 and 7.00 (Model PH5S; Boqu instrument) for semi-solid product. The pH was directly read from the screen of the instrument.

Examination For parasites

Examination of fish for ectoparasites was done by scrapping gently the flesh with a scapula into petri dish. 10mls of distilled water was added into the petridish. 1 – 2 drops of the solution was put on a slide and viewed under a light microscope with magnification x 4, x 10, x 40 respectively. Parasites observed were photomicrographed as described by Paperna (1996).

Examination of the Gills

The portion of the operculum was removed with a pair of scissors to expose the gills. The part removed is placed in 10 mls of distilled water in a petri dish. The gills were placed on a slide and examined for presence of parasites.

Examination for Endoparasites

The body cavity of fish was dissected using a pair of Scissors and different portions of the gut (Oesophagus, Stomach, Intestine, and Rectum) were separated and kept in different petri – dishes containing 10mls distilled water. Parasites obtained were preserved in 10% formalin. Parasites were photomicrographed, and the number of parasites species and location were recorded in the data sheets. All procedures were carried out using standard methods as described by (Paperna,1996).

RESULTS

In this study the sensory evaluation was carried out using the Quality Index Method QIM. The quality of the fish samples were of moderate to low quality, while a few of the samples were of very low quality that is rejected according to the typical sensory scores for quality as determined by the QIM scheme. The mean value scores of the quality index range of all six species examined during study were as *Oreochromis niloticus* and Croaker (*Micropogonias furnieri*) having the best quality of 8.48 and 8.42 which falls at moderate quality of 6 to 9 score by the QIM scheme. Atlantic Mackerel (*Scromber scrumbus*) having 11.70 falls on low quality of 10 to 14 score by the QIM scheme. Herring (*Clupea harengus*) 12.64 and Hake (*Merluccius capensis*) 12.36 these also falls within the range of 10 to 14 of low quality. Horse Mackerel (*Trachurus trachurus*) has value of 14.24 which is over 14, this ought to be rejected according to the scheme as in Table 3.

The overall mean value scores of all fish species during study of pH condition, quality index range and estimated shelf life. The average score range of the quality index or demerit points for each fish species during

11weeks showed that Horse mackerel (*Trachurus trachurus*) having the highest score of 14.24, Herring (*Clupea harengus*) 12.64; Hake (*Merluccius capensis*) 12.36, Atlantic Mackerel (*Scromber scrumbus*) 11.70. The lowest index range were observed in Tilapia (*Oreochromis niloticus*) and Croaker (*Micropogonias furnieri*) having 8.48 and 8.42 respectively. Figure 1 illustrates the mean values of the quality index range of fish species during the study.

The average pH values of fish species indicated that Tilapia and Croaker having pH values of 6.6 and 6.4; Hake and Herring each having 7.2; horse mackerel 7.5 and Atlantic Mackerel having 6.9 respectively as in Figure 2. The estimated shelf life for all fish samples shows that Hake and Herring having value of 12.5 Atlantic Mackerel 11.0; Horse Mackerel 14.0; Tilapia 8.0 and Croaker 8.5. The values are almost similar to the quality index points of the fish species.

Table 4 indicates taxonomic groups of parasites and the frequency distribution of parasites of fish species during study period. Parasites identified belong to four families during the study and the species includes a species of Monogenea identified as *Neobenedenia* on the skin of Croaker. *Anisakis simplex* (Nematode) was found to parasitize a total of three species: Herring (*Clupea harengus*), Atlantic Mackerel (*Scromber scrumbus*), and Horse mackerel (*Trachurus trachurus*). *Cystacanthus* (Acanthocephala) was observed in the intestine of Atlantic Mackerel and Tilapia. Two species of cestodes were recovered in the intestine of Tilapia and Herring namely *Bothrio cephalus sp* and *Ligula intestinalis*. A species of Anisakids *contracecum sp* was found to parasitize on Hake. A species of Acanthocephala: *Acanthogyrus tilipiae* was observed in the intestine of Tilapia. Another species of Acanthocephala *Neochinochynchus* was identified in the intestine of Croaker. Two unidentified sp of nematode and cestode was found in Horse Mackerel and Herring respectively.

Table 3 Mean Values of pH, Quality index range and Estimated Shelf Life of Some Frozen Fishes at Sallanta Fish Market, Kano

SPECIES	QI	Est. Shelf			
		Life	pH	Length	Weight (g)
Herring	12.64	12.50	7.20	27.03	258.18
Horse Mackerel	14.24	14.00	7.50	28.03	281.52
Atlantic Mackerel	11.70	11.00	6.90	31.27	333.94
Hake	12.38	12.50	7.20	21.7	174.55
Tilapia	8.48	8.00	6.60	30.7	794.55
Croacker	8.42	8.50	6.40	38.76	653.21

QI = Quality Index

Table 4: Frequency Distribution of Parasites of Fish species

Parasites	Taxonomic Group	Fish species	Site of infection	No of parasites	% Prevalence
<i>Acanthogyrus tilipiae</i>	Acanthocephla	<i>O. niloticus</i>	Intestine	2	2.53
<i>Anisakis simplex</i>	Nematode	<i>C. harengus</i> <i>S. scrumbus</i> <i>T. trachurus</i> <i>S.</i>	Stomach/ visceral body cavity	41	51.8
<i>Cystacanthus</i>	Acanthocephla	<i>scroumbus</i> <i>O. niloticus</i>	Intestine	5	6.32
<i>Botheriocephalus sp</i>	Cestoda	<i>O. niloticus</i> <i>C. harengus</i>	Intestine	3	3.79
<i>Ligula Intestinalis</i>	Cestoda	<i>O. niloticus</i>	Intestine/ body cavity	2	2.53
<i>Cantracaecum sp</i>	Nematode	<i>M. capensis</i>	Stomach intestine/ body cavity	12	15.18
<i>Neobenedenia sp</i>	Monogenea	<i>O. niloticus</i> <i>M. furnieri</i>	skin	9	11.39
<i>Neochinorhynchus sp</i>	Acanthocephla	<i>M. furnieri</i>	Intestine	2	2.53
<i>Unidentified sp</i>	Nematode Cestoda	<i>T. trachurus</i> <i>C. harengus</i>	Intestine	3	3.79
Total				79	

DISCUSSION

The shelf life of freshly harvested fish depends on the bacterial flora, storage temperature, handling and physiological condition of fish. The shelf life reflects the quality of the final fish product either fresh or processed. For Herring, the lowest quality range was 8 and

the highest index of 17. The estimated shelf life for demerit point 8 was 4 days while demerit point 17 was 8 days, these could be associated with possible fat deposit and lower pH value and a similar outcome was reported by Chuma *et al.*, (2010).

Horse Mackerel having its lowest quality index range of 9 and highest of 19 which gave estimated shelf life of 4.5 days for the lowest point and 9 days for the highest point. Atlantic Mackerel species have its lowest index range at 7 and highest at 15, the estimated shelf life is 3 days and 6 days respectively a similar trend in terms of highest and lower value has direct relation to the size of the fishes examined these also confirms the assertion by Chuma *et al.*, 2010 that smaller fishes in size when frozen stay longer than larger fishes under the same condition. The estimated shelf life of Hake was determined at 4 days for lowest index range of 8 and 8 days for highest index point of 17. The estimated shelf life of Tilapia during study using the quality index range was 2 days at demerit point 5 and 4.2 days at demerit point 11, while the estimated shelf life of Croaker was 3 days at demerit point 6 and 4.3 days at demerit point 11 during the course of study. In addition to the sizes difference these last three fishes exhibits lower pH values signifying few days of shelf life these also confirm the report by Abbas and Abdul (2008) that acidic pH hasten deterioration of fish flesh.

Quality assessment of fishes has more to do with the determination of its shelf life or storage life which is the amount of time that fish remain palatable.

The physical method involves measuring the pH of the fishes. The mean pH values of all six species Atlantic Mackerel 6.9; Tilapia 6.6; Croaker 6.4; Hake 7.2; Herring 7.2 and Horse Mackerel 7.5. Indicates that pH value of seafood varies depending on struggling at the time of harvesting it is also important determinant of microbial growth and the lower pH value of seafood has a high spoilage potential and a short shelf life (Abollo *et al.*, 2001). Walker and Betts (2000) reported that ultimate pH of meat was significant for its resistance to spoilage because most bacteria grow optimally at about pH 7 and not well below pH 4 or above pH 9 Abbas and Abdul (2008). Microbial load increased with the increase in final pH of the meat (Dharmaveer *et al.*, 2007).

The results of this study revealed the occurrence of parasites from four major taxonomic group which includes: Nematodes, Cestodes, Monogenea and Acanthocephala. *Anisakis simplex* had the highest incidence of

41 (51.8%). It was found to parasitize on four fish species, which are *Clupea harengus* (Herring), *Scomber scrumbus* (Atlantic Mackerel), Hake (*Merluccius capensis*) and *Trachurus trachurus* (Horse Mackerel). This parasite has been observed in these species in Several studies demonstrated that the host specificity of *Anisakis spp.* is low since it was identified in many different fish families (Klimpel *et al.*, 2010). The most common species of *Anisakis* found in Horse Mackerel populations from Atlantic Ocean and Mediterranean Sea are *A. simplex* and *A. peregrinii* as reported by (Abubakar, *et al.*, 2014), and they were also identified in fishes from different families as Macrouridae, Ternoptychidae, Carangidae, Scombridae, and Stomidae.

Anisakis spp. is very common parasite among free-living fish with a prevalence of 49-100% (Klimpel *et al.*, 2004). Abollo *et al.*, (2001) recorded a prevalence of 100% in five fish species from Galician waters. *A. simplex* and *A. peregrinii* found in *Trachurus trachurus* are usually localized in the muscles, liver, body cavity, and gonads as confirms in studies by Santoroa *et al.*, 2010). *Anisakis* prevalence accounts up to 88%, with an incidence of 15 %, and one of the principal pathogenic effects on fish and paratenic host, are compression on organs and granulomatous inflammation of serous membranes. The post-mortem migration of larvae of *Anisakis spp.* observed in several fish species such as *Scomber scombrus*, *Trachurus trachurus* and *Micromesistius poutassou* could be interpreted as a way of parasite defence which is in agreement of work done by (Santoroa, 2010).

Another species of *Anisakis* *Contracaecum sp.* was found to parasitize mainly Hake *Merluccius capensis*, with incidence of 12(15.18%). This observation is in line with Adeyemo (2011) reported presence of *Contracaecum osculatum* larvae in imported frozen Hake in Bayelsa State.

Aloo (2007) reported *Contracaecum sp.* found on *O. leucostictus* from Oloidien Bay, Kenya. The same specie was also found on families Siluridae, Anabantidae both in the fresh and brackish water environment and Clupeidae and Ascianidae in marine environment Adebayo-Tayo, *et al.*, (2001).

They also found various species of Anisakids identified in Hake sample from the Mediteranean Sea and Atlantic Ocean. *Acanthogyrus tilipiae* was found on *Oreochromis niloticus* with prevalence of 2 (2.53%).

The incidence of *Neobenedenia* sp was 9 (11.3%) discovered in Tilapia and croaker *Micropogonias furnieri*. *Cystacanthus* sp 5 (6.32%) were found on *Scomber scrumbus* and *Oreochromis niloticus*. Two species of Cestodes

were observed, *Botheriocephalus* sp3(3.79%) was found in Tilapia and Herring, while *Lingua Intestinalis* was recorded in Tilapia with prevalence of 2 (2.53%).

Another species of Acanthocephla, *Neochinorhynchus* was found in Croaker with incidence of 2 (2.53%) and an unidentified specie of nematode was found in Horse Mackerel while an unidentified species of cestode was discovered in Herring 3 (3.79).

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