Evaluating the Impact of Leaching on the Nutritional Composition and Bioactive Potential of *Quercus pyrenaica* Acorn Flour

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Introduction

Acorns, the fruit of oak trees, are highly abundant in Portugal's territory. However, they remain largely unexploited, with less than 1% being integrated into human diets. *Quercus* trees, which cover approximately 34% of Portugal's forested area, produce around 300 thousand tons of acorns annually. Rich in fatty acids, phenolic compounds, tocopherols, and minerals, acorns are promising to enhance traditional foods with functional and health-boosting properties[1,2,3]. Given that Portugal is a net food importer, the valorization of this nutrient-dense resource can be advantageous, especially considering its established nutritional benefits[1,2]. Moreover, acorn by-products offer considerable potential for added-value bioactive compounds, contributing to industrial waste reduction, while encouraging upcycling and highlighting the potential of sustainable non-edible agrifood products for technical applications. This study aimed to evaluate the nutritional composition and bioactive potential of *Quercus pyrenaica* flour (QP), provided by LandraTech, before and after leaching (QPL).

Objective and Methods

This study aimed to evaluate the nutritional composition and bioactive potential of *Quercus pyrenaica* flour (QP), provided by LandraTech, before and after leaching (QPL). The leaching processes were performed using ultrapure water at a 1:6 (w/v) ratio and agitation for 24 h, at room temperature, followed by centrifugation (4,000 rpm, 15 min, 4 °C). The process was repeated three times.

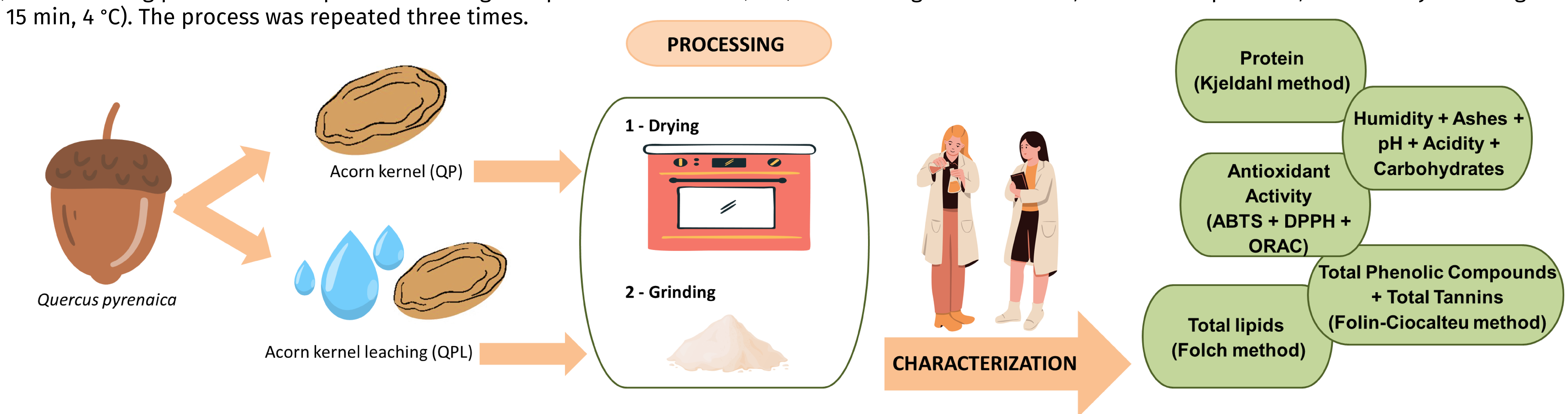

Figure 1. Processing and characterization methodologies diagram from the kernels of *Q. pyrenaica*, harvested in 2022.

Results

Table 1. Composition of the flours from *Q. pyrenaica* before (QP) and after leaching (QPL); DW – dry weight.

	pH	Acidity (g H_2SO_4/100 g DW)	Humidity (%)	Ash (% DW)	Protein (% DW)	Total lipids (% DW)	Carbohydrates (% DW)	Energy value (Kcal/100 g DW)
QP	5.88 ± 0.00	0.11 ± 0.00	10.34 ± 0.00	2.82 ± 0.01	8.60 ±0.07	7.19 ±0.79	71.11 ± 1.02	395.15 ± 2.66
QPL	5.32 ± 0.00	0.03 ± 0.00	5.84 ± 0.00	0.35 ±0.00	7.12 ±0.43	5.28 ±0.13	81.41 ±0.42	398.58 ±0.09

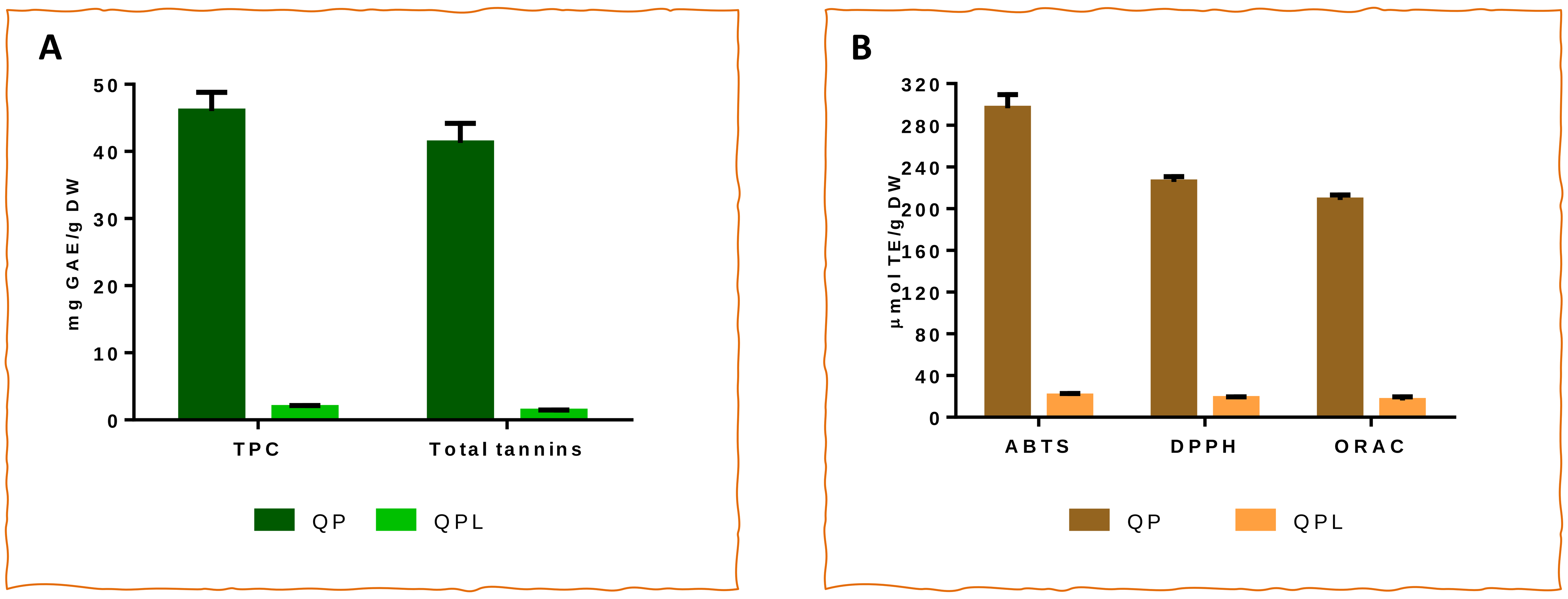

Figure 2. Differences between the flours from *Q. pyrenaica* before (QP) and after leaching (QPL) regarding (A) the total phenolic compounds (TPC) and total tannin composition; and (B) antioxidant capacity by ABTS, DPPH, and ORAC assays.

Overall, exploring alternative debittering techniques and their impact on the functional characteristics of acorn flour could enhance its integration into the food market. This study highlights the potential of acorns, particularly *Q. pyrenaica*, as a sustainable and promising versatile resource, rich in valuable nutritional compounds and bioactive properties.

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