MET - CONF 24
2ND CONFERENCE OF THE DOCTORAL PROGRAM IN METABOLISM – CLINICAL AND EXPERIMENTAL
25 OCTOBER, 2024
MEDICAL RESEARCH CENTER AUDITORIUM
Faculty of Medicine, University of Porto

Exploring the Health Benefits of Lentil Phenolics: Antioxidant and Immunomodulatory Effects

Rafaela A.F. Geraldo[1], Manuela Machado[1], Sara Silva[1], Eduardo M. Costa[1], Elisabete Pinto[1], Manuela Pintado[1], Delminda Neves[2 3], Marta W. Vasconcelos[1]

[1] Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Porto, Portugal; [2]Department of Biomedicine - Experimental Biology Unit, Faculty of Medicine of University of Porto, Porto, Portugal; [3]I3S—Instituto de Investigação e Inovação em Saúde, University of Porto, Porto, Portugal
s-rgeraldo@ucp.pt; mvasconcelos@ucp.pt

Introduction

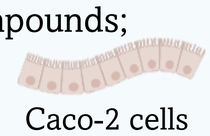
- **Lentils** are rich in **essential nutrients** such as protein, fibre, and flavonoids, with a **low glycemic index** that helps avoid glycemia peaks.
- Epidemiological data suggest **potential benefits against cardiovascular diseases and diabetes**.

Objectives: Identify the lentil variety with the highest phenolic and flavonoid content, antioxidant capacity, and anti-diabetic effects while evaluating its cytotoxicity and immunomodulatory activity.

Methods

- Raw and cooked *Lens culinaris L.* varieties:

- Determination of total phenolics, flavonoids, antioxidant and anti-diabetic activities;
- Quantification and identification of phenolic compounds;
- Cytotoxicity and immunomodulatory activity.



IL-6
IL-8

Results & Discussion

Phenolic and flavonoid compounds

Table 1 – Total phenolics, total flavonoids, and antioxidant activity of *Lens culinaris* L. varieties. Values represents mean ± SEM in mg of gallic acid, mg of catechin, and µg of Trolox equivalent per g of dry extract (DW), respectively. Different letters indicate significant differences at *p < 0.05.

		Total Phenolics (mg AG/g DW)	Total Flavonoids (mg CAE/g DW)	Antioxidant activity (µg Trolox/g DW)
Kermit	Raw	4.0 ± 0.1^{a}	2.4 ± 0.0^{a}	26.3 ± 0.6^{a}
	Cooked	3.3 ± 0.1^{c}	2.6 ± 0.0^{a}	23.36 ± 0.9^{a}
Green	Raw	3.4 ± 0.1^{b}	2.4 ± 0.1^{a}	22.5 ± 0.9^{b}
	Cooked	2.9 ± 0.0^{d}	2.5 ± 0.0^{a}	16.4 ± 0.8^{a}
Brown	Raw	2.9 ± 0.2^{c}	1.7 ± 0.1^{c}	19.3 ± 0.8^{c}
	Cooked	2.4 ± 0.1^{cd}	2.1 ± 0.0^{b}	18.8 ± 0.5^{c}
Red	Raw	0.8 ± 0.0^{f}	0.6 ± 0.0^{d}	0.8 ± 0.0^{d}
	Cooked	0.9 ± 0.0^{f}	0.7 ± 0.0^{d}	0.7 ± 0.0^{d}

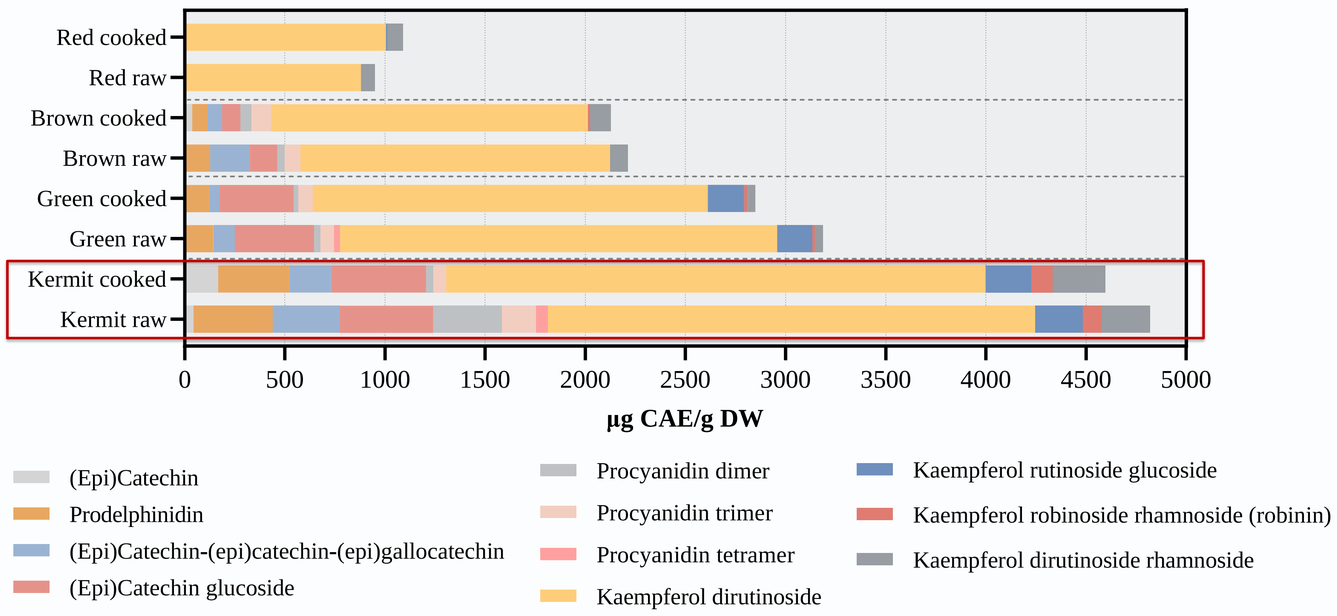


Figure 1 – Concentrations of phenolic compounds [µg catechin equivalent per g of dry weight (µg CAE/g DW)] of raw and cooked *Lens culinaris L* varieties measured using HPLC-MS.

Anti-diabetic activity

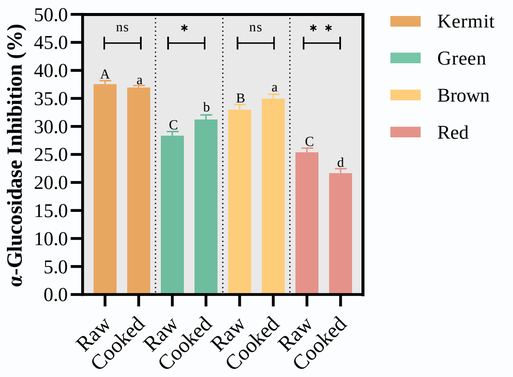


Figure 2– Anti-diabetic activity of *Lens culinaris* L. varieties. Value represents mean ± SEM. Capital letters show differences among raw varieties, lowercase letters among cooked varieties, with significance at p < 0.05. Differences between raw and cooked forms of the same varieties are marked at *p < 0.05; **p<0.01.

Cytotoxicity & immunomodulatory activity

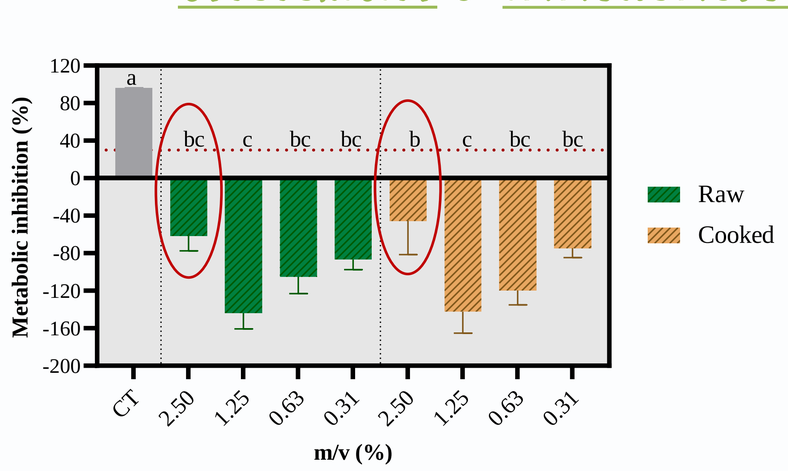


Figure 3- Cytotoxicity of phenolic extract of Kermit towards Caco-2 cells at different concentrations. CT is the negative control (40% of DMSO). The dotted line represents 30% cytotoxicity limit (ISO 10993-5:2009). Different letters indicate significant differences at *p < 0.05.

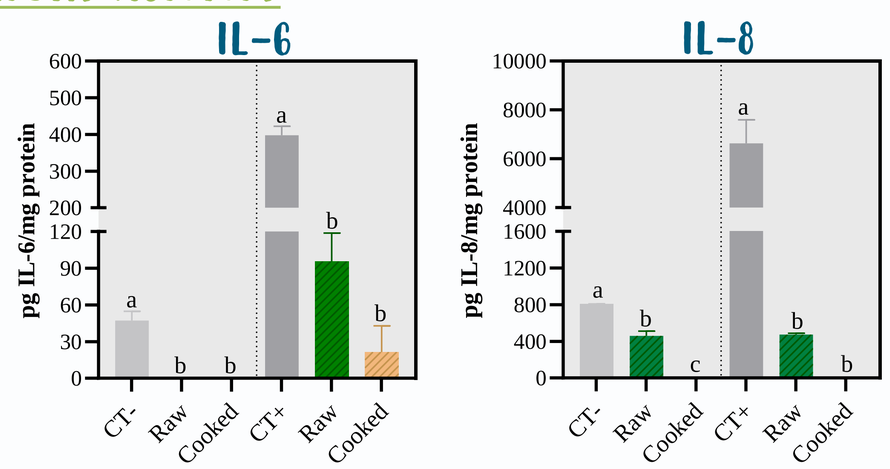


Figure 4- Modulation of immune response in Caco-2 cells by phenolic extract of Kermit [2.50 m/v (%)]. The left part corresponds to the non-stimulated cell's response, and the right to the inflammatory effect (using IL-1β). Different letters indicate significant differences within each stimulus treatment at *p < 0.05.

Conclusions

- **Kermit variety** exhibited the **highest phenolic and flavonoid content**, **antioxidant and anti-diabetic activities,** and the **largest quantities of phenolic compounds**, making it the best candidate for *in vitro* analyses.
- **Cooking affected phenolic composition**, often reducing **(Epi)Catechin and Procyanidin compounds,** though **Kaempferol derivatives** remained prominent across all varieties.
- **No deleterious effect regarding metabolic inhibition** was observed in Caco-2 cells when exposed to Kermit phenolic extracts. Regarding the immunomodulatory results:
  - The production of IL-6 and IL-8 significantly decreased with Kermit phenolic extracts.
  - In cells stimulated with IL-1β, the Kermit phenolic extracts showed relevant **anti-inflammatory effects**, as demonstrated by reductions in the selected cytokines' secretion.

Acknowledgements

This research was funded by European Union's Horizon 2020 Research and Innovation Programme through RADIANT (Grant Agreement #10100062) and by FCT (Portugal) through PhD scholarship 10.54499/2021.05683.BD and Scientific Employment Stimulus- Individual Call contracts number 10.54499/2022.07206.CEECIND/CP1745/CT0003. The authors also thank FCT project UIDB/50016/2020.