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Determination of fucoidan, alginate, and protein concentrations in edible seaweeds from the Salish Sea Region

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Objective

In the past, the indigenous people of the Pacific Northwest relied on a variety of edible seaweeds for food. There is now renewed interest in incorporating traditional foods back into their diet in order to reduce heart disease, diabetes, obesity and other health issues related to the Western commodity food diet.

Although seaweeds may contain contaminants, as observed in past studies, they also have numerous health benefits that may outweigh the detrimental effects of the contaminants. To better understand the health benefits of consuming these seaweeds, I began to quantify the concentrations of fucoidan and alginate in the same seaweed samples used in the contaminant project.

Figure 1. Songhees Nation members sampling Bull Whip Kelp, *Nereocystis luetkeana*, for Salish Seaweed Contaminant study.

Hypothesis

We predict that alginate and fucoidan concentrations will be lower in seaweed samples collected from historically contaminated sights.

Introduction to Fucoidan and Alginate

Seaweeds are a good source of vitamins and minerals and contain high concentrations of polysaccharides. Both fucoidan and alginate polysaccharides are composed of sulfated L-fucose with glycosidic bonds that make for easy extraction.

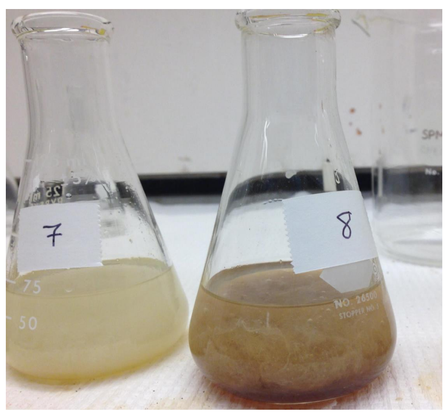

Figure 2. Extraction of polysaccharides prior to centrifuge with ethanol.

Previous research on fucoidans and alginates has shown that they possess diverse health benefits:

- Anti-allergic
- Antioxidant
- Anti-inflammatory
- Anti-tumor
- Anti-obesity
- Anti-coagulant
- Anti-viral
- Anti-hepatopathy
- Anti-uropathy
- Anti-renalpathy effects

Figure 3. *Fucus distinchus* in the field.

Figure 4. Map of Salish Sea collection sites.

Figure 5. Jennifer Hahn in a sea kayak collecting Bull Whip Kelp.

Figure 6. Alginate dried overnight in an oven at 50°C.

Methods

Fucoidan and Alginate Assays:

- Grind freeze dried samples
- Remove lipid-soluble materials from ground algae with methanol:dichloromethane:water and centrifuge after overnight extraction
- Hydrolyze and extract polysaccharides with 0.03 M HCl in a 90°C water bath
- Precipitate and wash polysaccharides with ethanol and centrifuge
- Separate alginate and fucoidan polysaccharides with CaCl and centrifuge
- Dry pellets retrieved from extractions in microcentrifuge tubes in an oven overnight

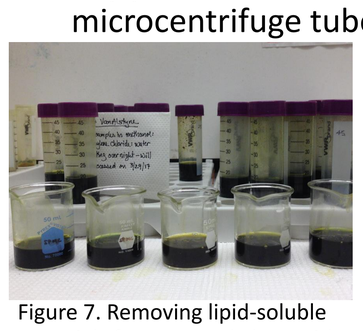

Figure 7. Removing lipid-soluble materials from ground algae with methanol:dichloromethane:water.

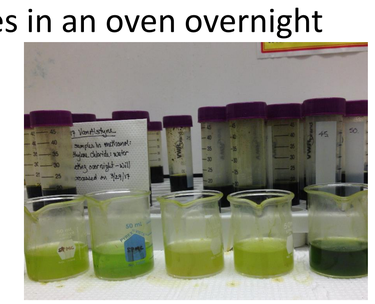

Figure 8. Extracting pellet with 20 mL of acetone two times and centrifuging.

Results

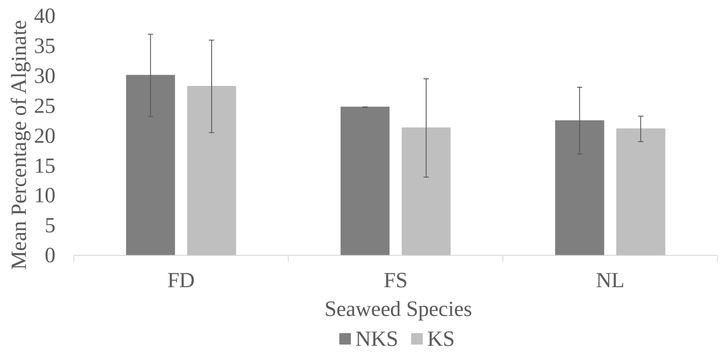

Figure 9. Comparison between no known source of contamination (NKS) and known source (KS) of contamination sites of mean alginate percentages derived from different seaweed species samples including *Fucus distichus* (FD), *Fucus spiralis* (FS), and *Nereocystis luetkeana* (NL) collected at 45 different sites. T-test results revealed no significance difference between species or sites.

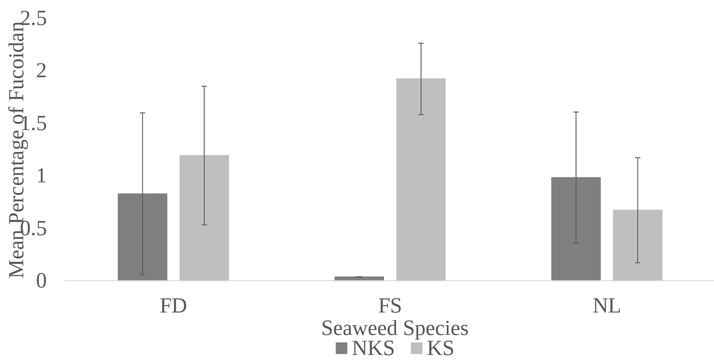

Figure 10. Comparison between no known source of contamination (NKS) and known source (KS) of contamination sites of mean fucoidan percentages derived from different seaweed species samples including *Fucus distichus* (FD), *Fucus spiralis* (FS), and *Nereocystis luetkeana* (NL) collected at 45 different sites. T-test results revealed no significance difference between species or sites.

Acknowledgements

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