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In vitro bioaccessibility and bioavailability of minerals and pigments from macroalgae-fortified frankfurters

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Meat products are known as a rich source of valuable nutrients, although when consumed in inappropriate quantities, may enhance the risk of some diseases [1]. In turn, the increasing consciousness of consumers on their eating habits has been boosting naturally-derived products demand. Hence, the development of meat-based functional products through the incorporation of healthier ingredients such as macroalgae may offer an interesting opportunity to address consumers' needs and to update recommendations regarding nutritional and dietary goals.

In this context, the nutritional composition of two fortified frankfurters (F1 and F2) formulated with distinct percentages of green, red and brown macroalgae was assessed. The major effects resulting from macroalgae fortification were observed in ash (3.0-3.6 %FW) and fiber (1.0-1.2 %FW) levels, which were higher than the control (2.0 and 0.5 %FW, respectively). Further, the new food products were characterized by a lower Na/K ratio and superior levels of I, Fe, K, and Mg, while minor impacts were observed for the remaining nutrients. Afterwards, fortified frankfurters F1 and F2 were subjected to different static *in vitro* digestion methods [2,3] in order to evaluate the bioaccessibility and bioavailability of the major incremented compounds, namely minerals and pigments. As accessed for F1 frankfurters, K, Mg, P, I and Zn were available for absorption after gastrointestinal digestion, which % bioaccessibility ranged between 18-100%. The use of dialysis membranes to mimic intestinal absorption revealed that K, Mg, P and I were potentially capable to be absorbed, showing % bioavailability from 10-50%. In addition, the effect of cooking (scalding) on mineral content was studied. As expected, mineral levels decreased slightly with cooking, which resulted in a decrease of 11-16% and 25% of bioaccessibility and bioavailability. Although, bioaccessible and bioavailable fractions of iodine suggested to be positively affected with cooking.

Pigments analysis in frankfurter F2 revealed the presence of chlorophyll pigments of the *a*, *b* and *c* series (126 mg/Kg FW), being pheophytin *a* and pheophorbide *a* the major ones. Carotenoids, mostly lutein and fucoxanthin, were also quantified (6 mg/Kg FW). *In vitro* digestion modified the chlorophyllic profile, being chlorophylls *a* and *c* completely transformed in Mg-free derivatives, while some chlorophyll *b* remained. Estimated bioaccessibilties of total chlorophylls and total carotenoids, defined as the percentage of the initial content in the frankfurter, were around 3.4 and 8%, respectively. In conclusion, the use of macroalgae as ingredient in frankfurters may be a potential form to improve their health benefits beyond the basic nutritional value, thus contributing to health and wellness.

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