



## STUDY ON THE EFFECTS OF ANTIOXIDANTS CITRIC ACID AND ASCORBIC ACID ON THE QUALITY OF INDIAN MACKEREL, *Rastrelliger kanagurta*, STEAKS DURING CHILLED STORAGE

### Zoology

**Dr. Devdatta Lad\*** Department of Zoology, Wilson College, Chowpatty, Mumbai - 400 007 \*Corresponding Author

**Nayab Khan** Department of Zoology, Wilson College, Chowpatty, Mumbai - 400 007

### ABSTRACT

Fishes contain high amount of Polyunsaturated Fatty Acids once the fish dies these Polyunsaturated Fatty Acids reacts with free oxygen radicals and undergoes oxidation. Upon oxidation the fatty acids present in the fish muscles become rancid and this leads to rancidity. The present research aims in studying the effects of antioxidants Citric acid and Ascorbic acid on the quality of Indian Mackerel, *Rastrelliger kanagurta*, steaks during chilled storage. Results of the research shows that the pH and Peroxide value is less in the steaks treated with Ascorbic acid then Citric acid and control steaks. Whereas the Acid value and free fatty acid value is observed to be less in steaks treated with Citric acid then Ascorbic acid and almost equal to the control steaks. Overall the Citric acid is found to be a good antioxidant for the Indian Mackerel fish steaks. It has kept the pH value stable by controlling the rancidification by forming less free fatty acid and Peroxide, which are important indicators of the level of rancidification of the fats.

### KEYWORDS

Indian Mackerel, Citric Acid, Ascorbic Acid, pH, Peroxide Value, Acid Value.

### Introduction

Fishes are considered to be an important part of human nutrition as they are rich in proteins, Lipids, Vitamins and Minerals. (H. Mandakini Devi and Gaihiannngam Kamei, 2017) Fishes have high content of Polyunsaturated Fatty Acid (PUFAs) especially Omega 3 family. (Rostamzad H., et. al., 2009) These polyunsaturated fatty acids helps to reduce the risks of cardiovascular diseases and are linked with curing certain types of cancers. Fish proteins is easily digestible and give shiny appearance to our face and body. Fish consumption is good for vitamins deficiency people as it contains Vitamin B6, B12 and minerals like Potassium, Sodium, Calcium, Magnesium and Copper. (H. Mandakini Devi and Gaihiannngam Kamei, 2017)

When the fish is caught it dies after that its immune system collapses and the bacteria are allowed to proliferate freely and that deteriorates the fish. It leads to Autolysis meaning self digestion. After the death the anaerobic muscles cannot maintain its normal level of ATP and when the intracellular level declines from 7 – 10 micromoles/g to 1.0 micromoles/g the tissues, muscles enter rigor mortis. The resolution of rigor always results in subsequent softening of muscle tissue which is coincidental with autolytic changes. Fishes contain high amount of Polyunsaturated Fatty Acids once the fish dies these Polyunsaturated Fatty Acids reacts with free oxygen radicals and undergoes oxidation. Upon oxidation the fatty acids present in the fish muscles become rancid and this leads to rancidity. Rancidity is a sign of spoilage and a range of volatile, unpleasant smelling substances are produced depending upon the fish species. Some volatile compounds produced are Trimethylamine and Hydrogen Peroxide, which have a characteristic fleshy smell. The pH level of the fish is also affected. During the latter stages strong rancid smell develops. The texture becomes either soft and watery or tough and dry. The fish can be characterized as spoiled or rancid. (www.fao.org)

Consuming rancid fish fatty acid could be harmful such as instead of providing heart protection oxidized oil may increase the rate of Atherosclerosis. Animal studies have found that oxidized fatty acid have lead to organ damages and inflammations. Consuming oxidized oil may cause carcinogenesis. Studies found that consuming oxidized oil had a negative effect on cholesterol level and could linked with Alzheimer's disease. (www.Omega3innovations.com)

Antioxidants prevent direct oxidation of Polyunsaturated Fatty Acids. It is also valuable in intercepting free radicals that travel through the aqueous parts of food. There are two types of antioxidants - natural and synthetic. Natural antioxidants sometimes tend to be short lived while synthetic antioxidants have a longer shelf - life. Sometimes the combination of natural and synthetic antioxidant is used when the fat material is more. Antioxidants prevents rancidification of fats, maintains pH and Acid value. They also prevent the formation of Hydrogen Peroxide. Thus, antioxidants are useful in preservation of high fat content food such as fishes. (Sabine Samples, 2013)

### Materials and Method

Freshly landed fish that is Indian Mackerel, *Rastrelliger kanagurta* was collected from Sassoon dock. It was immediately preserved in ice

and brought to the laboratory. Once the fish was brought to the laboratory, it was washed with distilled water and blood stains and mud spots were removed. The scales were removed with the help of sharp knife taking care that no damage was done to skin. All the fins and the gut were removed. Once again the fish was washed with distilled water. Then with the help of the sharp knife the fish was cut into steaks. Out of all steaks one steak from the fish was taken as Control. And two steaks from the fish were taken as Experimental 1 and 2 respectively which were treated with 10% Citric acid and 10% Ascorbic acid respectively.

On the 1<sup>st</sup> Day i.e. initial day once the control and experimental fish steaks of Indian Mackerel, *Rastrelliger kanagurta* were ready then they were immediately subjected to analysis of pH, Acid value and Peroxide value. Once the analysis was done then the control steak was placed in refrigerator without being subjected to any antioxidant. The Experimental steaks 1 and 2 respectively were treated with 10% Citric acid and 10% Ascorbic acid respectively before placing them in refrigerator. Similarly the analysis was carried out periodically on 3<sup>rd</sup>, 6<sup>th</sup>, and 9<sup>th</sup> day. On all the mentioned days the control steak was not exposed to any antioxidants and was used for analysis. While the experimental steaks i.e. E1 and E2 were subjected to antioxidants 10% Citric acid and 10% Ascorbic acid respectively for 15 min before freezing.

| Sr. No. | Parameters     | Methods                     |
|---------|----------------|-----------------------------|
| 1       | pH             | Standardized pH meter       |
| 2       | Peroxide value | Iodometric Titration method |
| 3       | Acid value     | KOH Titration method        |

(A. D. Woyewoda, 1986)

### Result

**Table 1 pH and Acid Value of the Control and Experimental fish steaks of Indian Mackerel**

| Parameters          | pH      |             |               | Acid value (mg of KOH) |             |               |
|---------------------|---------|-------------|---------------|------------------------|-------------|---------------|
|                     | Control | Citric acid | Ascorbic acid | Control                | Citric acid | Ascorbic acid |
| 1 <sup>st</sup> day | 6.25    | 6.20        | 6.20          | 0.06                   | 0.07        | 0.05          |
| 3 <sup>rd</sup> day | 6.50    | 6.57        | 6.29          | 0.06                   | 0.08        | 0.06          |
| 6 <sup>th</sup> day | 6.65    | 6.60        | 6.50          | 0.08                   | 0.10        | 0.08          |
| 9 <sup>th</sup> day | 6.77    | 6.67        | 6.60          | 0.10                   | 0.11        | 0.14          |

**Table 2 Peroxide value and Free fatty acid of the Control and Experimental fish steaks of Indian Mackerel**

| Parameters          | Peroxide value mEq O <sub>2</sub> /Kg |             |               | % of free fatty acid |             |               |
|---------------------|---------------------------------------|-------------|---------------|----------------------|-------------|---------------|
|                     | Control                               | Citric acid | Ascorbic acid | Control              | Citric acid | Ascorbic acid |
| 1 <sup>st</sup> day | 7.25                                  | 7           | 7.5           | 0.03                 | 0.03        | 0.02          |
| 3 <sup>rd</sup> day | 8                                     | 5           | 5             | 0.03                 | 0.04        | 0.03          |
| 6 <sup>th</sup> day | 6                                     | 6           | 5.5           | 0.04                 | 0.05        | 0.04          |
| 9 <sup>th</sup> day | 8                                     | 7           | 6             | 0.05                 | 0.05        | 0.07          |

### Conclusion and Discussion

The results of the present research clearly highlights that the control steaks of Indian Mackerel that were not subjected to any antioxidants had increased levels of pH, Peroxide value and free fatty acid. This was due to rancidification of the fats present in the tissues of the Indian Mackerel. In the experimental fish steaks the pH and Peroxide value is less in the steaks treated with Ascorbic acid then Citric acid and control steaks. Whereas the Acid value and free fatty acid value is observed to be less in steaks treated with Citric acid then Ascorbic acid and almost equal to the control steaks. Overall the Citric acid is found to be a good antioxidant for the Indian Mackerel fish steaks. It has kept the pH value stable by controlling the rancidification by forming less free fatty acid and Peroxide, which are important indicators of the level of rancidification of the fats.

Similar studies have been conducted earlier by Copes Julio et. al., (2014), where they investigated the effect of Chloride, Citric acid and Ascorbic acid dip treatments in conjugation with two types of packaging films on Pejerrey fillets, *Odonthested bonaerensis* at three storage temperature. Results showed that the use of Chloride, Citric and Ascorbic acids and vacuum packaging showed good organoleptic character. Aydin Kilic et. al., (2013), investigated the effect of Ascorbic acid on the quality of cold smoked trout *Oncorhynchus mykiss* with or without sodium nitrite. During the experiment minced fish were subjected to 6 forms of brine and was freezed at 4°C. Various parameters like pH, lipid oxidation, moisture, protein, salts were analysed. The results revealed that sample treated with only Ascorbic acid increased the shelf life of smoked fish.

### References

- 1) A. D. Woyewoda, S. J. Shaw, P. J. Ke and B. G. Burns, (1986). Recommended Laboratory Methods for Assessment of Fish Quality, Canadian Technical Report of Fisheries and Aquatic Sciences No. 1448, Pg. No. 1 – 112.
- 2) Aydin Kilic and Aydin Oztan, (2013). Effects of Ascorbic acid utilization on cold smoked fish quality (*Oncorhynchus mykiss*) during process and storage. Food Science, Technology, 19(5), Pg. No. 823 - 831.
- 3) Copes Julio, Pellicer Karina, Bignon Giselda and Giannuzzi Leda, (2014). The use of Chloride, Citric acid and Ascorbic acid dip and packaged film to extend the shelf life of Pejerrey (*Odonthested bonaerensis*) during storage at different temperature. Food and Nutrition Sciences, 5, Pg. No. 1506 - 1520.
- 4) H. Mandakini Devi and Gaihamngam Kamei, (2017). Importance of Fish in our daily Food. Scientific papers. Pg. No. 1
- 5) Rostamzad H., Shabanpour B., Kashaninejad M., Shabani A., (2009). Inhibitory impacts of natural antioxidants (Ascorbic acid and Citric acid) and vacuum packaging on lipid oxidation in frozen Persian sturgeon fillets. Iranian Journal of fisheries, 9(2) Pg. No. 279 - 292.
- 6) Sabine Samples, (2013). Oxidation and Antioxidants in Fish and Meat from farm to fork. Chapter 6, Intech Open Science, Page no 1 – 30.
- 7) www.fao.org
- 8) www.omega3innovations.com