Antioxidant And Antimicrobial Activity From Six Species Of Edible Irish Seaweeds

Sabrina Cox
Technological University Dublin, sabrina.cox@dit.ie

Follow this and additional works at: https://arrow.dit.ie/schfsehcon
Part of the Food Science Commons

Recommended Citation
Cox, S. Antioxidant And Antimicrobial Activity From Six Species Of Edible Irish Seaweeds. 2008. 8th Joint Meeting of the Seafood Science and Technology Society and Atlantic Fisheries Technology Conference. North Carolina State University, Department of Food, Bioprocessing and Nutrition Sciences, USA.
Antioxidant and antimicrobial activity from six species of edible Irish seaweeds
Sabrina Cox*, Nissreen Abu-Ghannam and Shilpi Gupta
School of Food Science and Environmental Health, Dublin Institute of Technology, Cathal Brugha Street, Dublin 1, Ireland

Introduction

Seaweeds are macroalgae which are macroscopic plants of marine benthos. Based on nutrient and chemical composition seaweeds are classified as Rhodophyta (red algae), Phaeophyta (brown algae) and Chlorophyta (green algae).

Irish harvests 32,000 tonnes of seaweed per year with an annual turnover of €15 million.

Seaweeds are a known source of bioactive compounds such as antiviral, antimicrobial and antioxidants as they contain secondary metabolites characterized by a broad spectrum of biological activities.

Seaweeds are exposed to light and high oxygen concentrations which result in free radicals and other strong oxidizing agents being formed. However, antioxidants suffer some serious photodynamic damage which implies that their cells have protective mechanisms and compounds.

Seaweeds are a relatively unexplored resource in Ireland. Thus investigation into this plentiful resource could provide a promising alternative and natural source of bioactive compounds, nutraceuticals and functional foods.

The main objective of this work was to investigate and evaluate the antioxidant and antimicrobial activity of six species of edible Irish seaweeds.

Materials and Methods

Three species of Phaeophyta, two Rhodophyta and one Chlorophyta were used in this study.

Antioxidant Analysis

Folin-Ciocalteau Method

DPPH Method

All species of seaweeds exhibited a concentration-dependent DPPH radical scavenging activity. DPPH assay is based on the concentration of sample required to reduce the DPPH radicals by 50% (EC50).

All three species of brown seaweed and Chondrus crispus showed better scavenging capacity than Palmaria palmata and Enteromorpha spirulina.

Himenthalia elongata showed highest antioxidant activity giving 50% reduction of DPPH radical at 14 µg/ml and gave 100% inhibition at 200 µg/ml.

Followed by Laminaria digitata, Laminaria saccharina and Chondrus crispus (all 5 µg/ml).

Palmaria palmata had an EC50 of 25 µg/ml and Enteromorpha spirulina gave the lowest level (75 µg/ml).

Antimicrobial Analysis

Antimicrobial properties of seaweed extracts against two species of gram- and gram- food pathogen and food spoilage bacteria are depicted in Fig. 3.

Brown seaweeds had the highest antimicrobial activity.

Himenthalia elongata gave 100% inhibition of all bacteria at 12.5 mg.

All extracts inhibited growth of bacteria except Chondrus crispus which increased the growth of the spirochete bacteria. This may have been due to high levels of polysaccharides in the extract which supported bacterial growth.

All effective extracts had highest impact in inhibiting Listeria monocytogenes.

Results and Discussion

Extracts from six species of edible Irish seaweeds were screened for antioxidant and antimicrobial activity.

All species of seaweeds exhibited a concentration-dependent DPPH radical scavenging activity. DPPH assay is based on the concentration of sample required to reduce the DPPH radicals by 50% (EC50).

All three species of brown seaweed and Chondrus crispus showed better scavenging capacity than Palmaria palmata and Enteromorpha spirulina.

Himenthalia elongata showed highest antioxidant activity giving 50% reduction of DPPH radical at 14 µg/ml and gave 100% inhibition at 200 µg/ml.

Followed by Laminaria digitata, Laminaria saccharina and Chondrus crispus (all 5 µg/ml).

Palmaria palmata had an EC50 of 25 µg/ml and Enteromorpha spirulina gave the lowest level (75 µg/ml).

The most effective concentration of seaweed extracts were analysed kinetically over 24 hours (Fig. 4).

Himenthalia elongata was most effective against all bacteria inhibiting bacteria from the first hour, followed by Laminaria saccharina and Laminaria digitata.

Palmaria palmata and Enteromorpha spirulina increased the lag phase (average 2 and 4 hours respectively) after which growth increased.

Chondrus crispus increased the overall growth of the bacteria higher than the control.

Conclusion

The results of the present work indicated that extracts of Irish seaweeds successfully displayed antioxidant activity.

Himenthalia elongata was most effective (phenolic content 153.1 gallic acid units; DPPH EC50 = 14 µg/ml).

All seaweed extracts except Chondrus crispus had some antimicrobial activity.

Himenthalia elongata was most successful in inhibiting bacteria (100% inhibition at 12.5 mg/ml concentration) followed by the other two Phaeophyta Laminaria saccharina and Laminaria digitata.

Chondrus crispus increased the growth of all bacteria.

The present findings appear useful in leading to further experiments to test the potential of the extracts to increase the shelf life of food products. The ability of seaweed extracts to quench free radicals is known to take place over a longer period of time than rapid acting synthetic antioxidants such as BHA. This may have benefits for extending the shelf-life of processed foods during distribution and storage.

References


Acknowledgements

This work was funded by the Dublin Institute of Technology ABBEST Scholarship.

The authors would like to acknowledge and thank The Marine Institute of Ireland for providing funding for attending the conference.

This work was presented in October 2008 at the 2008 8th Joint Meeting of the Seafood Science and Technology Society and Atlantic Fisheries Technology Conference. North Carolina State University, Department of Food, Bioprocessing and Nutrition Sciences, USA.

*Corresponding author. Tel: +353134024574
Email address: sabrina.cox@dit.ie