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Optimization of Polyphenol Extraction from Nuts Using Multivariate Experimental Design

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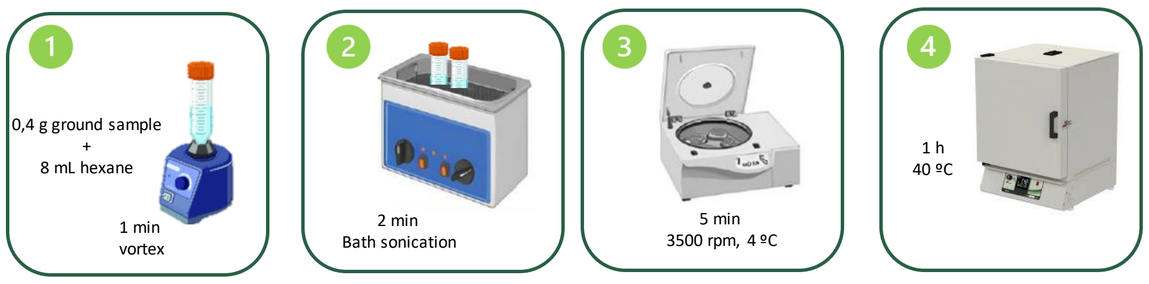
INTRODUCTION & AIM

Nuts are a natural source of phenolic compounds (PCs), which are characterized by their wide biological activities, particularly their role to prevent diseases associated with oxidative stress. The extraction efficacy of phenolic compounds from nuts can be significantly influenced by many factors, such as solvent composition, extraction time, extraction temperature and solvent to solid ratio. In this context, the application of non-conventional techniques such as ultrasound-assisted extraction (UAE) and the use of solvents generally recognized as safe, has gained growing attention for the efficient recovery of PCs. This study aimed to develop an optimized and eco-friendly method for the extraction of PCs from nuts.

METHOD

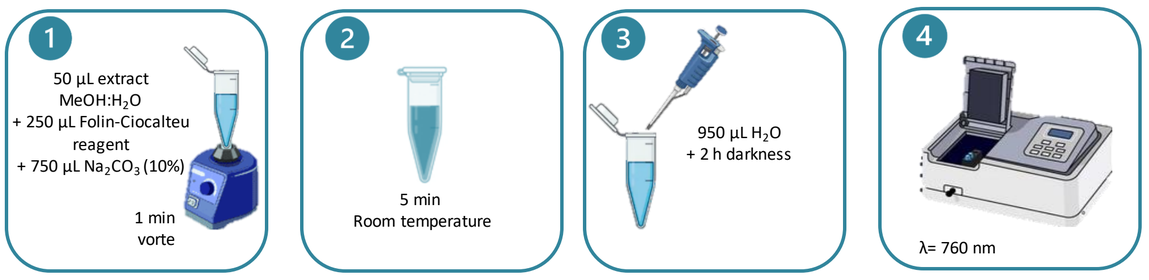
Factors evaluated: sample mass (0.2–0.4 g), solvent type for both defatting and extraction, pH (2–10), and extraction time (4–8 min) under UAE. An initial screening was followed by optimization using response surface methodology (RSM).

Step 1: Defatting procedure



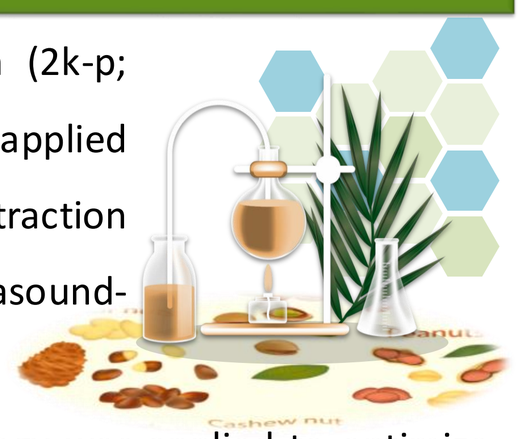
Step 2: Extraction of Polyphenol Content

Step 3: Determination of Total Polyphenol Content



RESULTS & DISCUSSION

A two-level fractional factorial design (2k-p; k=7; p=3) with four central points was applied to optimize the defatting and extraction conditions of polyphenols by ultrasound-assisted extraction.



Afterwards, response surface methodology was applied to optimize the significant factors with positive effects on extraction efficiency. A 2FI model (two-factor interaction) with a predicted R^2 of 0.8622 and an adjusted R^2 of 0.883, indicating good predictive capacity was obtained (Fig. 1).

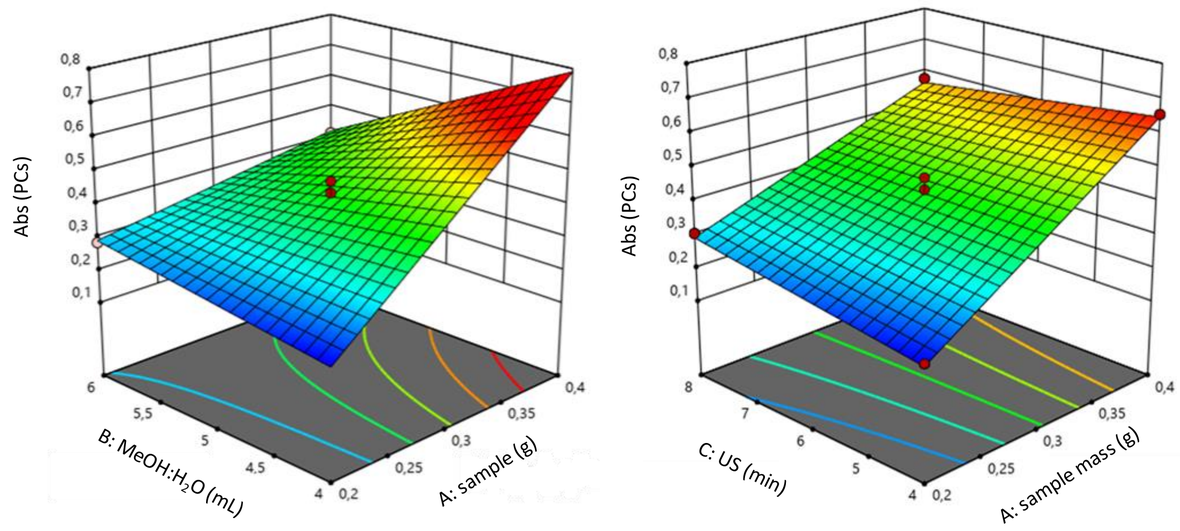


Fig. 1. Response surface plot of significant effect on PCs.

Significant differences were found in PCS content among the different nuts and local markts (Fig. 2).

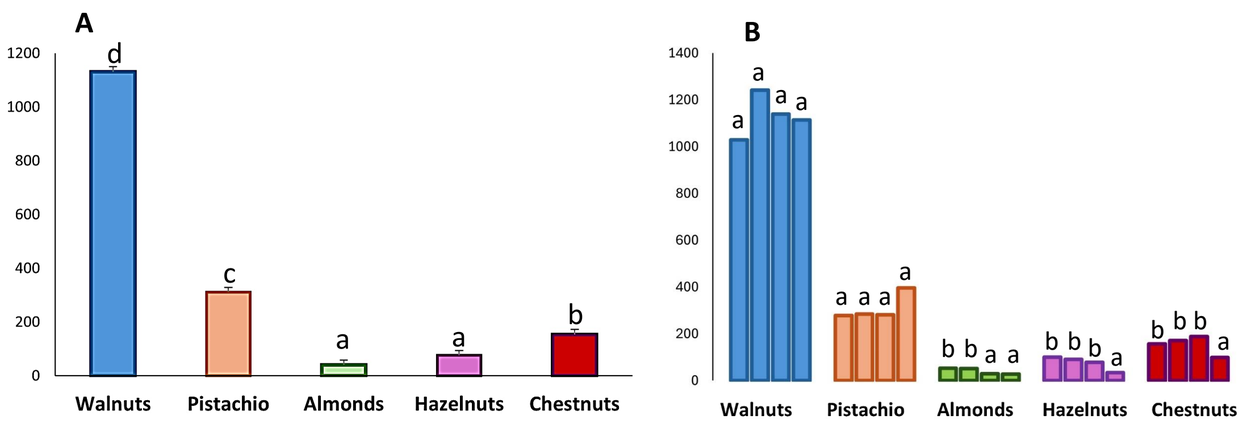


Fig. 2. PCs present in different species of nuts (A) and commercially available in local markets in Mendoza, Argentina (B). Mean values with a common letter are not significantly different at $p \leq 0.05$ (Tukey test)

CONCLUSION

The results revealed notable variability in PCs content and antioxidant capacity among the different nuts, suggesting that the health-promoting potential of each nuts type may differ depending on its phenolic profile.

Acknowledgments
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