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The effect of rosemary extract (*Rosmarinus officinalis*) on reducing spoilage of rainbow trout (*Onchorhynchus mykiss*) during storage in cold conditions

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Extended Abstract

Introduction: Fish, particularly rainbow trout (*Oncorhynchus mykiss*), is highly perishable due to its high moisture content, making it susceptible to spoilage and microbial growth. Ensuring the freshness of fish, especially during refrigerated storage, remains a challenge in the food industry. While synthetic preservatives have been used to prolong the shelf-life of fish, increasing consumer awareness of the negative effects of these chemicals has led to a growing preference for natural alternatives. Rosemary (*Rosmarinus officinalis*), a plant known for its antimicrobial and antioxidant properties, has gained attention as a natural preservative. This study evaluates the effectiveness of rosemary extract in two concentrations (0.1% and 0.3%) in extending the shelf-life of rainbow trout fillets during refrigerated storage, focusing on chemical and microbial spoilage indicators.

Methods: Eighteen rainbow trout were purchased from a local farm and transported under cold chain conditions to the laboratory. After filleting, the fish fillets were treated with ethanolic rosemary extract at two concentrations: 0.1% and 0.3%. The rosemary extract was prepared by soaking dried rosemary in 80% ethanol for two days, followed by filtration and concentration. The fillets were coated with the extract through immersion and stored in refrigerated conditions at 4°C for 15 days. The chemical parameters, including Peroxide Value (PV) and Total Volatile Base Nitrogen (TVB-N), and microbial parameters, including Total Viable Count (TVC) and Psychrotrophic Bacteria Count (PTC), were measured on days 0, 3, 6, 9, 12, and 15 of storage. The data were analyzed using a completely randomized design, with Duncan's multiple range test employed for statistical comparisons at a significance level of 0.05.

Results: The peroxide value (PV) showed a significant increase over the storage period for all treatments, with the 0.3% rosemary extract group exhibiting the slowest rate of increase compared to the other treatments. Specifically, at day 9, the PV in the control group was higher than in the rosemary-treated groups. On day 12, a slight reduction in PV was observed across all treatments. The rosemary extract at 0.3% demonstrated the most effective inhibition of lipid oxidation,

maintaining a lower PV compared to the 0.1% concentration and the control group. Similarly, the total volatile base nitrogen (TVB-N) increased significantly during the storage period, with the control group showing the highest increase. The 0.3% rosemary extract treatment exhibited the lowest TVB-N values, indicating better preservation of fish quality over time. Microbial analysis showed that TVC and PTC increased progressively in all treatments, but the rosemary-treated groups had a slower rate of bacterial growth, particularly at the 0.3% concentration, which exhibited the lowest bacterial counts at all time points compared to the control.

Discussion: The results indicate that rosemary extract, particularly at the 0.3% concentration, effectively reduced microbial growth and delayed oxidative spoilage in rainbow trout fillets. The antimicrobial activity of rosemary is attributed to its phenolic compounds, such as rosmarinic acid, which inhibit bacterial growth. Additionally, rosemary's antioxidant properties, due to compounds like carnosic acid, help delay the oxidation of lipids, which is a major cause of quality deterioration in fish. The slower increase in PV and TVB-N in rosemary-treated fillets suggests that rosemary not only preserves freshness by preventing microbial growth but also helps maintain the sensory qualities of the fish. This is consistent with previous studies showing rosemary's effectiveness in preserving fish and other perishable foods by extending their shelf life. The study confirms that the 0.3% rosemary extract concentration is particularly effective in extending shelf-life, as it slows down both the microbial spoilage and chemical deterioration of fish fillets during refrigeration. The results align with other studies that found rosemary extracts to be a viable alternative to synthetic preservatives in fish preservation.

Conclusion: This study demonstrates that rosemary extract, especially at a concentration of 0.3%, is highly effective in reducing spoilage and extending the shelf-life of rainbow trout fillets during refrigerated storage. The rosemary treatment significantly reduced microbial growth and delayed fat oxidation, which are key factors contributing to fish spoilage. Therefore, rosemary extract can be considered a natural, safe, and effective preservative for enhancing the shelf life and quality of fish products. Further studies using higher concentrations and a broader range of parameters are recommended to optimize the preservation technique for commercial applications.