Effect of the extraction method on the phenolic profile and antimicrobial activity of quince peel extracts

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INTRODUCTION

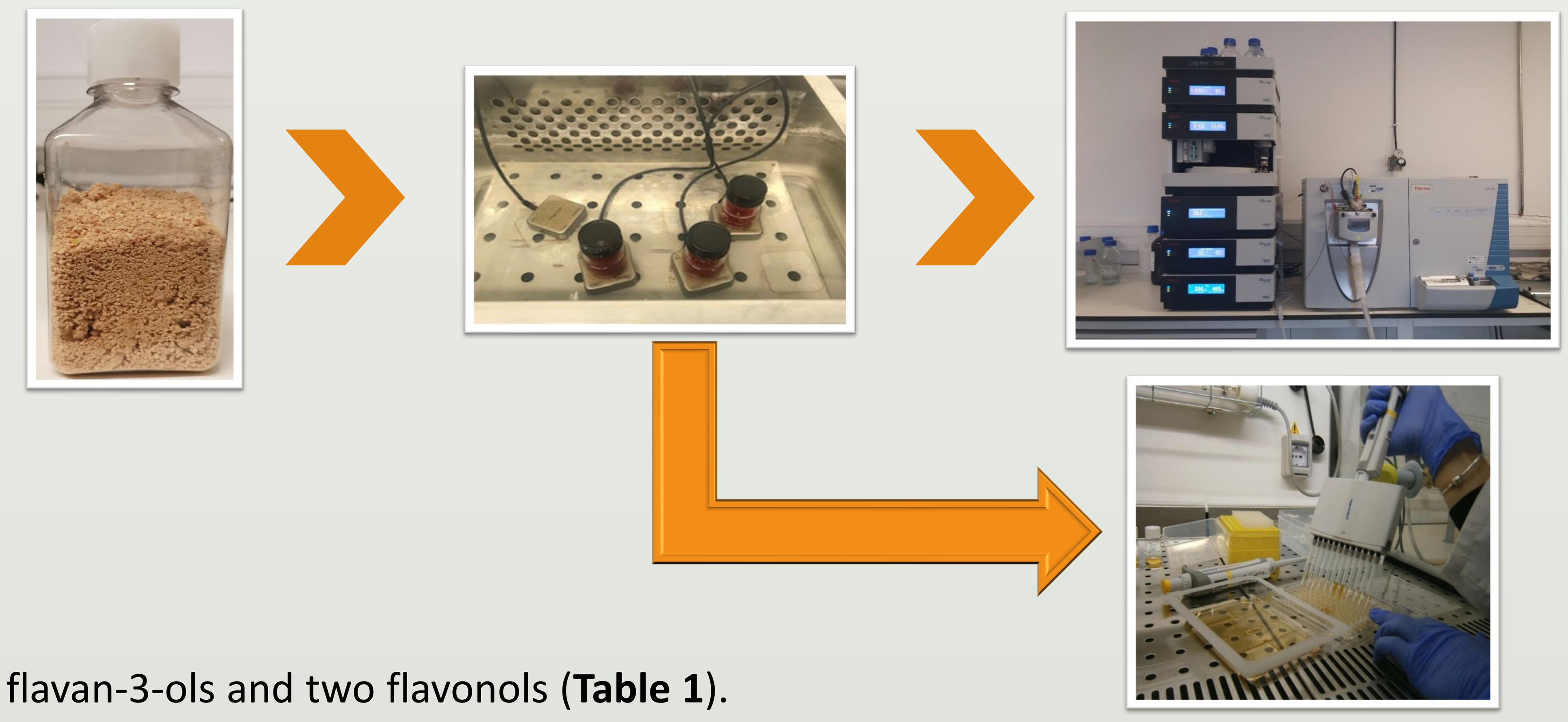
Quince is the golden yellow fruit of *Cydonia oblonga* Mill., a deciduous small tree native to the Trans-Caucasia and north of Iran and which has spread to west and east Asia, Europe, and America [1]. This fruit has an intense aroma, flavor, and acidity, but most varieties are too hard and sour to be eaten raw, so it is cooked or processed into other food products such as jam, jelly, and quince pudding or marmalade, being the peel discarded in the process as by-product [2]. In previous studies quince peel has been described as a rich source of phenolic compounds with antimicrobial activity [2,3].

OBJECTIVE

This work was performed to characterize the phenolic profile of quince peel extracts obtained by hydroethanolic maceration (HM) and hot water (HW) and test their antibacterial activity through serial microdilution methods.

METHODOLOGY

A dried powder of quince peel underwent extraction by hydroethanolic maceration (HM) and hot water (HW), being the obtained extracts characterized (identification and quantification) for their composition in phenolic compounds by HPLC-DAD-ESI/MS^n [4]. The antibacterial activity of the extracts was evaluated by the serial microdilution method (minimum inhibitory concentration, MIC) [4].



RESULTS and DISCUSSION

Sixteen phenolic compounds were identified, including five caffeoylquinic acids, nine flavan-3-ols and two flavonols (**Table 1**). Flavan-3-ols were the major compounds, corresponding to approximately 56.6% and 47.8% of the phenolic compounds quantified in the HM and HW extracts, respectively. Phenolic acids were more abundant in the HW extract, and they ranked second overall with *cis*-5-*O*-caffeoylquinic being the major compound.

Table 1. Content of phenolic compound in the quince peel extracts obtained by hydroethanolic maceration (HM) and hot water (HW).

Phenolic compounds	Content (mg/g extract)	
	HM extract	HW extract
3-*O*-Caffeoylquinic acid	0.372 ± 0.004	0.399 ± 0.008
3-*O*-*p*-Coumaroylquinic acid	0.087 ± 0.004	0.082 ± 0.002
cis-5-*O*-Caffeoylquinic acid	0.498 ± 0.005	0.63 ± 0.02
trans-5-*O*-Caffeoylquinic acid	0.192 ± 0.007	0.183 ± 0.006
(+)-Catechin	0.218 ± 0.003	0.182 ± 0.002
5-*O*-*p*-Coumaroylquinic acid	0.028 ± 0.002	0.037 ± 0.002
β-Type (epi)catechin trimer	0.76 ± 0.02	0.557 ± 0.006
β-Type (epi)catechin tetramer	0.330 ± 0.008	0.226 ± 0.007
β-Type (epi)catechin dimer	0.3 ± 0.02	0.233 ± 0.002
β-Type (epi)catechin tetramer	0.192 ± 0.009	0.152 ± 0.002
β-Type (epi)catechin trimer	0.385 ± 0.005	0.302 ± 0.005
β-Type (epi)catechin trimer	0.185 ± 0.007	0.146 ± 0.006
β-Type (epi)catechin trimer	0.128 ± 0.002	0.126 ± 0.004
Quercetin-*O*-deoxyhexosyl-hexoside	0.427 ± 0.001	0.490 ± 0.002
Procyanidin with A-type linkage	0.171 ± 0.007	0.120 ± 0.002
Kaempferol-*O*-deoxyhexosyl-hexoside	0.435 ± 0.004	0.403 ± 0.003

As shown in **Table 2**, the HM extract was most effective against the tested bacteria than the HW extract, particularly against *Salmonella* Typhimurium, one of the leading causes of inflammatory gastroenteritis in humans, *Staphylococcus aureus*, the most dangerous of the many common staphylococcal bacteria, and *Enterobacter cloacae.* Both quince peel extracts were more bioactive against *Staphylococcus aureus* and *Bacillus cereus* than the synthetic food additives E211 and E224, respectively. The HM extract was also more effective than E211 against *Enterobacter cloacae*.

Table 2. Antibacterial activity of the extracts obtained by hydroethanolic maceration (HM) and hot water (HW) and positive controls sodium benzoate (E211), potassium metabisulfite (E224), streptomycin, and ampicillin. Results are presented as minimum inhibitory (MIC) concentrations (mg/mL).

	Quince peel extracts				Positive Controls							
	HM extract		HW extract		E211		E224		Streptomycin		Ampicillin	
	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC
Bacillus cereus	1.50	3.00	1.50	3.00	0.50	0.50	2.00	4.00	0.10	0.20	0.25	0.40
Staphylococcus aureus	1.50	3.00	2.00	3.00	4.00	4.00	1.00	1.00	0.04	0.10	0.25	0.45
Listeria monocytogenes	1.50	6.00	1.50	6.00	1.00	2.00	0.50	1.00	0.20	0.30	0.40	0.50
Escherichia coli	1.50	3.00	1.50	3.00	1.00	2.00	0.50	1.00	0.20	0.30	0.40	0.50
Enterobacter cloacae	1.50	3.00	1.50	6.00	2.00	4.00	0.50	0.50	0.20	0.30	0.25	0.50
Salmonella Typhimurium	1.50	3.00	3.00	6.00	1.00	2.00	1.00	1.00	0.20	0.30	0.75	1.20

CONCLUSION

The results demonstrated that the hydroethanolic maceration is preferable for obtaining higher amounts of flavan-3-ols, whereas the hot water extraction can be more indicated to recover phenolic acids and flavonols, which could explain the antimicrobial assay results. Thus, quince peel could be exploited by industrial sectors in food and beverage formulation due to its composition in caffeoylquinic acids and flavonoids, and because of its antibacterial properties, mainly due to its high composition in flavan-3-ols.

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