Research Article

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Rancidity development of refrigerated rainbow trout (*Oncorhynchus mykiss*) fillets: comparative effects of *in vivo* and *in vitro* lycopene

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Abstract

BACKGROUND: The problem of lipid oxidation in fish during storage is well known and is related to both temperature and storage time. Antioxidants could have a main role in limiting the deteriorative effects of lipid oxidation in fish. The present study aimed to investigate the effect of dietary supplement against postmortem addition of lycopene on the deterioration of trout fillets during storage at 4 ± 1 °C for 12 days.

RESULTS: At the end of the feeding trial, no significant differences were observed with respect to the fatty acid composition of different dietary groups. However, a strong positive correlation ($r = 0.96$) was observed between fillet and diet lycopene levels. Lower indices of lipid oxidation (peroxide value and thiobarbituric acid) and lipid hydrolysis (free fatty acids) were observed in fillets that received lycopene ($P < 0.05$). Although exogenous lycopene was more effective ($P < 0.05$) than endogenous lycopene in delaying lipid oxidation, the fatty acid composition of fillets that received dietary lycopene supplement showed a higher stability ($P < 0.05$) during refrigeration storage.

CONCLUSION: Accordingly, based on the time of appearance of off-odors and discoloration in fish fillets, exogenous lycopene, especially at higher levels, was more effective in terms of quality parameters.

Keywords: shelf-life; rainbow trout; lipid oxidation; lycopene; diet and fillet addition

INTRODUCTION

Epidemiological, nutritional and clinical studies have demonstrated that fish and fish-derived food products comprising rich sources of *n*-3 polyunsaturated fatty acids (PUFAs) can have beneficial effects on various disorders such as cancer, cardiovascular disease, hyperactivity, obesity, diabetes, arthritis, asthma, depression, etc. Hence, the consumption of at least two fish servings is recommended per week by the American Heart Association. However, *n*-3 fatty acids (FAs) are highly unsaturated; therefore, they are susceptible to oxidation during storage.[1,2]

Lipid oxidation in seafood is an important issue because it contributes to the deterioration of flavor, color, texture and nutritional values. It also imposes harmful effects on human health that greatly depend on storage time and temperature, the presence of natural antioxidants, physical treatment, type of chemicals used and packaging.[3,4] As a result of problems concerning rapid postharvest lipid oxidation, the seafood industry has embarked on the search for solutions. Currently, the application of antioxidant agents for controlling lipid oxidation in seafood is well established. A major trend for food consumers, producers and researchers is a shift away from synthetic antioxidants to natural ones aiming to inhibit the development of oxidative rancidity in muscle foods.[4]

Carotenoids, which are known as fat-soluble pigments, are prevalent in numerous fruits and vegetables. Lycopene, the natural carotenoid in tomato and its products, is the most potent antioxidant among other natural antioxidants, such as α-tocopherol, α-carotene, β- cryptoxanthin, and β-carotene. Recently, lycopene has become the focus of great interest because of its highly efficient antioxidant scavenging activity; some studies have suggested a protective role for lycopene in preventing

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