Foods 2024 Conference

The 5th International Electronic Conference on Foods

28–30 October 2024 | Online

MDPI

Bioactive protein hydrolysates derived from chayote seeds using Subcritical Water Hydrolysis

Elsa F. Vieira[1*], Jaroslava Švarc-Gajić[2], Filipa Rego[3], Cristina Delerue-Matos[1]

[1]REQUIMTE/LAQV, School of Engineering, Polytechnic of Porto (ISEP/IPP), Portugal

[2]Faculty of Technology, University of Novi Sad, Serbia

[3]Faculty of Pharmacy, University of Porto, Portugal

*elsavieiraf@gmail.com; elsa.vieira@graq.isep.ipp.pt

INTRODUCTION & AIM

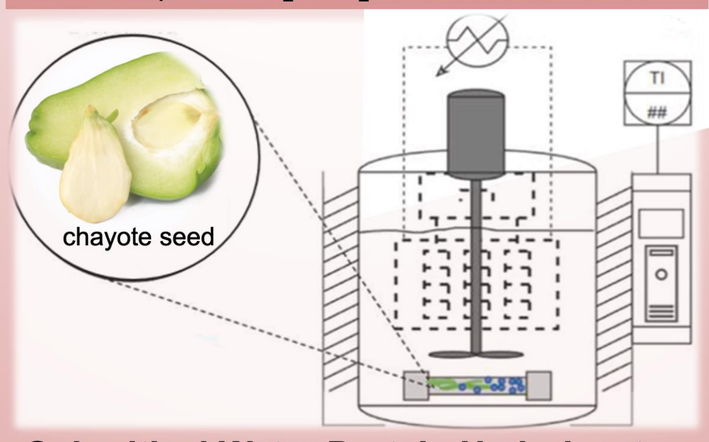
Chayote seeds have good protein quality and biological properties, being still unexplored as a protein source to produce protein hydrolysates [1]. Subcritical Water Hydrolysis has become a favorable technique to produce protein hydrolysates due its low price, safety and green character of water, good yields and reduced energy consumption [2].

This study explores Subcritical Water Hydrolysis technique to produce chayote seed protein hydrolysates with promising antioxidant and anti-diabetic properties.

METHODS

Fixed extraction parameters:
pressure (15 bar)
frequency of 3 Hz,
solid solvent ratio of 1:30 g/ mL (W/V)
reaction time of 60 min

Variable parameters:
Temperature: 160 ºC, 190 ºC
Gas atmospheres: N_2, CO_2, 0.05 M HCl modifier



Subcritical Water Protein Hydrolysates

SWPH.1 160 ºC, **N2**, 15 bar, 60 min, ratio =1:30, v=3
SWPH.2 190 ºC, **N2**, 15 bar, 60 min, ratio =1:30, v=3
SWPH.3 160 ºC, **0.05 M HCl**, 15 bar, 60 min, ratio =1:30, v=3
SWPH.4 190 ºC, **0.05 M HCl**, 15 bar, 60 min, ratio =1:30, v=3
SWPH.5 160 ºC, **CO_2**, 15 bar, 60 min, ratio =1:30, v=3
SWPH.6 190 ºC, **CO_2**, 15 bar, 60 min, ratio =1:30, v=3

Protein quality [1]
RP-HPLC amino acid composition [1]
TPC and RP-HPLC phenolic compounds composition [1]
Antioxidant activity (ABTS, FRAP) [1]
α-amylase inhibition activity [1]

Fig 1. Production and characterization of SWPHs.

RESULTS & DISCUSSION

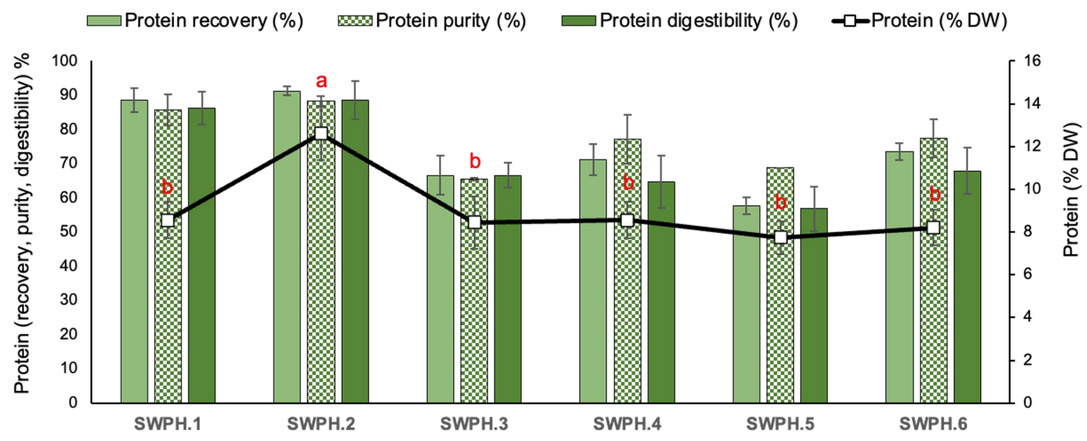


Fig 2. Nutritional quality of SWHPs. Results are expressed as mean ± SD (n = 3). (a-b) show significant differences ($p < 0.05$) between groups (Duncan test).

Table 2. Content (mg/100 g DW) of the identified phenolic compounds in the SWPHs. Results were expressed as mean ± SD (n = 3).

Phenolic compound	SWPH.1	SWPH.2	SWPH.3	SWPH.4	SWPH.5	SWPH.6
Gallic acid	170.53 ± 8.53	1646.63 ± 82.33	7.03 ± 0.35	67.09 ± 3.35	35.17 ± 1.76	70.11 ± 3.51
Protocatechuic acid	43.78 ± 2.19	152.34 ± 7.62	2.10 ± 0.11	5.20 ± 0.26	0.64 ± 0.03	3.97 ± 0.20
Neochlorogenic acid	10.84 ± 0.54	35.95 ± 1.80	0.58 ± 0.03	3.60 ± 0.18	0.71 ± 0.04	2.99 ± 0.15
Caftaric acid	11.69 ± 0.58	262.01 ± 13.10	0.66 ± 0.03	7.88 ± 0.39	1.31 ± 0.06	7.24 ± 0.36
Chlorogenic acid	70.91 ± 3.55	102.20 ± 5.11	2.04 ± 0.10	13.81 ± 0.69	1.37 ± 0.07	17.49 ± 0.87
4-*O*-caffeyolquinic acid	1.17 ± 0.06	143.81 ± 7.19	<LOQ	4.44 ± 0.22	0.74 ± 0.04	2.86 ± 0.14
Vanillic acid	25.19 ± 1.26	60.68 ± 3.03	0.77 ± 0.04	1.51 ± 0.08	<LOQ	3.78 ± 0.19
Caffeic acid	2.15 ± 0.11	42.73 ± 2.14	0.21 ± 0.01	0.94 ± 0.05	<LOQ	1.64 ± 0.08
Syringic acid	4.17 ± 0.21	52.66 ± 2.63	ND	0.92 ± 0.05	ND	0.70 ± 0.03
p-Coumaric acid	1.06 ± 0.05	7.63 ± 0.38	<LOQ	0.13 ± <0.01	<LOQ	0.15 ± 0.01
Ferulic acid	<LOD	5.93 ± 0.30	<LOD	<LOQ ±	<LOD	0.12 ± 0.01
Sinapic acid	2.83 ± 0.14	18.45 ± 0.92	0.17 ± 0.01	0.14 ± <0.01	<LOQ	0.18 ± 0.01
Ellagic acid	1.63 ± 0.08	5.68 ± 0.28	0.17 ± 0.01	0.23 ± 0.01	0.15 ± <0.01	0.18 ± 0.01
4,5-di-*O*-Caffeoylquinic acid	ND	1.02 ± 0.05	ND ±	0.61 ± 0.03	<LOQ	0.33 ± 0.02
∑ Phenolic acids	**367.66 ± 18.38**	**2665.01 ± 133.25**	**15.70 ± 0.78**	**110.24 ± 5.51**	**40.96 ± 2.05**	**116.60 ± 5.83**
(+)-Catechin	85.33 ± 4.27	811.63 ± 40.58	3.42 ± 0.17	18.76 ± 0.94	0.26 ± 0.01	36.95 ± 1.85
(-)-Epicatechin	11.99 ± 0.60	58.69 ± 2.93	0.66 ± 0.03	0.74 ± 0.04	<LOQ	1.70 ± 0.08
∑ Flavanols	**97.32 ± 4.87**	**870.32 ± 43.52**	**4.07 ± 0.20**	**19.50 ± 0.98**	**0.26 ± 0.01**	**38.65 ± 1.93**
Rutin	<LOD	1.78 ± 0.09	<LOD	<LOD	ND	<LOQ ±
Quercetin-3-*O*-galactoside	1.61 ± 0.08	11.65 ± 0.58	0.10 ± <0.01	0.32 ± 0.02	0.20 ± 0.01	0.87 ± 0.04
Quercetin-3-*O*-glucopyranoside	ND	ND	ND	ND	ND	ND ±
Myricetin	1.75 ± 0.09	2.13 ± 0.11	0.13 ± <0.01	0.12 ± <0.01	0.11 ± 0.01	0.18 ± 0.01
∑ Flavonols	**3.36 ± 0.17**	**15.56 ± 0.78**	**0.24 ± 0.01**	**0.44 ± 0.02**	**0.31 ± 0.02**	**1.05 ± 0.05**
Phloridzin	10.45 ± 0.52	10.72 ± 0.54	0.71 ± 0.04	0.36 ± 0.02	0.39 ± 0.02	0.44 ± 0.02
∑ All Phenolic compounds (mg/100 g DW)	478.78 ± 67.90	3561.61 ± 199.56	20.71 ± 1.79	130.54 ± 10.67	41.91 ± 6.64	156.75 ± 3.89
Total Phenolic Content (mg GAE/100 g DW)	623.79 ± 36.06	4524.49 ± 294.39	33.58 ± 0.7	252.54 ± 7.17	75.16 ± 4.71	180.59 ± 9.48

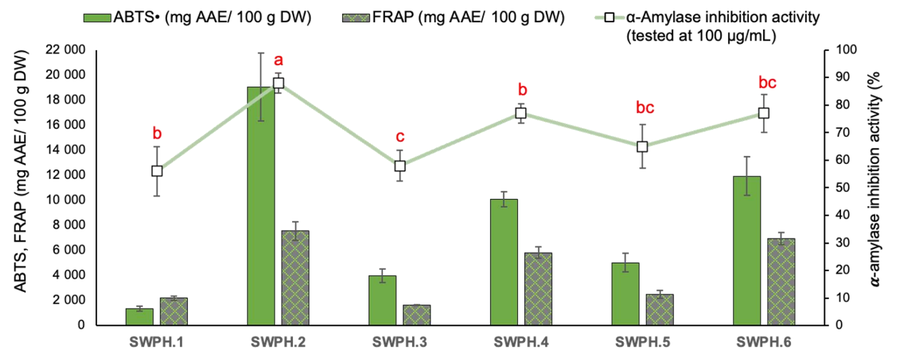


Fig 3. Antioxidant and α-amylase inhibition activity (tested at 100 µg/mL) of SWHPs. Results are expressed as mean ± SD (n = 3). (a-c) show significant diferences ($p < 0.05$) between groups (Duncan test).

REFERENCES

[1] Vieira E.F.; Fontoura A.Q., Delerue-Matos, C. 2023. Foods, 12, 2949. doi.org/10.3390/foods12152949. [2] Nastić N., Švarc-Gajić J., Delerue-Matos C. et al, 2023. Industrial crops and products, 111, 579-589. doi:10.1016/j.indcrop.2017.11.015-

ACKOWNLEGMENTS

This work received financial support from FCT/MCTES (UIDB/50006/2020 DOI 10.54499/UIDB/50006/2020) through national funds. Elsa F. Vieira thanks FCT (Fundação para a Ciência e Tecnologia) for funding through the Scientific Employment Stimulus-Individual Call (DOI 10.54499/CEECIND/03988/2018/CP1545/CT0006).

CONCLUSION

The Protein recovery (%) was highest at 190°C and N_2 atmosphere (SWPH.2) and lowest in CO_2 atmosphere at 160°C (SWPH.5)

All SWPHs presented high values for essential amino acids (~334.13 mg/g of protein) and good protein digestibility (57-88%)

SWPH produced in a N_2 atmosphere at 190°C (SWPH.2) exhibited the highest phenolic content (4525 mg GAE/ 100 g DW), antioxidant capacity and α-amylase inhibition (~88%, at 100 µg/mL concentration).