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A COMPARATIVE STUDY ON THE EFFECT OF GREEN PRESERVATIVES TO ENHANCE THE QUALITY AND LONGEVITY OF COMMERCIALLY IMPORTANT FISH FILLET IN FROZEN CONDITION

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ABSTRACT

This study explores the effectiveness of natural antioxidants from Garlic *(Allium sativum)*, Red onion *(Allium cepa)* and Green tea *(Camellia sinensis)* in mitigating lipid peroxidation and enhancing the quality of *Catla catla* fish fillets during refrigerated storage. Fish were treated with varying concentrations (1%, 2.5%, and 5% v/v) of plant extracts and stored at 4°C for 8 days. The treatments significantly reduced peroxide values and maintained Heme iron levels, with garlic juice showing the highest antioxidant capacity. Sensory evaluations indicated that treated fillets exhibited better colour, texture, flavour, and odour compared to the control, although high extract concentrations occasionally resulted in off-Flavors. These findings suggest that natural antioxidants can effectively improve the shelf life and quality of fish, presenting a viable alternative to synthetic preservatives.

KEYWORDS: Antioxidants, Shelf life, Garlic, Red onion, Green Tea, Peroxide values etc.

➢ INTRODUCTION

Fish is a very important source of animal protein in the diets of man. The importance of fish as a source of high quality, balanced and easily digestible protein, vitamins and polyunsaturated fatty acids is well understood now (Ravichandran et. al., 2011). Fish is favourite food stuff for the majority of societies. Fish meal contains most important nutritional components and serves as a source of energy for human beings (Ojewola and Annah, 2006; Sutharshiny and Sivashanthini, 2011). The biochemical composition of fish tissues is of significant interest in food science and nutrition due to their high content of proteins, carbohydrates, and lipids, which contribute to their calorific value and overall quality. Notably, marine lipids are rich in polyunsaturated fatty acids (PUFAs) such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are essential for human health (Joshi et al., 1979; Pasoz et al., 2005). However, this high concentration of unsaturated fats makes fish products highly susceptible to lipid oxidation, leading to quality deterioration and the development of off-Flavors and odours, ultimately impacting their nutritional value and economic viability (Sanchez-Alonso and Borderias, 2008; Amanatidou et al., 2000; Frankel, 1998).

Microbial spoilage during storage is inhibited by freezing, yet this process can alter the structural and functional properties of muscle proteins (Badii and Howell, 2002). Autoxidation and hydrolytic degradation of fats, particularly in the presence of oxygen, further exacerbate the formation of rancid Flavors, primarily due to the secondary oxidation products from lipid hydroperoxides (Gunderson, 1984; Bremner, 2002). Effective strategies to prevent these detrimental changes include low-temperature storage, appropriate packaging, and the addition of antioxidants (Yildiz et al., 2006; Serdaroglu and Felekoglu, 2005).

The food industry is increasingly shifting towards natural antioxidants derived from plant sources such as herbs, spices, and fruit extracts due to their ability to mitigate oxidative damage without the potential health risks associated with synthetic antioxidants (Sherwin, 1990; Khan et al., 2006; Benjakul et al., 2005).The Indian fish processing industry has witnessed a surge in the use of

plant extracts as natural preservatives for fish fillets. The trend is driven by the growing demand for chemical-free and sustainable food products. Compounds such as tocopherols, flavonoids, and phenolic compounds have been identified for their antioxidant properties, along with their effects on microbial growth (Sahoo et al., 2004; Yano et al., 2008). Many Indian fish processing companies are now incorporating these natural preservatives into their production lines, either as dips or coatings, to enhance the quality and safety of their products.

Garlic (*Allium sativum*), Red onions (*Allium cepa*), and Green tea (*Camellia sinensis*) are recognized not only for their culinary value but also for their potent antioxidant and antimicrobial properties. Garlic contains allicin, which has demonstrated antimicrobial effects (Maidment et al., 2001), and Red onions are rich in quercetin, a powerful flavonoid with significant antioxidant activities (Zielinska et al., 2008). Green tea catechins have also been shown to enhance the stability of fats and oils by chelating metals that catalyze oxidation (Chander et al., 2005).

In light of these findings, the present study aims to explore the feasibility of using natural antioxidants from red onion, green tea, and garlic to control lipid peroxidation and enhance the quality of *Catla catla* fish fillets during eight days of refrigerated storage. The study will assess chemical spoilage, Moisture (M), and Heme iron (HI), alongside sensory evaluation of colour, taste, odour, and texture. This investigation will contribute valuable insights into the application of natural antioxidants in the preservation of fish quality, thus addressing concerns over shelf-life and sensory properties in the seafood industry.

➢ MATERIAL AND METHOD

Sample Collection

Fresh red onions, garlic, and green tea leaves were obtained from local markets. Fresh *Catla catla* fish were caught from a Tiltwala lake and transported to the laboratory.

Extraction of Plant Juices/Extracts

Onion juice (OJ) was extracted from 50g of chopped onions using 500ml of pre-heated water. Green tea extract (TE) was extracted from 10g of ground dry green tea powder using 100ml of distilled water. Garlic juice (GJ) was extracted from 1kg of garlic using 30ml of distilled water.

Sample Preparation

Fish fillets were prepared and divided into four groups: control, OJ treatment, GJ treatment, and TE treatment. Each treatment group was further divided into three sub-groups with different concentrations of the plant extract (1%, 2.5%, and 5% v/v).

Treatment and Storage

Fish fillets were tumbled in the prepared dipping solution for 10 minutes and then packaged with polyvinylidene film. The samples were stored at 4°C for up to 8 days and analysed for lipid oxidation indices and sensory characteristics at 5 intervals (0, 2, 4, 6, and 8 days).

Total phenolics were determined by a calorimetrical method of Folin-Ciocalteu reagent moisture, crude protein, fat, and ash content, using established methods like Gravimetric drying, Kjeldahl's method, Bligh and Dyer extraction and Muffle furnace incineration. These measurements are essential for evaluating the fish's nutritional value, shelf-life stability, and overall quality for consumer consumption pH Value, Peroxide Value (PV)and Heme Iron Content was determine for biochemical analysis. The sensory analysis evaluated the colour, texture, flavour, and odour of fish.

The experimental design was a factorial 10×5×3, and data were analysed using one-way ANOVA with a significance level of α=0.05, followed by the Least Significant Difference (LSD) test for comparisons. This approach helped assess the impact of preservation on the sensory qualities of the fish.

➢ RESULTS AND DISCUSSION

1)Phenolic content of plant extract

Phenolic compounds serve as significant antioxidants in plant extracts, contributing to their ability to mitigate oxidative stress results indicating varying levels of phenolic content among different plant sources, such as garlic juice exhibiting higher levels compared to onion juice and green tea extract. Factors like extraction conditions also play a crucial role in determining the total phenolic content in extracts.

Table 1: Phenolic content (mg TAE/gdw) of Green tea extract (TE), Garlic juice (GJ) and Onion juice (OJ) at different concentration

TE 1%	145.6±0.037	GJ1%	169± 0.049	OJ1%	15.4±0.031
TE2.5%	243.6±0.012	GJ2.5%	443±0.020	OJ2.5%	37.39±0.022
TE 5%	538±0.055	GJ5%	734±0.066	OJ5%	85.76±0.04
*mg Tannic acid equivalents per gram dry weight of sample					

- **Proximate Composition**

The proximate composition of fresh *Catla catla* fillets was analyzed, revealing a moisture content of 77.9%, protein content of 16.5%, lipid content of 1.66%, and ash content of 1.22%. These values vary due to factors like

nutrition, catching season, environment, and fish size and gender.

Table 2: The proximate composition of the tissue of Catlacatla on analysis gave the following values in Percentage.

Moisture	**77.9%**
Protein	**16.5%**
Fat	**1.66%**
Ash	**1.22%**

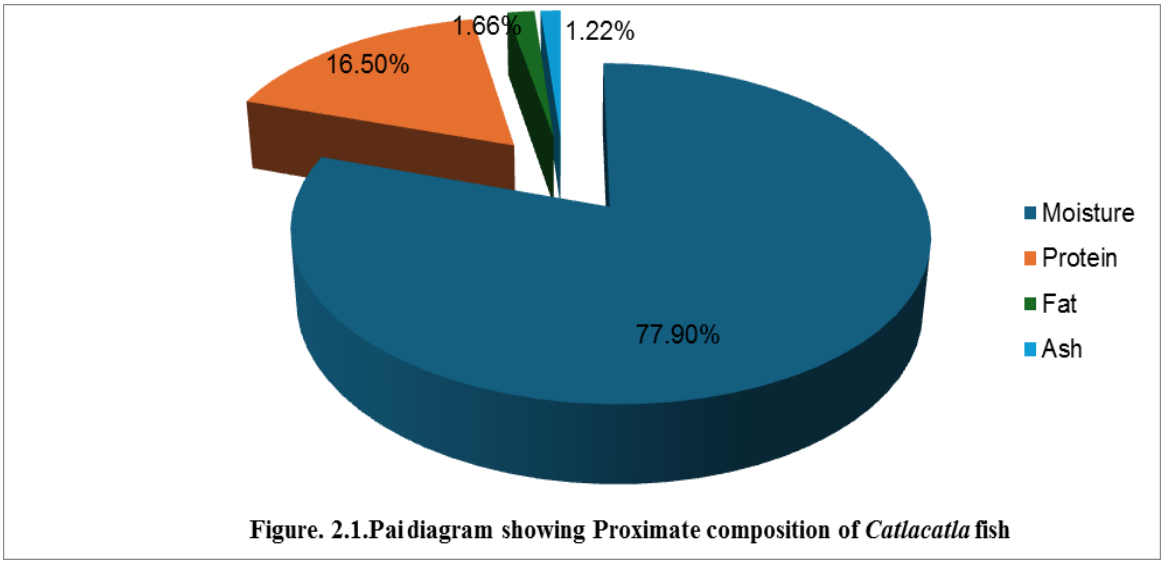


Figure. 2.1.Pai diagram showing Proximate composition of *Catlacatla* fish

- **Changes in pH content**

During the 8-day storage of *Catla catla* fillets, the pH values gradually increased, peaking at 7.23, likely due to the production of volatile basic compounds from microbial and endogenous enzymes, as well as the breakdown of nitrogenous substances. Such changes in pH can undermine the effectiveness of antioxidants, as varying pH affects their solubility and charge. The documented pH increase suggests that the fish fillets approach the upper limit of acceptability for freshness, typically around 6.8 to 7.0.

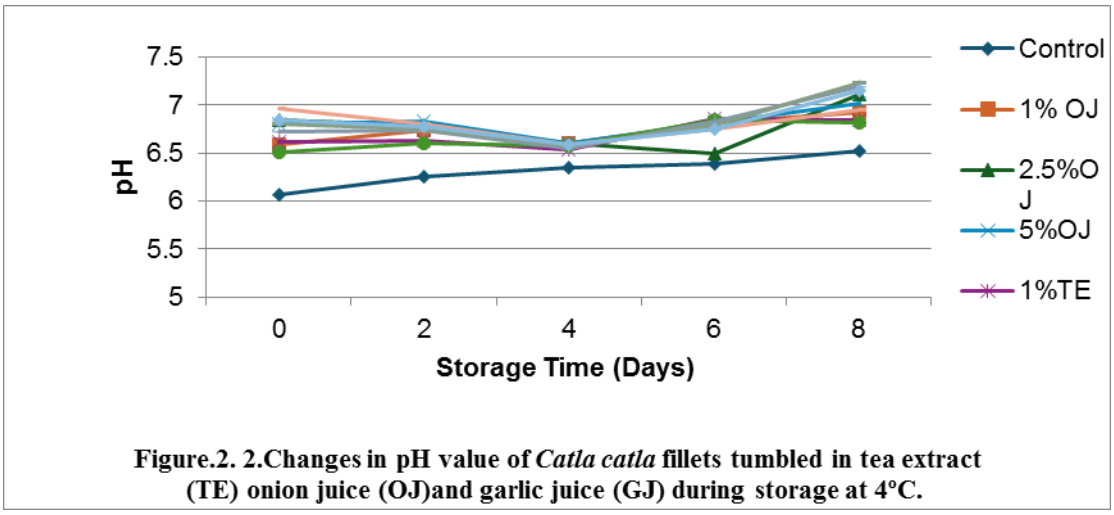


Figure.2. 2.Changes in pH value of *Catla catla* fillets tumbled in tea extract (TE) onion juice (OJ)and garlic juice (GJ) during storage at 4°C.

- **Changes in Peroxide value**

Onion juice, green tea extract, and garlic juice slowed down the increase in peroxide value (PV) in fish lipids during storage. Higher concentrations of these solutions were more effective in preventing oxidation. This suggests that these natural antioxidants can help preserve fish by reducing lipid oxidation**.**

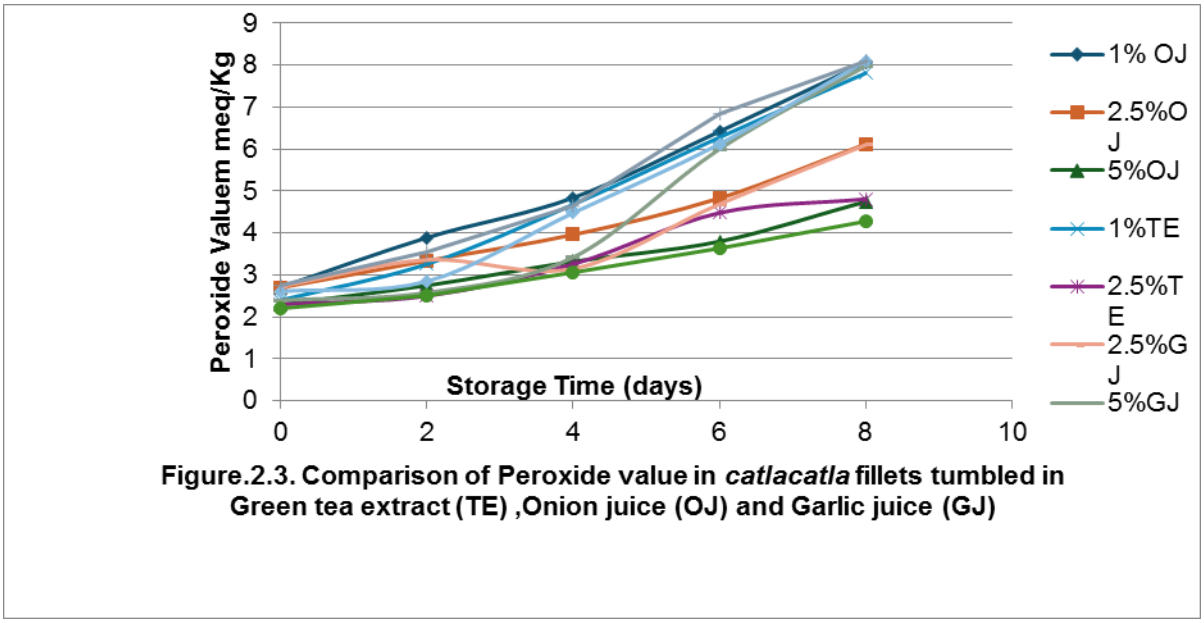


Figure.2.3. Comparison of Peroxide value in *catlacatla* fillets tumbled in Green tea extract (TE) ,Onion juice (OJ) and Garlic juice (GJ)

- **Changes in Haeme iron content**

Fish muscles, particularly in fatty species, contain high levels of haematin components that can lead to oxidative rancidity due to iron release from complexes during processing and storage. Adding green tea extract, which is rich in phenolic compounds, effectively inhibits this iron release and helps maintain haematin content, thus reducing oxidation. In contrast, lower phenolic content from onion and garlic juices also showed some protective effects against iron release.

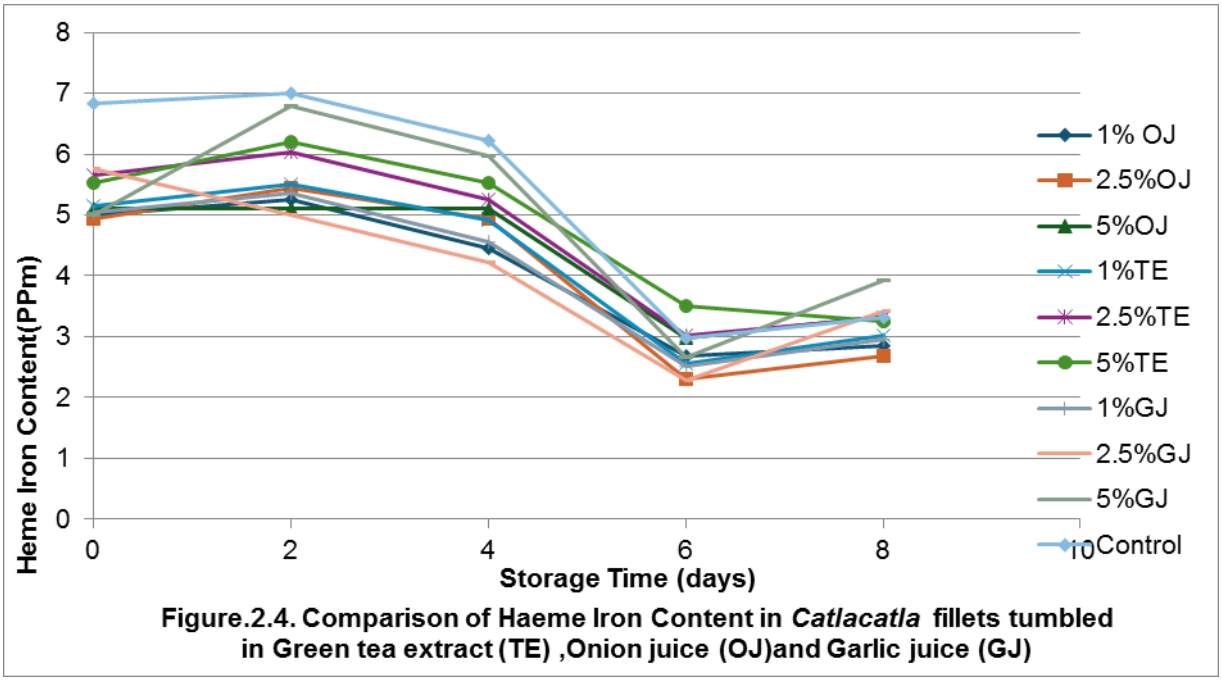
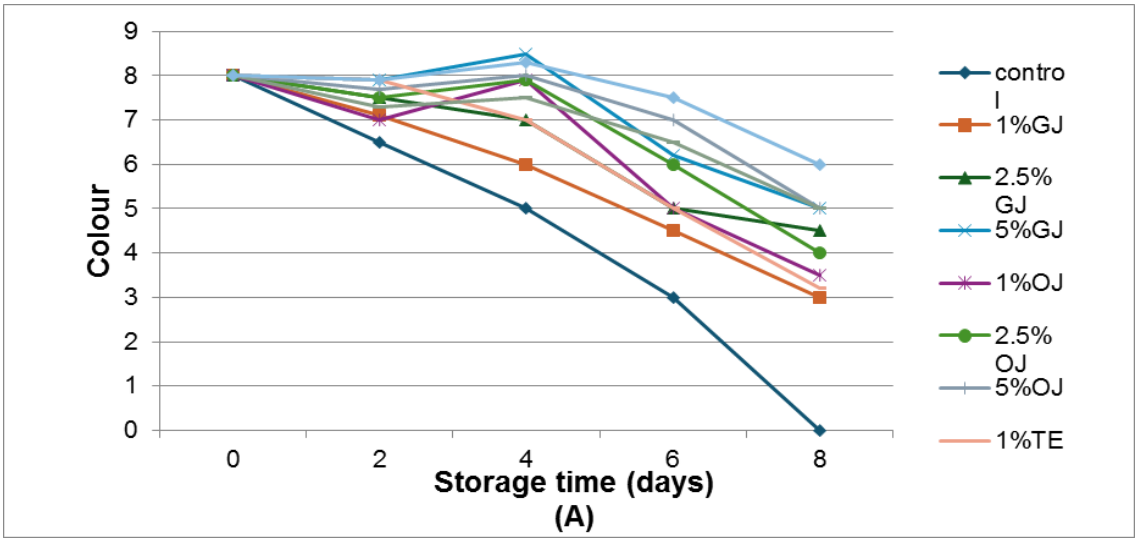
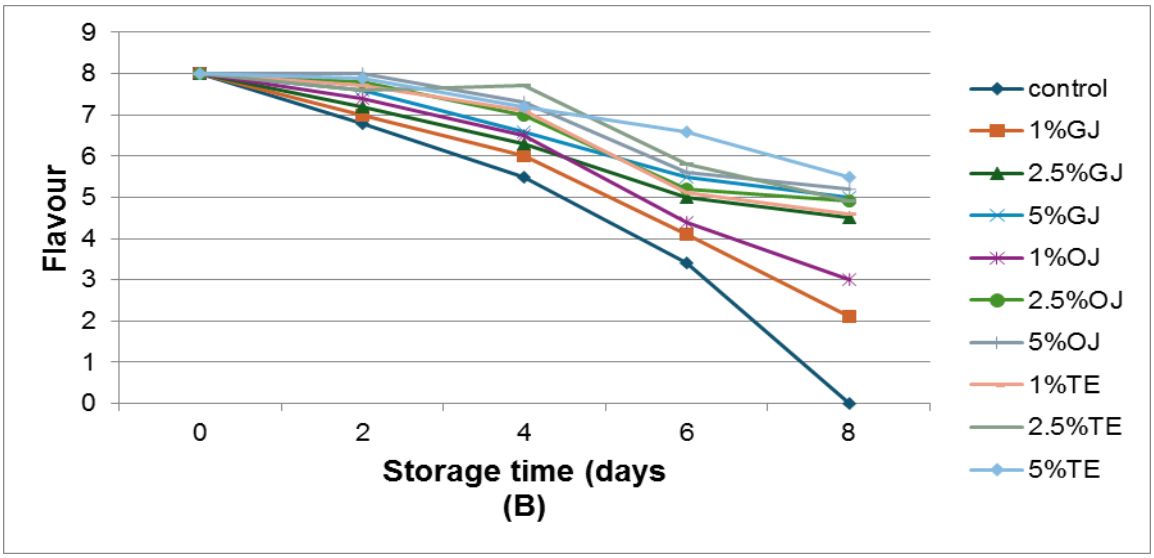


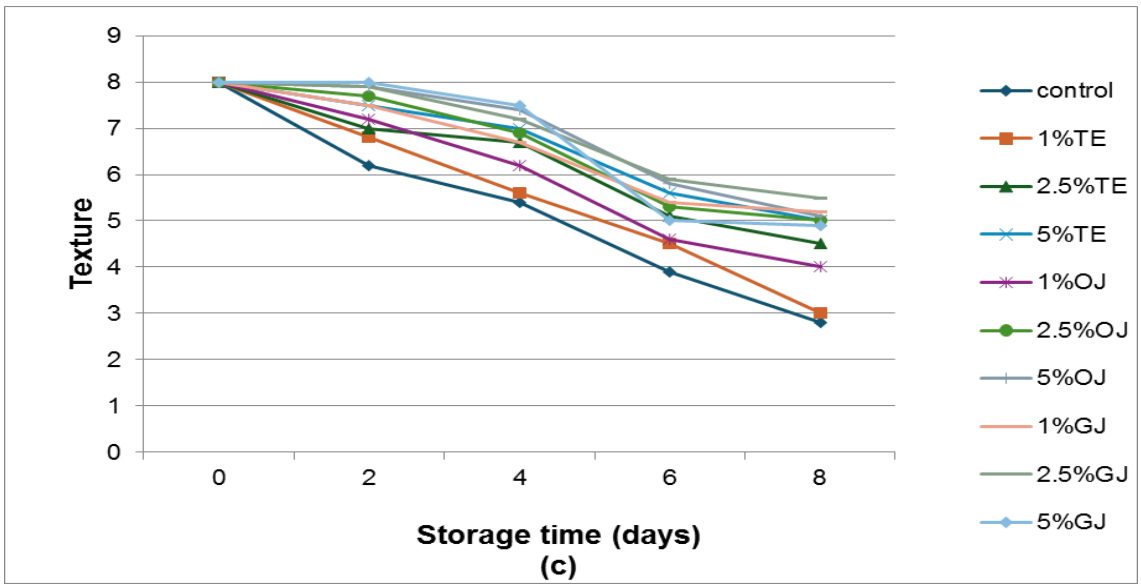
Figure.2.4. Comparison of Haeme Iron Content in *Catlacatla* fillets tumbled in Green tea extract (TE) ,Onion juice (OJ)and Garlic juice (GJ)

- **Changes in sensory attributes**

The sensory evaluation of *Catla catla* fish samples showed a significant decline in colour, texture, flavour, and odour during frozen storage, with treatments using green tea extract, garlic juice, and onion juice exhibiting better sensory scores than the control. Garlic treatment led to improved texture, while other treatments and the control became softer over time due to enzymatic degradation. The study found that certain plant extracts can help preserve the quality of fish, but high concentrations can create undesirable Flavors and colours.


Colour
Storage time (days)
(A)
control
1%GJ
2.5% GJ
5%GJ
1%OJ
2.5% OJ
5%OJ
1%TE


Flavour
Storage time (days
(B)
control
1%GJ
2.5%GJ
5%GJ
1%OJ
2.5%OJ
5%OJ
1%TE
2.5%TE
5%TE


Texture
Storage time (days)
(c)
control
1%TE
2.5%TE
5%TE
1%OJ
2.5%OJ
5%OJ
1%GJ
2.5%GJ
5%GJ

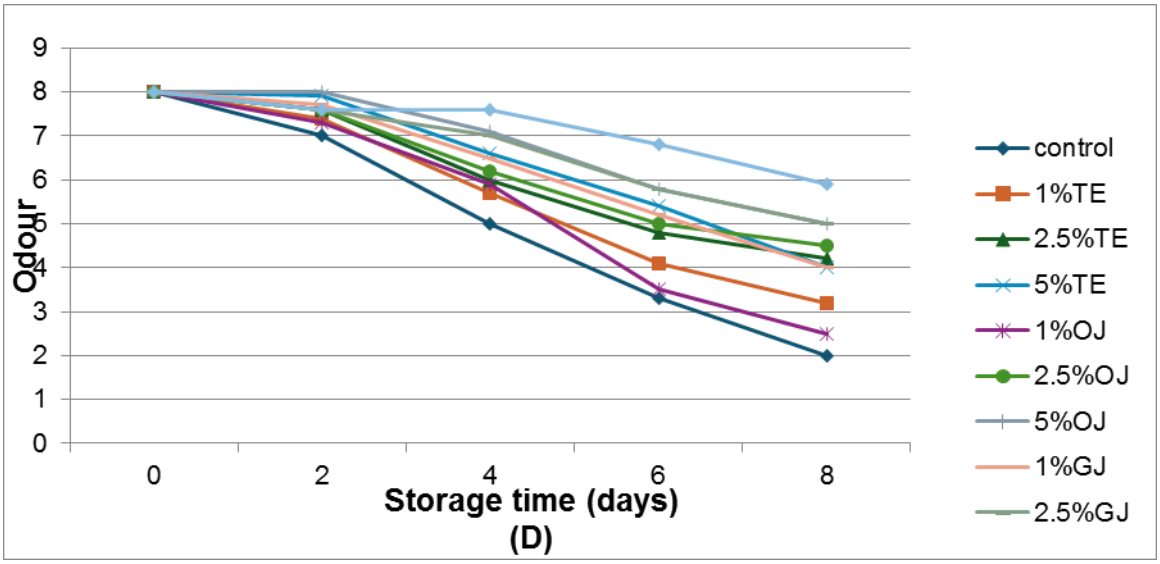


Figure 2.5: Comparative evolution of Colour (A), odour (B) , Texture (C) and Flavour (D) scores in Catla catla fish fillets treated by tea extract (TE), onion juice (OJ) and garlic juice (GJ)at three concentrations (1%, 2.5%, 5%) during refrigerated storage.

➢ CONCLUSION

The study found that natural antioxidants from garlic, green tea, and onion effectively reduce lipid oxidation and enhance the shelf life of *Catla catla* fish during storage. Among these, garlic showed the strongest antioxidant properties, while green tea was preferred for sensory qualities.

This study contributes to the growing body of research on the use of plant extracts as natural preservatives in the fish processing industry. The findings of this study can be applied to the Indian fish processing industry, where there is a growing trend towards the use of natural and sustainable preservatives. The use of plant extracts such as onion, garlic, and green tea can help to reduce the reliance on synthetic preservatives and enhance the quality and safety of fish products.

Overall, the use of plant extracts as natural preservatives for fish fillets is becoming increasingly popular in the Indian fish processing industry, and it is expected to continue to grow in the coming years as consumers become more aware of the benefits of chemical-free and sustainable food products.

➢ REFERENCES

1. Badii, F. and N. K. Howell, (2002).- Change in the texture and structure of cod and haddock fillets during frozen storage food hydrocolloid, 16: 313: 319.
2. Benjakul, S., Visessanguan, W., Phongkanpai, V. and Tanaka, M., (2005). Antioxidative activity of caramelisation products and their preventive effect on lipid oxidation in fish mince. *Journal of Food Chemistry*, 90: 231-239.
3. Chander, R., Khanna, A.K. Kanwal, R. and Rastogi, A.K. (2005) -Antioxidant And lipid activities of Indian black tea Indian Journal of clinical Biochemistry, 20: 153-159.
4. Gunderson, J. (1984). Fixin' Fish: A Guide to Handling, Buying, Preserving, and Preparing Fish. 2nd Edition, University of Minnesota Press, Minneapolis, 56: 7.
5. Joshi, B.D., D.KGupta, and L.D.Chaturvedi (1979). Biochemical Composition of some tissues of a freshwater fish *Heterop-neustes fossilis* during winter months. Matsya, 5: 47-49.
6. Ojewola, G.S. and Annah, S.I. (2006). Nutritive and economic value of Danish fish meal, Crayfish dust meal and Shrimp waste meal inclusion in broiler diets. *International Journal of Poultry Science*, 5(4): 390-394.
7. Ravichandran, S., Kumaravel, K. and Florence, E.P. (2011). Nutritive composition of some edible fin fishes. International Journal of Zoological Research, 7(3): 241-251.
8. Sahoo, J., Kawasra, R.K. and Hooda, S., (2004). Studies on a-tocopherol acetate as an antioxidant in chicken mince on its quality during refrigated storage. *Journal of Food Science and Technology*, 41(3): 240-243.
9. Sanchez-Alonso, I. and A. Borderias, (2008). "Technological effect of red grape antioxidant dietary fibre added to minced fish muscle," J. Food Sci. & Tech., 43: 1009-1018.
10. Sherwin, E.R.(1990). Antioxidants. In: Branen, A.L. Davidson, P.M., Salminen, S. and Marcek D. Food additives, p139-193. Inc, New York, USA.
11. Yildiz, M., E. Ener and H.G.N. Seyin (2006), "Effect of Refrigerated Storage on Fillet Lipid Quality of Rainbow Trout (*Oncorhynchus mykiss W.*) Fed a Diet Containing Different Levels of DL a-Tocopherol Acetate," *Turk J Vet Anim Sci*, 30: 143-150.

12. Zielinska, D., Wiczkowski, W. and Piskula, M.K. (2008). Determination of the Relative Contribution of Quercetin and Its Glucosides to the Antioxidant Capacity of Onion by Cyclic Voltammetry and Spectrophotometric Methods. Journal of Agriculture and Food Chemistry, 56: 3524-3531.