# From Waste to Worth: Evaluating Chestnut Flour Quality from Downgraded Chestnut Fruits in Greece

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## Abstract

***Downgraded chestnut fruits**, typically excluded from commercial use due to size or appearance, were evaluated for their potential as raw material for flour production. Samples from five mountainous Greek regions (Group 1, Group 2, Group 3, Group 4, Group 5) were analyzed for **moisture**, **fat**, **protein**, and **ash** content. **Significant differences were observed across regions, especially in protein** (6.63–11.30%) **and lipid content** (1.16–2.05%), indicating the influence of environmental and possibly genetic factors. Despite their classification as waste, these chestnuts demonstrated **valuable nutritional properties**, supporting their use in **sustainable food applications** and promoting circular economy practices.*

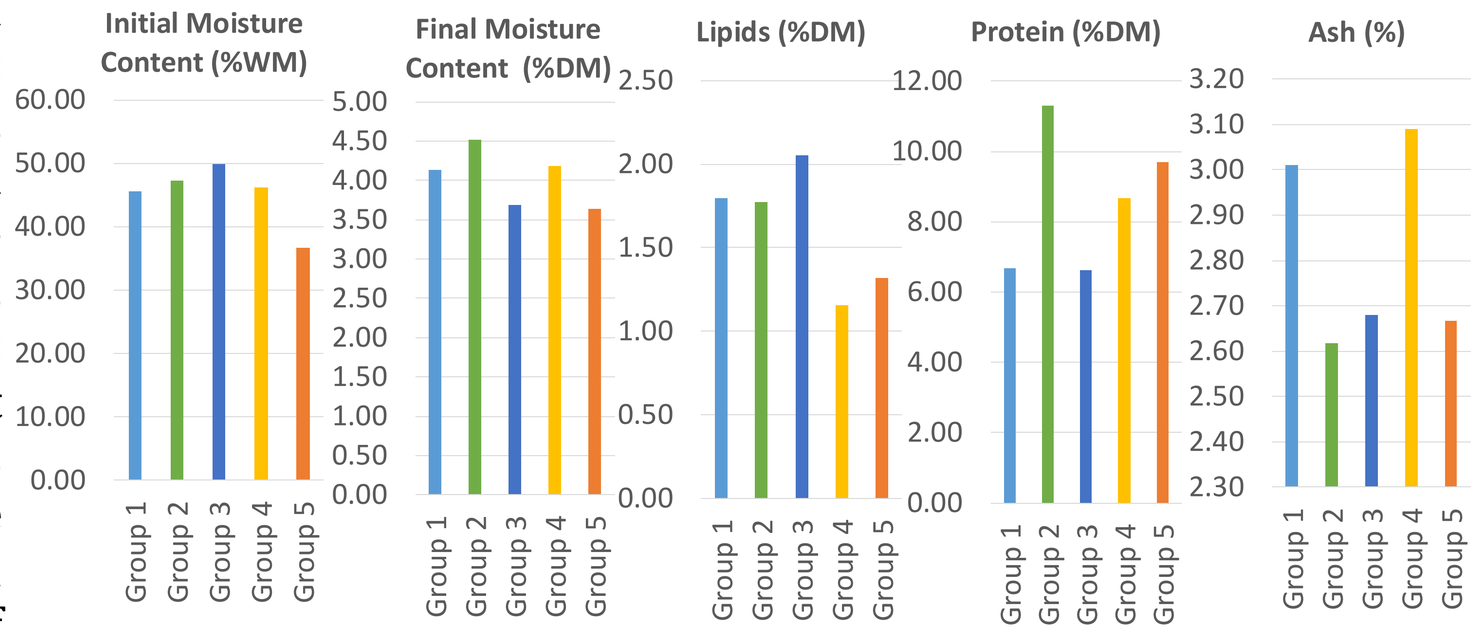
## • Introduction

Chestnuts (*Castanea* spp.) have long held ecological and economic importance across Europe, Asia, and North America. In Greece, *Castanea sativa* is a key crop, particularly in mountainous regions, yet faces multiple challenges—including rural abandonment, climate change, and disease—that threaten its sustainability. A significant share of the harvest is downgraded due to size or condition and is typically discarded. This study investigates the potential of utilizing these downgraded chestnuts by assessing the nutritional quality of flour produced from them, aiming to promote sustainable practices and support the resilience of chestnut-producing communities.

## • Materials and methods

Moisture content was determined by the oven-drying method, in which samples were dried at 110 °C until a constant weight was achieved. Fat content was assessed using an automatic Soxhlet extraction system, employing cyclohexane as the extraction solvent for 1 hour. Protein content was measured using the Kjeldahl method. Ash content was determined gravimetrically by incinerating the samples in a muffle furnace at 550 °C. Final data were statistically analyzed using SPSS version 26.0 (IBM Corporation, Armonk, NY, USA).

## • Results and Discussion




Chestnut flour samples from five Greek regions showed significant variation in initial **moisture content** (36.6–49.9%), aligning with reported values of 45–54% depending on cultivar and origin (Lo Piccolo et al., 2020; Erem, 2024). **Final moisture content** post-drying was standardized across groups, confirming the effectiveness of the drying process (Erem et al., 2024). **Lipid content** ranged from 1.16% to 2.05%, within the 1.6–3.1% range documented by Borges et al. (2008) and Fernandes et al. (2022). **Protein content** varied from 6.6% to 11.3%, with Group 2 exceeding typical values (4–8%), suggesting enhanced nutritional potential possibly due to soil or climatic factors (Borges et al., 2008). **Ash content** ranged from 2.62% to 3.09%, consistent with values in the literature (1.5–4.7%) and reflecting regional mineral differences (De Vasconcelos et al., 2010).

## • Conclusions

**Downgraded chestnuts**, though excluded from commercial markets, exhibit **valuable nutritional profiles**. Their effective transformation into flour highlights their **potential in sustainable food production**, supporting **waste reduction** and **adding value to local chestnut chains**.

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