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Original Article

Determination of Quality and Shelf life of Three Marine Fishes (Coral trout, Greasy grouper and Red mouthed bream) Based on Total Volatile Nitrogen test (TVN)

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ABSTRACT

This study was carried out to evaluate the quality and Shelf life of three marine fishes (Coral trout, Greasy grouper, and Red mouthed bream) based on total volatile nitrogen test (TVN). The studied fish was collected newly caught from commercial sale point at Khartoum center-Sudan, kept under -4 C° and immediately transferred to laboratory for further analysis. The total volatile basic nitrogen (TVB-N) test was performed to assess the shelf life period and quality status of product at intervals time of 5days extended for 40 days. The results revealed that the total volatile basic nitrogen (TVB-N) ratio in the first two species (coral trout and greasy grouper) reached the recommended limit (30mg/100g) at interval time of 25 days, while the third one (Red mouthed bream) reached the recommended limit in interval time of 20days as the limits of TVN for fishery products in Commission Regulation (EC) NO 2074/2005, which was ranged between 25 to 35 milligrams of nitrogen/ 100grams of fish flesh. It could be concluded that this result can comply with Europe Unite (EU) standard which was widely used in many world countries.

Key words: quality, Shelf life, coral trout, greasy grouper, red mouthed bream, total volatile nitrogen test.

INTRODUCTION

Fish are an important part of a healthy diet since they contain high quality protein, but typically have unsaturated fatty acids when compared to other meat. In addition, most fish contain omega 3-fatty acids and other essential nutrients (FAO, 1995).

Fishery products presents an important part of international trade, currently worth more than US$ 50 billion, indicating the increase of consumer interest in the commodity from time to time. Fish products are more perishable than animal products, quality of fish is often more difficult to control due to variations in species, sex, age, habitats and action of autolysis enzymes as well as hydrolytic enzymes of microorganisms on the fish muscle Venugopal2002.

The fresh water fishery resources in Sudan distributed in an area of about 100,000km^2, while the Red Sea, which represents the marine fisheries has coast line of more than seven hundred kilometers (AbuGideiri, 1973). These two water bodies can land up to 110,000 tons/year General Administration Fisheries Report-Khartoum, Sudan, (2006) which is consumed fresh or processed for later marketing and distribution. It was noted that most of the fish landings from this sector were subjected to very poor condition because of lacking facilities, bad handling and processing which negatively affected quality and the value of the products. Therefore, international cooperation in the formulation of quality standards for fish and fishery products and adoption of these standards by individual countries and organizations were significantly increased and noted in line with, many developing countries attempt to set up standards for their fishery product in order to comply with requirement of international trade and markets (Bremner, 1985).

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 sea foods remain palatable. Different species of fishes have different shelf life which also

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varies depending on the oil levels, catch area, season, and duration of rigor mortis, intrinsic conditions of the fish and how it was captured and handled Huss, 1995.

There are two main methods of assessing fish quality to determine its freshness and shelf life. These are sensory and non-sensory methods. Sensory methods rely mostly on appearance, odour, texture and taste of the fish whether to be acceptable or rejected while non-sensory methods use physical, biochemical, chemical and microbiological means Huss, 1995.

Shelf life of food is defined as the maximum length of time a given product is fit for human consumption. For fish, shelf life is the time from when it is taken from the water until it is no longer fit to eat. In marketing, the shelf life of fresh and frozen fish is a very important consideration John, 1995. Knowing the remaining shelf life allows the processor and retailer to plan the length of time a product can be held, allowing control of their market. Adding one or two days to the shelf life allows the market to get top dollar and assure repeat sales John, 1995.

Temperature and handling practices are the most important factors in determining the shelf life of all species of fish. If the fish product is handled carefully, the temperature at which it is held controls its useful life. Temperature will control the rate of bacterial spoilage and enzyme breakdown, the higher the temperature the faster fish spoils (John, 1995, Bagge-Ravn *et al.*, 2003, Beuchat, 1995 and De Rover, 1999).

Several biochemical methods have been suggested and designed by many authors (Bremner, 1984, Bremner,*et al.,* 1987, and Ronsivalli, *et al.,*1975), to measure one or a group of quality index and use the result as an indication for fish spoilage. Biochemical Total Volatile Nitrogen test which is the common test for fish freshness has been selected and used in this research in order to assess quality and progressive decline in shelf life of some fishes collected from marine origin, namely Coral Trout *(Plectropomusmaculatus*, local name;Najil), Greasy grouper *(Epinephlusareolatus,* Local name; Hamoor), and Red mouthed bream (*Lethreniusspp*; local name; Shouar) kept in a refrigerator.

MATERIALS AND METHODS

Sample treatment:

Three fish species includedCoral Trout *(Plectropomusmaculatus*, local name; Najil), Greasy grouper *(Epinephlusareolatus,* Local name; Hamoor), and Red mouthed bream (*Lethreniusspp*; local name; Shouar) were collected as frozen products in plastic bags. Each sample was identified with a properly marked strip of masking tape. Name of sample, date, time of collection were recorded. The samples immediately were submitted to the laboratory in an ice isolated box chest. During transportation and handling the temperature of the samples were maintained at -4 C^{o}. As soon as the samples arrived at the laboratory the general physical condition of the container was inspected for tears, pin holes and puncture marks in order to verify safety of the sample. Thereafter, the samples were kept in a refrigerator at waiting for testing.

Preparation of sample:

The representative sample was thoroughly comminuted in a food processor and 10 g portion of the sample was weighed in order to be tested for total volatile nitrogen.

Procedure for determination of (TVN):

For determination of total volatile nitrogen the magnesium oxide method was used in which the samples which contain (ammonia, mono-methyl amine, diethyl amine and tri-methyl-amine and other volatile amine). Samples were blended with magnesium oxide and distilled into boric acid. The boric acid was titrated to its original with strong acid (H_2SO_4) at low concentration to determine the amount of the base distilled, which correlated to the total volatile nitrogen as described by AOAC (1990).

- 10g of sample was added to the heating flask containing 300 ml distill water plus 2 gm magnesium oxide and anti-bumping granules.
- In the receiving flask 25 ml of boric acid (2%), a few drops of methyl red indicator was added.
- The two flasks (heating &receiving) were connected to the evaporator and the water bath was managed.
- After 25 minutes, distillation was stopped.
- The content of the receiving flask was transferred to another flask and titrated to the end point by very weak acid 0.05 (H_2SO_4).
- The total volatile nitrogen was determined as follows:

$$TVN = \frac{(V \times N \times 100 \times 14)}{W}$$

Where:
V=volume (ml) H_2SO_4 used for sample.
N=normality of H_2SO_4.
W=weight of sample in grams.

Statistical Analysis

The data was analysed using statistical package (IBM SPSS version 19.0).

RESULTS AND DISCUSSION

The present study was carried out to investigate and to determine the quality and Shelf life of three marine fishes (Coral trout, Greasy grouper, and Red mouthed bream) based on total volatile nitrogen test (TVN).

Table (1) and figures (1, 2, 3 and 4) show the total volatile nitrogen test parameter was consecutively carried out over study period at interval of five days. The result revealed a continuous increasing in the level of total volatile nitrogen with time of experiment among the studied species.

Table1Mean ± SE Total volatile nitrogen (mg/100g) levels over interval time (days) for the three marine fish species

Interval Time (day) / Fish Species	1st	5th	10th	15th	20th	25th	30th	35th	40th	Main Effect on fish sp.
Coral trout Mean ± SD	7.7± 0.200	15.6± 1.4	18.5 ± 2.1	21.3 ± 2.1	25.2 ± 2.5	28.6± 1.8	31.3 ± 1.7	33.7 ± 2.9	37 ± 1.4	**
Greasy grouper Mean ± SD	8.3±0.26	16.2 ± 1.2	19.7 ± 1.2	23.9 ± 1.2	25.9 ± 1.4	28.5 ± 1.5	31.2 ± 1.9	33.9 ± 3.2	37.9 ± 2.4	
Red mouthed bream Mean ± SD	11.2±0.25	17.6 ± .61	20.7 ± 1.3	24.7 ± 1.1	26.9 ±2.4	31.4 ± 1.7	34.8 ± 2.4	39.9 ± 3.8	42 ± 4.2	

** = High Significant (P<0.01). SE = standard error

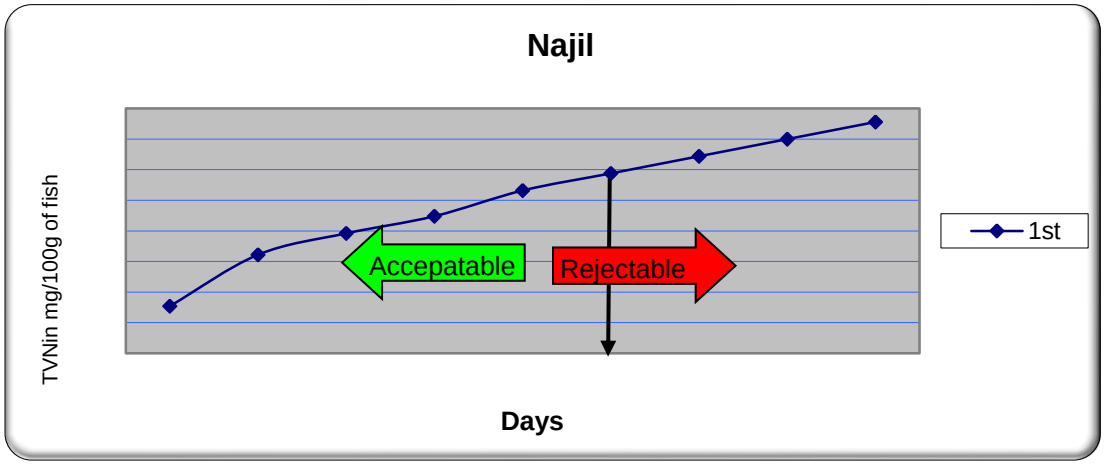

Figure1. Shows the acceptable & rejectable level of TVN (mg/100g) for Coral Trout fish at different interval days

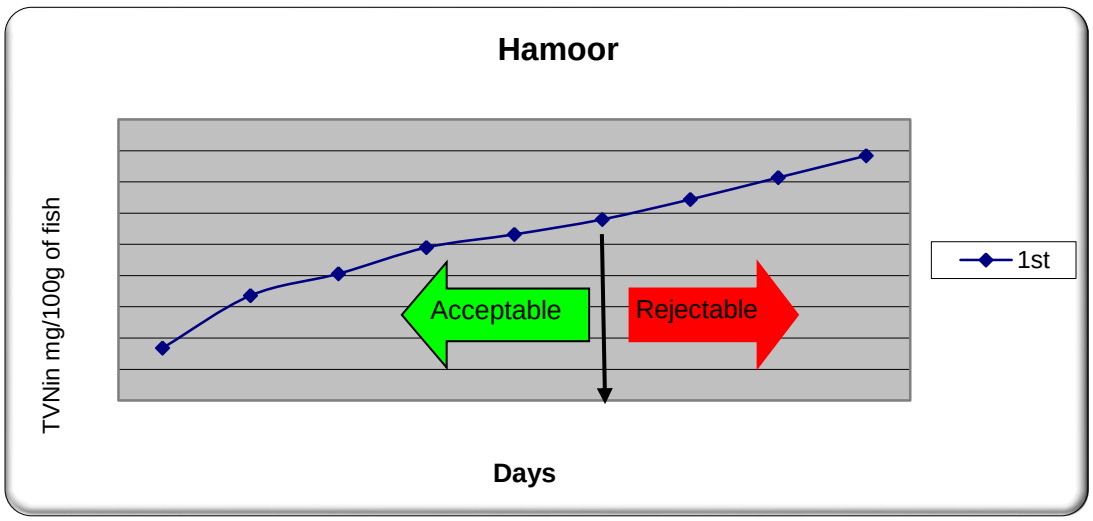

Figure2. Shows the acceptable & rejectable level of TVN (mg/100g) for Greasy grouper fish at different interval days

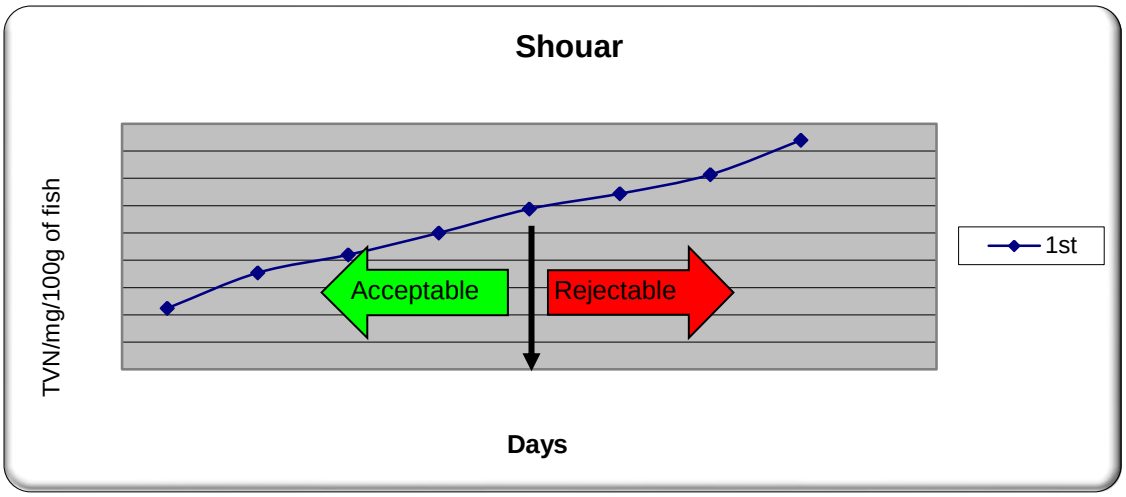

Figure 3. Illustrates acceptable and rejectable level of TVN (mg/100g) for Red mouthed bream fish at different interval days

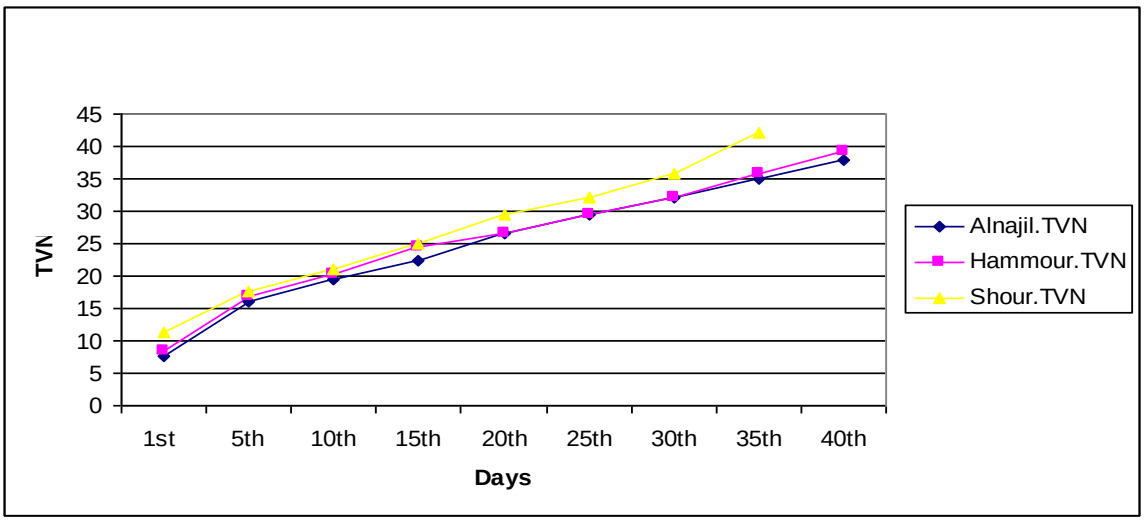

Figure 4. Status of the development of TVN in mg/100g over interval time for three marine fish species of fishes

Total volatile nitrogen of Coral trout (*Plectropomusspp)* fish at the first day of collection was recorded 7.7mg/100g and after interval time of 25 days was found to be 29.4mg/100g. These results were considered as acceptable level as set by many international organizations such as European Unit (EU).The highest value of TVN was observed when the interval time was increased at 40 days (37.8 mg/100g) this result was beyond the Maximum Recommended Limits (MRLs) which set at 30 mg/100g for most of the world countries. The consecutive test of total volatile nitrogen of Greasy grouper fish also show progressive declined in the quality over time. The first test of Total volatile nitrogen was estimated at 8.4mg/100g. After 25 days from collection the TVN increased and reached its marginal acceptable limit (29.4 mg/100g). This level led the product became at rejected limit (more than 30 mg/100g), which probably occurred at interval time 30 days from collection time. These findings in agreement with Pons-Sanchez-Cascade *et al*. (2006) as recommended TVBN levels of 10 mg/100g or less for fresh fish and 20-30 mg/l00g for beginning of spoilage and over 30 mg/100g for spoilage fish. Total volatile nitrogen result for theRed mouthed bream fish (Shouar) in Table 1 at the first day was recorded at 11.2 mg/ 100g value, but when was exceeded the 20th day the total volatile nitrogen was reached its marginal acceptable limit (29.4 mg /100g). This result was confirmed that the product become deteriorated after mentioned period. This might be referring to many factors such as handling, storage or biological enzymes activity. The finding of TVN values were agrees with recommendations of Huss, 1995 who pointed that the shelf life of most marine fishes have been predicted to range between 2-24 days when kept in ice .The finding of this study also agree with the finding of Ola and Ladipo, 2004 who found the shelf life of Croaker fish (*Pseudotolitus elongates*) in Nigerian marine water could be predicated at 20 days in ice.

In this study it worth to mention that the value of TVN for the three species were showing significant increase in the second interval time (increase by 8mg/100g) and this may be due to temperature dropping while thawing product from freezing -18^{0}C to 5^{0}C. However, after that the value of TVN showed to some extent constant rate of increasing by (3 mg/100g).

The result of this study is complying with the maximum recommended limits set by the European commission regulations (EC) NO 2074/2005 this set the range of TVN for the acceptable fish at 25-35mg/100g of fish.

CONCLUSION

We could conclude that, the safe use of refrigerated fish products should be within (20-25) days when kept at constant temperature below 4^0C. The study also revealed the acceptability of three studied fish "Coral Trout, Greasy group and Red mouthed bream" as refrigerated product can last for 15 days as a good quality and 25 days as marginal acceptable products. The total volatile nitrogen not exceeds maximum recommended limit set (30mg/100g) by international organization Codex Aliment Aries, EU Stander and regulators countries.

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