From waste to worth: addressing strategies to value onion and zucchini by-products

Tatiane C. G. de Oliveira,[1,2,6] Tayse F. F. Da Silveira,[1,2] Cristina Caleja[1,2], Délio Raimundo,[3] Marija Ivanov,[4] Dejan Stojković,[4] Javier C. Lou,[5] Víctor López,[5] Isabel C.F.R. Ferreira, [1] M. Beatriz P.P. Oliveira,[6] Eliana Pereira[1,2*] Lillian Barros,[1,2]

[1]*Centro de Investigação da Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253, Bragança, Portugal*
[2]Laboratório para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal
[3] Campotec IN S.A., Estrada Nacional 9, Zona Industrial de Casalinhos de Alfaiata 2560-393 Silveira Torres Vedras – Portugal.
[4] Institute for Biological Research "Siniša Stanković"- National Institute of the Republic of Serbia, University of Belgrade, Bulevar despota Stefana 142, 11000 Belgrade, Serbia
[5]Department of Pharmacy, Faculty of Health Sciences, Universidad San Jorge, 50830 Zaragoza, Spain
[6]REQUIMTE/LAQV, Departamento de Ciências Químicas, Faculdade de Farmácia da Universidade do Porto, Rua Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal

*eliana@ipb.pt

Introduction

Fruit and vegetable by-products originate throughout the food chain and are usually underutilized. However, they still contain significant amounts of macro and micronutrients. Additionally, they are rich in bioactive compounds, such as phenolic compounds, which show a broad spectrum of biological functions. In this context, addressing strategies to value these by-products is essential to promote their reintegration into the industry and, consequently, waste reduction and circular economy [1,2].

Objective

The goal of this work is to identify bioactive characteristics and phenolic compounds in hydroethanolic extracts from two commonly discarded vegetable by-products: onion peel and zucchini that do not meet consumption standards

Samples and Methodology

Hydroethanolic extracts of:

Onion peel
(Allium cepa L.)

Zucchini
(Cucurbita pepo L.)

1. Identification the individual phenolic profile LC-DAD-ESI-MS^n
2. Antioxidant activity – DPPH and TBARS
3. Antimicrobial activity – Microdilution method
4. Antidiabetic activity – α-glucosidase and α-amylase inhibition

Results

Ten compounds were identified
One compound belongs to the phenolic acids class
Nine compounds belongs to the flavonoids class
TPC = 9.14 ± 0.01 mg/g extract

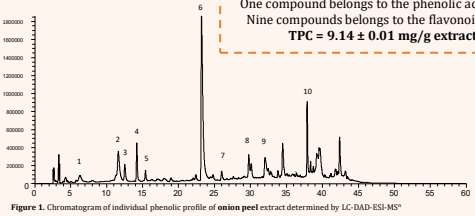

Figure 1. Chromatogram of individual phenolic profile of **onion peel** extract determined by LC-DAD-ESI-MS^n

Table 1. Antioxidant and antidiabetic activity of the zucchini and onion peel extract.

	Zucchini	Onion peel	Control
Antioxidant activity			**Potassium metabisulfite**
DPPH (EC_{50} μg/mL)	752.7 ± 20.6	9.8 ± 0.3	43 ± 4
TBARS (EC_{50} μg/mL)	836 ± 37	10.0 ± 0.3	228.7 ± 0.1
Antidiabetic activity			**Acarbose**
α-Glucosidase inhibition (IC_{50} μg/mL)	n.a.	64.39 ± 8.72	68.19 ± 6.71

n.a.: no activity (not reached at 2000 μg/mL)

Five flavonoids are identified
TPC = 296.99 ± 0.17 mg/g extract

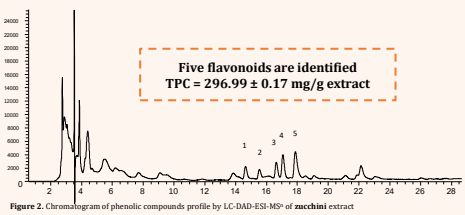

Figure 2. Chromatogram of phenolic compounds profile by LC-DAD-ESI-MS^n of **zucchini** extract

Table 1. Antibacterial activity of of the zucchini and onion peel extract. The results are presented in mg/mL.

		Staphylococcus aureus	*Bacillus cereus*	*Listeria monocytogenes*	*Escherichia coli*	*Salmonella typhimurium*	*Enterobacter cloacae*
Zucchini	MIC	2	0.25	1	1	1	1
	MBC	4	0.5	2	2	2	2
Onion peel	MIC	0.5	0.25	0.5	1	0.5	1
	MBC	1	0.5	1	2	1	2
E211	MIC	4.0	0.5	1.0	1.0	1.0	2.0
	MBC	4.0	0.5	2.0	2.0	2.0	4.0
E224	MIC	1.0	2.0	0.5	0.5	1.0	0.5
	MBC	1.0	4.0	1.0	1.0	1.0	0.5

Sodium sulphite (E221) and potassium metabisulphite (E224) food additives were used as positive controls

Conclusion

These findings highlight the strong potential of onion peel extracts to benefit food and nutraceutical products. Although the results from zucchini extract were less significant, its notable antibacterial activity make it also a potential candidate for further exploration as a natural ingredient in food and nutraceutical formulations.

Acknowledgments

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This work aims to align with objectives 2, 12 and 15 of the sustainable development goals by identifying bio-based functional ingredients to promote food and nutritional security, reducing food waste in production