



Original Research Article

Bioaccessibility of target essential elements and contaminants from *Fucus spiralis*

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ABSTRACT

Fucus spiralis is an edible brown seaweed (SW) found in the Portuguese Coast that is still undervalued and not very well studied. However, SW are known to be nutritious and healthy foods, in part, for their potential to supply mineral nutrients to the body. Nevertheless, with the increasing levels of pollution in the coastal areas, SW can also accumulate some contaminants.

Therefore, to expand the knowledge about this marine resource, the contents of Mg, Mn, Co, I, Cd, Pb, As and Hg in fresh and freeze-dried *Fucus spiralis* were determined before and after *in vitro* human digestion simulation. Magnesium was the major element with 11.86 mg/g dry weigh (DW), but it must be highlighted that I in this SW presented concentration values of approximately 135 µg/g DW. Concerning contaminants, *F. spiralis* seems to have low levels of Cd, Pb, and Hg. The elements' bioaccessibility was always high, ranging between 45.8% (I – Fresh SW) and 88.5% (Hg – FD SW). The freeze-drying process seemed to enhance element bioaccessibility.

1. Introduction

There is a tradition in countries with extensive shorelines to use seaweed (SW) for different applications, such as soil fertilizers and food. More recently, besides these traditional applications, biotechnological and pharmaceutical utilization of the SW resources has been steadily increasing (Caliceti et al., 2002; McHugh, 2003). In particular, many consumers consider SW as nutritious and healthy food, in part, for their potential to supply mineral nutrients to the body. The growing awareness of the critical relationship between diet and health, as well as the intensification of trade flows between distant geographical areas, is expected to lead to more people consuming SW or SW-based foods (Flores et al., 2015; Mabeau and Fleurence, 1993).

Of course, SW mineral content can vary depending on SW phylum, physiological variations, geographical source, environmental conditions, and seasonality (Ortega-Calvo et al., 1993; Ruperéz, 2002). This mineral content includes both macro and trace elements, such as magnesium (Mg), calcium (Ca), iron (Fe), sodium (Na), potassium (K), manganese (Mn), and especially iodine (I) that is usually present in much higher concentrations in SW than in higher plants (Mabeau and

Fleurence, 1993; Mohamed et al., 2012).

Magnesium is present in high quantities in seaweed and has an important biological role in the human body. Particularly, this element is a co-factor for DNA and protein synthesis, oxidative phosphorylation, neuro-muscular excitability, enzyme activity, and regulation of parathyroid hormone secretion (Ayuk and Gittoes, 2014).

Cobalt is an essential trace element for the human body. It's most known as a core element of vitamin B₁₂. Moreover, Co is also very important in the biosynthesis of amino acids and participates, between other roles, in the formation of erythrocytes (Czarnek et al., 2015).

Manganese is another trace element present in the human body, and it helps the body form connective tissue, bones, blood clotting factors, and sex hormones. It also plays a role in fat and carbohydrate metabolism, calcium absorption, and blood sugar regulation. Manganese is also necessary for normal brain and nerve function (Ayuk and Gittoes, 2014).

As mentioned before, iodine is present in SW at high concentrations and is an important element for human health, since this element plays a physiological role in the synthesis of thyroid hormones. Thyroperoxidases (TPO), using as substrates iodine and hydrogen

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