Effect of *Brassica* flour enrichment on the development of new food product and its nutrictional, antioxidant and sensory evaluation

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Several studies reported that the consumption of *Brassica* species is associated to the preventive effect against some chronic diseases, such as cancer, atherosclerosis and diabetes. These beneficial effects have been attributed to the presence of bioactive compounds like glucosinolates, phenolics compounds, carotenoids and flavonoids compounds, vitamins and minerals. From the sustainability and food security point of view, it is also pertinent to consider the great potential of processing cabbage by-products such as outer leaves, and production surplus, which are usually discarded, to produce value-added products. Also, these products are often overproduced and discarded, generating large amounts of waste. One possibility to take advantage of these products is to use it as a nutrient source to the enrichment of food matrices.

The objective of this work was the development a new food product enriched with *Brassica* flour as a value-added food ingredient. The new product consisted in a *Brassica* flour enriched traditional soup, based on the Atlantic Diet. Nutritional, sensory and antioxidant properties were studied. *Brassica* flour was added to the soup basis formulation at four levels: 0% (control), 0.5%, 0.8% and 1.0% (w/w). *Brassica* flour was obtained in the laboratory by using a drying method: fresh cabbages (*Brassica oleracea* L. var. *acephala* DC) were subject to convective air drying at 80 ºC, during 2 h, to a final moisture of 10%, and finally crushed to a flour texture. Results showed that the addition of four levels of *Brassica* flour to the soup significantly increased the protein content (from 0.29% to 1.05%, 2.36% and 2.44%, respectively), crude fibre content (from 0.24% to 0.43%, 0.91% and 0.99%, respectively) and carbohydrates content (from 1.80% to 3.60%, 4.20% and 5.40% respectively). The study about the consumers acceptance of the soup developed indicated that the soup prepared with 0.8% *Brassica* flour presented greater acceptance by the consumers. Sensory analysis was performed in a test room by six semi-trained tasters. Each taster was given a proof sheet and asked to evaluate the following attributes of the soup with 0.8% *Brassica* flour: appearance, smell, texture, flavour, salt and fat. The acceptability of the appearance of the soup was between "good" (83.3%) and "very good" (16.7%); the acceptability of product's smell was between "acceptable (33,3%) and "good" (66.7%); the texture attribute was between "good" (66.7%) and "very good" (16,7%), the attribute flavor was between "acceptable" (66.7%) and "good" (33.3%), the amount of salt was between "bad" (16.7%), "good" (16.7) and "very good" (66.7%) and finally the acceptability of the amount of fat was "good" (100%). The total phenolic content was measured by Folin-Ciocalteu method and antioxidant activity was conducted by ABTS and DPPH assay. The addition of *Brassica* flour to the soup significantly increased the antioxidant activity: ABTS assay from 0.24± 0.07 (control) to 2.54± 0.5 μmol $_{Trolox}$/g and DPPH assay from 0.45±0.2 (control) to 0.74±0.04 μmol $_{Trolox}$/g (0.8%). The same behavior was found on total phenolic content which increased from 0.09±0.01 (control) to 0.23±0.01 mg_{GAE}/g (0.8%).

It can be concluded that *Brassica* flour could be incorporated into an innovative formulation to obtain enriched soup with improved nutritional properties and being a natural source of antioxidants.

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