Study on the Effect of Chemical, Microbiological and Organoleptic Parameters Related to the Flesh Colour of Yellowfin Tuna (*Thunnus albacares)*

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Introduction

The fishing industry is particularly important for Sri Lankans for the domestic supply and there is also a small but growing export market for high value products. Yellowfin tuna is one of the most important fish species in Sri Lankan export market (Amarasiri *et al.*, 2004). Yellowfin tuna is sold as fresh in local markets and exported as frozen, chilled or fresh products. The local market is highly regulated and price oriented with low emphasis on quality. They sold products in fresh form with little or no processing other than drying. However, the export market is characterized by demand for quality and high prices. So the freshness of the fish is of high interest to both retailers and consumers. Colour grade of the fish flesh is the most important attribute when assessing the quality and price in industry. However, marine species like yellowfin tuna are highly susceptible to rapid spoilage. Therefore, loss of quality of flesh followed by spoilage is a complex combination of microbiological, chemical and physical processes. Therefore, the quality of fish can be estimated by sensory evaluation, microbial method and chemical method (Ozogul and Gokbulut, 2006). This study was designed to evaluate the chemical qualities of yellowfin tuna flesh by measuring histamine, microbiological qualities by measuring total plate count and sensory qualities in four colour grades.

Methodology

The research was carried out at the Ceylon Fresh Seafood (Pvt) Ltd. Fresh yellowfin tuna flesh colour was categorized into four colour grades such as, bright red, light red, brown red and pale brown using a reference colour chart. Forty fishes were selected from each colour grade making total sample size 160 individual fishes. Homogeneous samples were selected to get accurate results. Therefore, all the samples were collected from Negombo landing site with identical body weight and length and sex. The temperature of each fish was measured and samples were collected only from the fishes which contain body temperature below 4 °C. Appropriate 160 samples of four colour grades were collected from the area below the pectoral fin of each fish. Histamine values were measured by using competitive direct Enzyme Linked Immune Sorbent Assay (CD – ELISA) method (AOAC 977.13 method, 1992).

Data were analysed by using one way Analysis of Variance (ANOVA) with 95% confidence interval using Minitab 16 software. Another 160 samples were collected from the area below the pectoral fin of above selected fishes to test the Total Plate Count (TPC) according to the AOAC (1992). Data were analysed by using one way Analysis of Variance (ANOVA) with 95% confidence interval using Minitab 16 statistical software. Organoleptic parameters such as odour, texture, appearance and overall acceptance of four colour grades were evaluated using thirty two untrained penalties. This sensory scale is based on the freshness quality grading system for yellowfin tuna mentioned in Act No. 1045/01 Gazette notification in 1998. Each assessor was given scoring demerit point from one to four. Data were analysed using non - parametric Freidman test in Minitab 16 software.

Results and Discussion

Colour of fresh yellowfin tuna flesh were categorized as bright red colour, light red colour, brown red colour and pale brown colour. The results revealed that the flesh colour is significantly influenced by 48.50% to the histamine value. Furthermore, the mean histamine values are 0.66±0.37 ppm, 1.70±1.13 ppm, 5.19±4.55 ppm and 10.14±6.13 ppm in bright red, light red, brown red and pale brown colours respectively. The highest mean histamine value ($p>0.05$) was found in pale brown colour whereas the lowest was found in bright red colour. However, in all the samples histamine value were below 50 ppm which was the defect action level mentioned by Food and Drug Administration (FDA) in United States (FDA, 1995). Also mean histamine value of bright red colour, light red colour and brown red colour was below 10 ppm which was the histamine rejection limit in Ceylon Fresh Seafood (Pvt) Ltd. However, the mean histamine value of pale brown colour was above the 10 ppm. The histamine value below 1.6 ppm was considered as excellent quality and can only be achieved by appropriate handling and chilling onboard (Caraven *et al*., 2001). A significant difference of mean histamine value between bright red colour and light red colour was not observed. However, mean histamine values of brown red colour and pale brown colour significantly differ from the bright red colour. Similarly, it was significantly differed in light red colour from the brown red colour and pale brown colour. The brown red colour also significantly differs from the pale brown colour.

According to the analysed data from non – parametric Freidman test colour grade of fish flesh was significantly influenced to the texture, odour and appearance of flesh. Also, colour grade of flesh was significantly influenced to the overall acceptability ($p<0.05$). Figure 1 shows the estimated medians of texture, odour, appearance and overall acceptance.

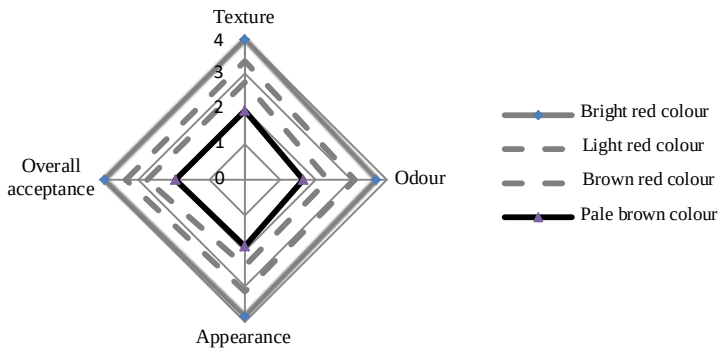

Figure 1. Web diagram of sensory characteristics for four different fish catergory

According to the diagram best quality colour grade is bright red colour and pale brown colour is the least quality colour grade. Bright red colour was got highest scores for all attributes.

Flesh colour is significantly influenced by initial microbial count of the flesh. Mean TPC values were 2.62±0.40 log CFU/g, 3.18±0.28 log CFU/g, 3.54±0.31 log CFU/g and 3.85±0.22 log CFU/g in bright red, light red, brown red and pale brown colour flesh respectively. These results are compatible with the findings of Fardiaz *et al.* (2013) which reported that TPC in fresh tuna fish were ranged from 1.8±0.10 to 4.4±0.21 log CFU/g. According to the Act No 2 (1996), acceptable total bacteria count for fresh fish is 5.7 log CFU/g. Therefore, none of the samples from four flesh colour grades were not exceed standard value ($P>0.05$). Mean TPC values of light red colour, brown red colour and pale brown colours were significantly different from bright red colour. Mean total plate count of brown red colour and pale brown colours were significantly different from light red colour. Mean total plate count of Brown red colour also significantly different from pale brown colour. Many factors such as, fish species, the

physiological condition of fish, environment factors, catching and harvesting methods, killing procedures and post harvest handling are affect to determine the flesh colour Bright red colour of fish flesh is dominant with the presence of oxy – myoglobin (Amarasiri *et al.*, 2004) But it will degrade to ultimately form of met – myoglobin during storage. The auto oxidation of tuna muscle can be minimized by setting the storage temperature below 10 °C (FAO, 2009). Fresh tuna handled well pre-harvest and post-harvest will retain their colour for 7 to 10 days but if poorly handled will go brown within 24 hours (Amarasiri *et al.*, 2004).

Conclusions

Among the different chemical, microbiological and organoleptic parameters of yellowfin tuna flesh, histamine content and TPC value were found as the factors that significantly influence the flesh colour. Colour grade is directly affected by the histamine value of a particular fish with 48.50%. Colour grade is also directly affected by the total plate count of a particular fish with 68.71%. According to the sensory qualities best colour grade is bright red colour.

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