Inhibition of lipid oxidation development in refrigerated salmon (*Salmo salar*) paste by addition of different stevia (*Stevia rebaudiana* Bert.) extracts

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INTRODUCTION

The great development that has reached the agribusiness activity has had a negative impact on the environment. One of the main adverse effects is the increase in the generation of waste, this impelling to look for new techniques or methods for the use of off-products. Each residue generated in the agro-industrial process can be exploited in other applications (O'Shea et al., 2012). Concerning the stevia (*Stevia rebaudiana* Bert.) industry, the only thing that is used is the sweetener, leaving aside the other bioactive compounds, in which polyphenols that have antioxidant and antimicrobial capacities are present (Rodriguez-Carpena et al., 2011). Accordingly, it would be interesting to search for new methods of obtaining these bioactive compounds using environmentally friendly and safe methods (Esquivel and Vargas, 2007). The aim of this study was to evaluate the potential protective effect of crude stevia extracts on the quality and shelf-life of salmon (*Salmo salar*) paste.

ABSTRACT

The aim of this study was to evaluate the potential protective effect of crude stevia extracts on the quality and shelf-life of salmon (*Salmo salar*) paste. For this purpose, polyphenol extracts obtained by water extraction, ethanol/water extraction and supercritical CO_2 with ethanol extraction were evaluated throughout the refrigerated storage (5 °C for 21 days) of salmon paste. Primary, secondary and total lipid oxidation compounds were monitored throughout storage by means of peroxide, p-anisidine and TOTOX indices, respectively. In addition, ω3/ω6 fatty acids ratio, polyene index and α-tocopherol content were also monitored. Microbiological analysis comprised the investigation of aerobic mesophiles and psychrotrophes.

Salmon paste samples treated with ethanol/water and supercritical CO_2-ethanol stevia extracts exhibited the highest ($p<0.05$) ω3/ω6 ratios and α-tocopherol contents. Besides, partial inhibition of both primary and secondary lipid oxidation events and aerobes and psychrotroph growth was also observed in both kinds of samples. These results agreed with the fact that ethanol/water and supercritical CO_2-ethanol extracts provided the highest DPPH and FRAP values.

MATERIALS AND METHODS

Stevia (*Stevia rebaudiana* Bert.) leaves provided by Manto Verde S. A. (Quillota, Chile) were dried at 40 ± 1.0 °C to a moisture content of 5.4 ± 0.5 %, and then ground to a particle size of 0.8 ± 0.1 mm and stored at 25 ± 1.0 °C in sealed polyethylene bags.

Salmon (*Salmo salar*) employed as lipid matter was obtained as frozen fillets (–20 °C) from Nova Austral (Puerto Montt, Chile) and kept at the same temperature in our laboratory for further analysis.

Fig. 1. Stevia leaves and salmon pieces.

Polyphenol extracts obtained by water extraction (W), ethanol/water extraction (E/W) and supercritical CO_2 with ethanol extraction (SCE) were evaluated throughout the refrigerated storage (5 °C for 21 days) of salmon paste. Primary, secondary and total lipid oxidation compounds were monitored along storage by means of peroxide, p-anisidine and TOTOX indices, respectively. In addition, ω3/ω6 fatty acids ratio, polyene index and α-tocopherol content were also monitored. Microbiological analysis comprised the investigation of aerobic mesophiles and psychrotrophes.

Fig. 2. Supercritical extraction equipment.

RESULTS AND DISCUSION

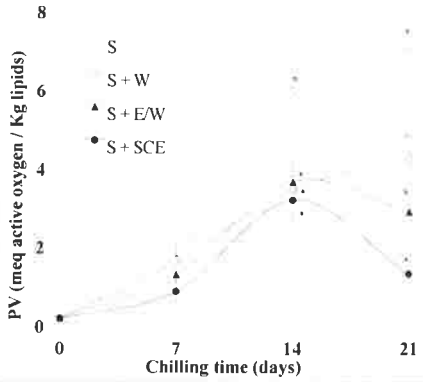

Fig. 3. Effect of different stevia extracts addition on the peroxide value (PV) in refrigerated salmon paste.

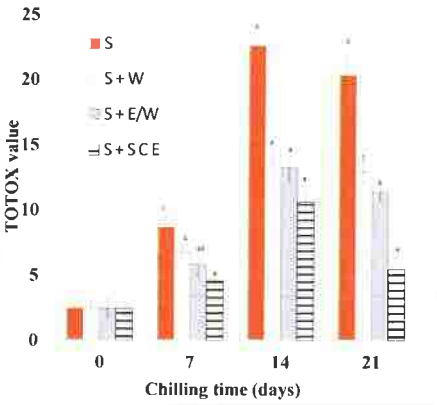

Fig. 4. Effect of different stevia extracts addition on the total oxidation (TOTOX) value in refrigerated salmon paste

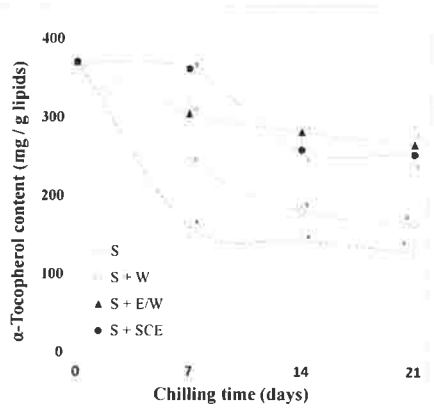

Fig. 5. Effect of different stevia extracts addition on alpha-tocopherol content in refrigerated salmon paste.

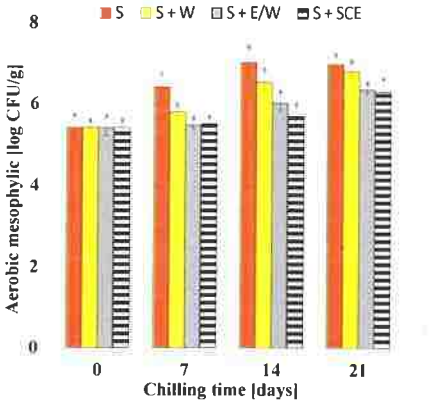

Fig. 6. Effect of different stevia extracts addition on the mesophylic bacteria counts in refrigerated salmon paste

CONCLUSIONS

It is concluded that, on the basis of employing the actual stevia extracts, it is possible to obtain a preservative effect on salmon paste throughout its refrigerated storage, as a result of inhibiting the two most important damage pathways (i.e., development of lipid oxidation and spoilage microorganisms). The results obtained in this research show the possibility of using stevia and/or its derivatives of the sweetener industry as an alternative source of natural antioxidants in refrigerated fatty fish paste.

ACKNOWLEDGEMENTS

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REFERENCES

- Esquivel, A., Vargas, P. (2007). *Tecnología en marcha, 20: 4.*
- O'Shea, N., Arendt, E., Gallagher E. (2012). *Innovative Food Science and Emerging Technology, 16: 1-10.*
- Rodriguez-Carpena, J. G., Morcuende, D., Estévez, M. (2011). Avocado *(Persea americana Mill.)* phenolics: In vitro antioxidant and antimicrobial activities, and inhibition of lipid and protein oxidation in porcine patties. *Journal of Agricultural and Food Chemistry, 59: 5625–5635.*