

Valorization of prickly pear cladodes by optimizing the extraction of phenolic compounds and their application for the fortification of a dairy product

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Introduction & Objectives:

Prickly pear cladodes can be exploited in many applications and are characterized by their effect on health and their richness in bioactive compounds. The present study aimed to select the most adequate conventional extraction parameters of total phenolic (TP) compounds from the prickly pear cladodes. Then, the dried potato peels were used as a polyphenol source to formulate a new yogurt.

Methodology (Material and methods):

A three-level factorial design was used to optimize the extraction parameters to maximize the TP yield of cladodes. The factors considered were the ethanol concentration (X_1 : 20-80%), the extraction time (X_2 : 60-360 min) and the liquid/solid ratio (X_3 : 10-60 mL/g) and the maceration was used as the extraction method. Yogurt formulations were developed using powder and dried pieces of the sample studied. The physicochemical and sensorial properties, total phenolic content (TPC), total flavonoid content (TFC), and the antioxidant capacity (DPPH assay and total antioxidant activity) were assessed and compared between the yogurts prepared with or without the dried prickly pear cladodes by adopting the protocols cited in our previous study^[1].

Results and Discussion:

A second-order polynomial model was applied to fit experimental data and predict the response, and this mathematical model produced a satisfactory fit ($R^2 = 0.88$; $P < 0.01$). The factors (X_1 ; X_2 ; $X_1 X_2$; $X_2 X_3$ and $X_1 X_3$) have a significant effect ($P < 0.05$), while the linear coefficient (X_3), the quadratic coefficients (X_2^2 and X_3^2) and the interaction coefficient ($X_1 X_3$) were considered insignificant ($P < 0.05$). The optimal extraction conditions were 40% ethanol, with an extraction time of 60 minutes and a solid/liquid ratio of 1 g/20 mL. The maximum theoretical PPT yield was 243.91 mg of gallic acid equivalent/100 g of dry matter and it is equivalent to the experimental value (253.4±47.52 mg EAG/g DM). The optimized extract was rich in flavonoids and showed interesting antioxidant activity using two tests. The results of physico-chemical analyzes comply with standards. Enriched yogurts revealed higher levels of phenolic compounds and better antioxidant activities.

Conclusion:

The results obtained affirmed the cost-effectiveness of the application of prickly pear cladodes as a natural food fortifier. Suitable for food uses, the powder of prickly pear cladodes has not altered the sensorial parameters of the assessed dairy product; on the contrary, it has improved some evaluated attributes such as consistency and overall quality, which is auspicious in terms of consumer acceptability and can be taken into consideration by the food industry.

Keywords: total polyphenols, optimization, cladodes, prickly pear, antioxidant activity, yogurt.

Reference

1. Brahmi, F. et al. (2022), Antioxidants 11:1-21.

