

Determination of some chemical properties of uncommon flours

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Flours of wheat, chestnut, acorn and lupin were evaluated in relation to phenolic compounds, antioxidant activity, and oxalate content.





Introduction

- Wheat is one of the most important food for the world population, in which about 35% of the total world population regularly consume wheat-based foods.
- In recent times, there has been a growing interest in using uncommon flours for use in food industry because:
 - their chemical composition is close to many cereals (mainly high starch content)
 - and also to improve the nutritional value of other foods
 - or as a means of valorization of “low-cost” products.



Introduction

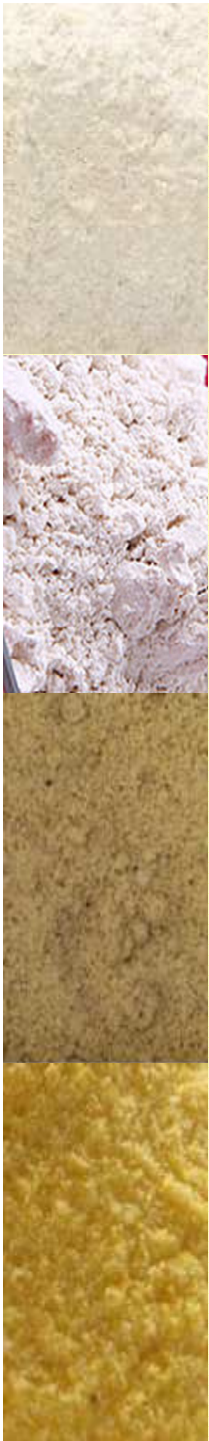
- Antioxidants are important molecules that inhibit the oxidation of other molecules, and they are widely used in dietary supplements.
- Thus, antioxidant activity is the total capacity of antioxidants for eliminating free radicals in the cell and in food.
- Phenolic compounds are also largely known to be very effective in fighting free radicals, thus their regular consumption has been associated with benefits for human health, such as anti-inflammatory, antimutagenic and anticancer effects.
- Oxalate is an antinutritional factor which can lead to death in humans, mainly individuals with kidney stone problems.

Material and methods



Samples

- Chestnuts (*C. sativa*) were collected from Soutos da Lapa a Protected Designation of Origin region (PDO), Viseu, Portugal.
- Acorns from *Q. rotundifolia* were collected in Idanha-a-Nova region, Portugal.
- Three sets of 1 kg each of chestnut and acorn fruits were dried and after they were milled in a SK 100 Cross Beater Retsch hammer mill to pass through a 1mm sieve.
- Lupin flour was purchased from local market, Viseu, Portugal.
- Two wheat flours were also purchased from two different milling factories, with the designation of Ceres and Cerealis. These wheat flours are both used commercially for bakery purposes.



Extraction methods and conditions

1) Method used for the extraction:

- 3 extractions with methanol 50 %;
- 3 extractions with acetone 50 %;
- 3 extractions with ethanol 50 %.

2) Constant agitation:

- 100 rpm
- 50 °C
- 75 minutes

3) Vacuum filtration.



Determination of:

- Dry extracts were calculated as the weight loss percentage of the initial material

$$\% \text{ Dry extract} = \frac{\text{Dry extract}}{\text{Weight of Sample}} \times 100$$

- The determination of total phenolic compounds was estimated according to Folin–Ciocalteu method.
- The antioxidant capacity was determined by the method DPPH. The DPPH radical-scavenging activity of phenolic extract was calculated according to the following equation:

$$\text{DPPH}(\%) = \left[\frac{(\text{Absorbance of control} - \text{Absorbance of sample})}{\text{Absorbance of control}} \right] \times 100$$

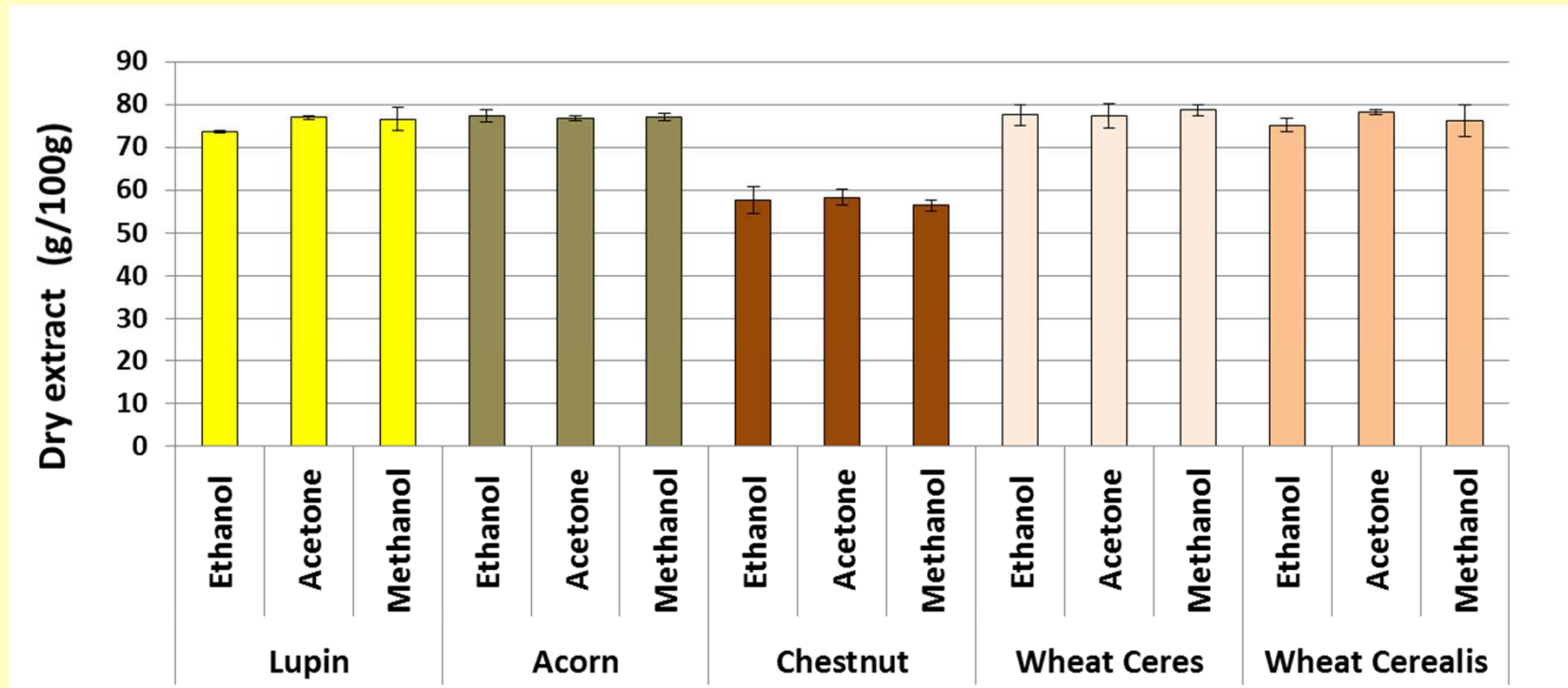
Oxalate determination

- The oxalate content was determined using a volumetric analysis method, with a titration described by Siger et al.
- All procedures were carried out in triplicates.

Results and discussion

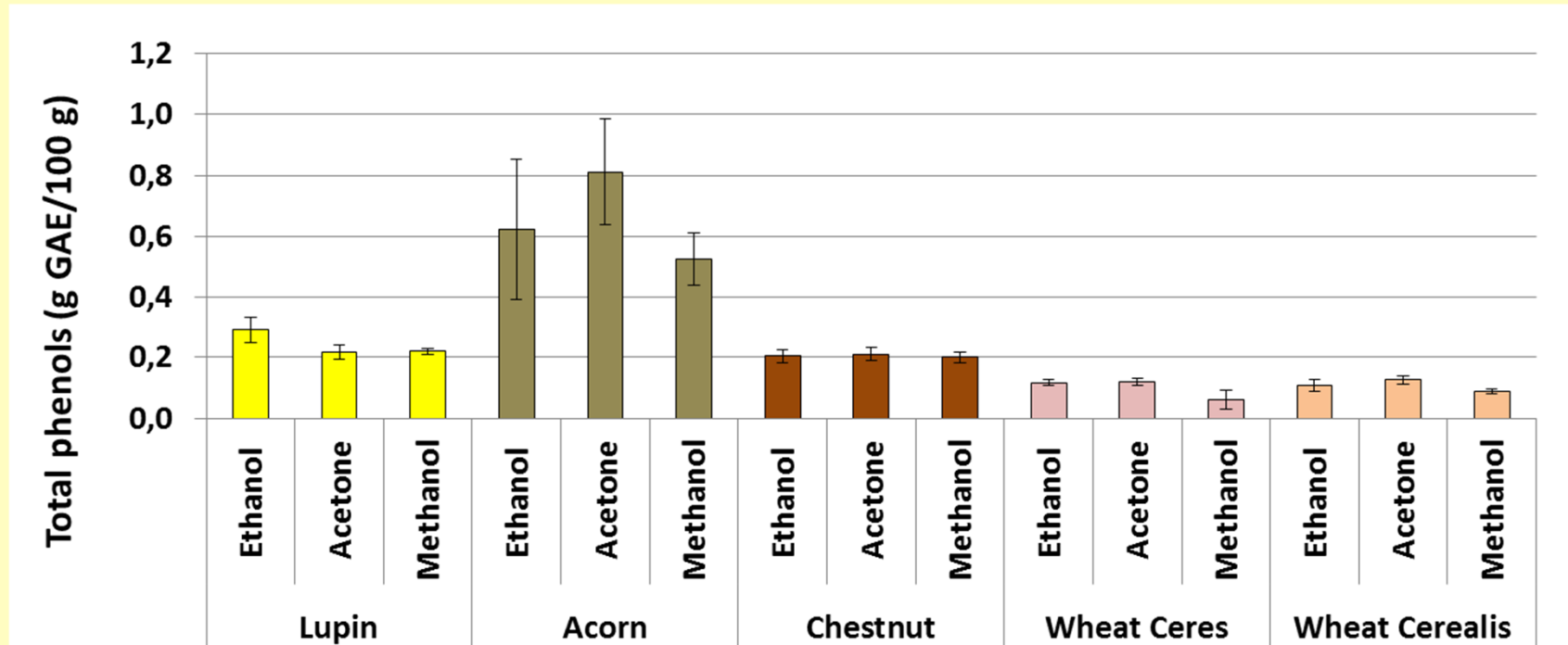


Dry Extract



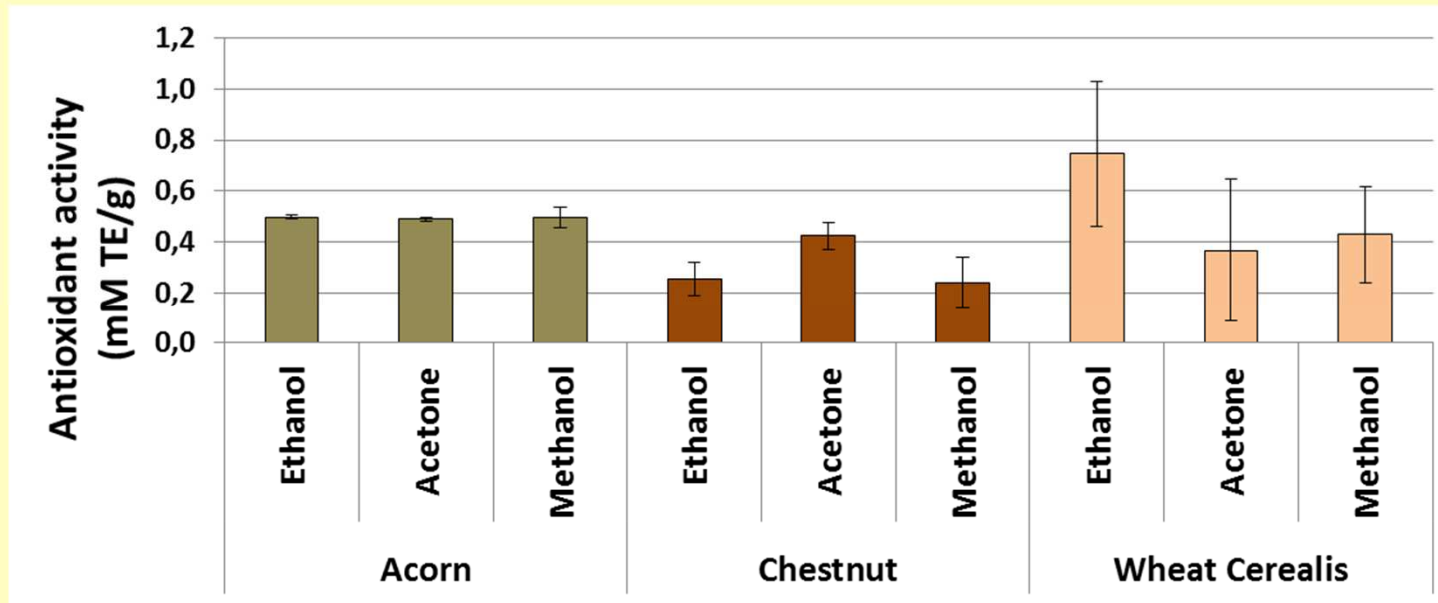
- The results showed that the extraction yield was similar for the three solvents used for each type of flour, regardless of the extraction method.
- Chestnut flour was the one that gave a lower extraction yield compared to the other flours under study (Lupin, Chestnut, Acorn, Ceres Wheat and Cerealis Wheat), lower than 60%.

Phenolic Compounds



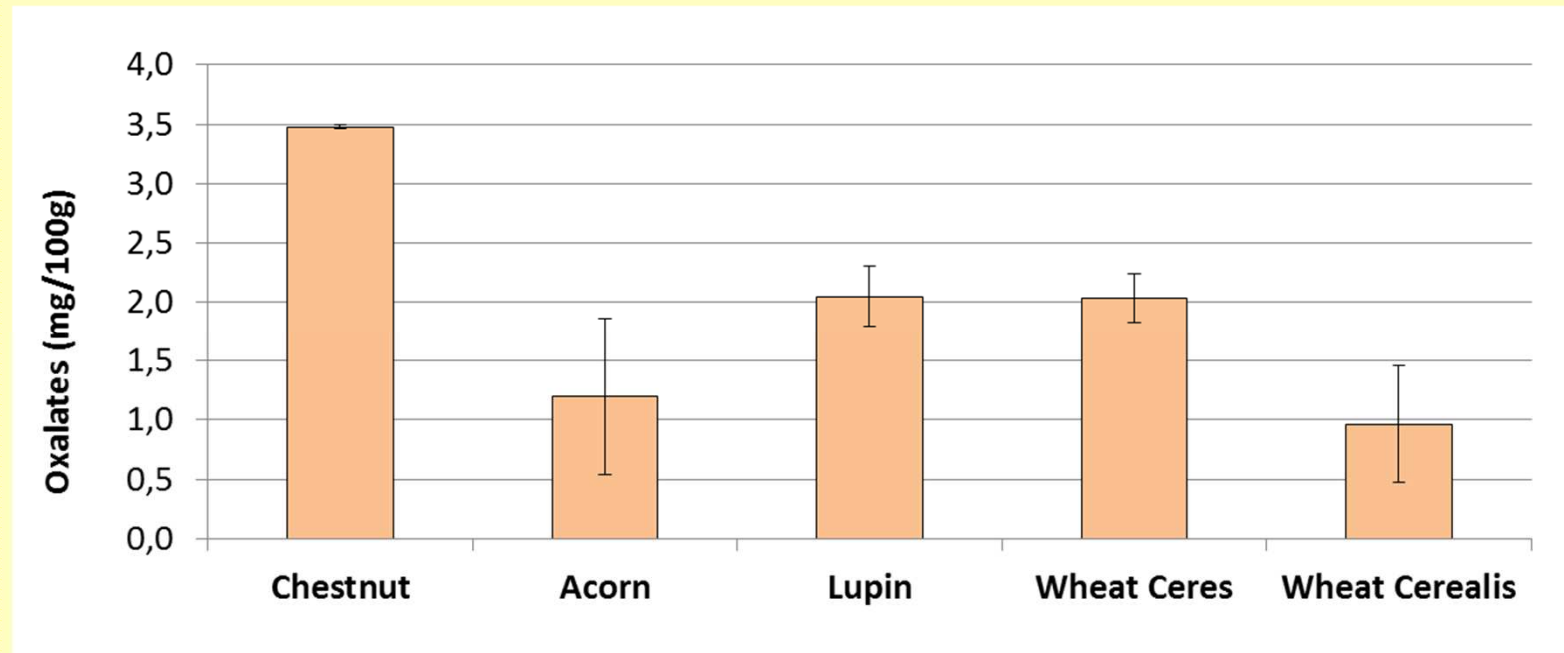
- Generally these flours are low polyphenol content.
- The acorn flour stood out with a higher content in this type of compounds, for all methods of extraction, mainly for the extract acetone/water - with the highest value.
- Generally, the extract that showed the lower content in phenolic compounds was the methanol/water, and the wheat flour type Ceres presented the lowest value.

Antioxidant Activity



- Only three types of flour from the five samples studied showed antioxidant activity.
- The sample wheat Ceres with extraction ethanol/water presented the highest value, whereas the lowest antioxidant activity was the chestnut flour in the ethanol/water and methanol/water extractions.
- The acorn flour presented a more or less constant antioxidant activity independently of the solvent used for extraction.

Oxalate contents



- The greatest value was found in chestnut flour.
- On the other hand, lupin flour presented the lowest value.
- The values reported in this study were low when compared to other flours, from other cereals, legumes and nuts.



Conclusions

- There were no significant differences in the estimation of dry matter using the methods with different types of extraction, and this tendency was observed for all samples.
- Samples of acorn flour showed the highest values of total phenols, and particularly for the extraction with acetone 50%.
- The antioxidant activity was greater in the sample of wheat Cerealis, when the extraction as with ethanol 50%.
- The content of oxalates was particularly low for the lupin flour, and comparing with other flours it is very low, which is good nutritionally.



Conclusions

- Generally, the lupin, chestnut, acorn and wheat flours studied presented good functional properties, considering total phenols content and antioxidant activity, with low content of oxalate (antinutritional compound).
- Furthermore, the results of the study revealed that these flours have a great potential to be used in food industry either for the purpose of:
 - formulating new products or
 - for the replacement in food products made from various conventional flour sources.

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