Phenolic profile, bioactivity and fibre content of quince peel

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INTRODUCTION

The resources on our planet are finite and limited. Still, more and more waste is being produced worldwide. In this sense, it is essential to acquire circularity and "zero waste" approaches to move from the current environmentally unsustainable agri-food system to a more sustainable practice. Quince (**Fig. 1**) is the golden yellow pome fruit of *Cydonia oblonga* Mill. (syn. *C. vulgaris* Pers., Rosaceae family), 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]. Despite this, quince peel has been reported in previous studies to be rich in phenolic compounds with antioxidant potential such as hydroxycinnamic acids (caffeoylquinic acids), flavan-3-ols, and flavonol glycosides (quercetin and kaempferol glycosides) [2,3].

Figure 1. Quince fruit

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 phenolic composition by high-performance liquid chromatography coupled to electrospray ionization mass spectrometric detection working in the negative ion mode (HPLC-DAD-ESI/MSⁿ) [4]. The antioxidant activity of the HM and HW extracts was evaluated *in vitro* by their ability to inhibit the oxidative hemolysis (OxHLIA) and the formation of thiobarbituric acid reactive substances (TBARS) using sheep erythrocytes and porcine brain cells, respectively [4]. The fibre content in the solid residues from the extractions was determined by an enzymatic-gravimetric method [5].

RESULTS and DISCUSSION

The HM extract presented lower IC_{50} values than the HW extract in both *in vitro* assays, meaning that it has higher antioxidant activity (**Fig. 2**). Sixteen phenolic compounds were identified, including five phenolic acids (caffeoylquinic acids), nine flavan-3-ols ((+)-catechin, β-type (epi)catechin dimers, trimers, and tetramers, and a procyanidin with A-type linkage), and two flavonols (quercetin and kaempferol glycoside derivatives) (**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 predominant compound (0.498–0.63 mg/g extract) (**Table 1**). These results demonstrated that the dynamic 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. The extraction residues revealed fibre contents that reached 37 g/100 g DW.

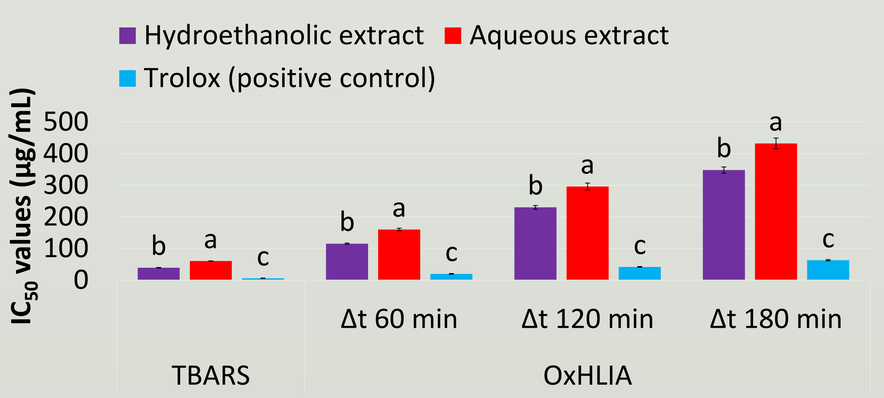

Figure 2. Antioxidant activity of the quince peel extracts evaluated by the TBARS formation inhibition and OxHLIA (at Δ*t* 60, 120 and 180 min) assays.

Table 1. Content of the phenolic compound identified in the HM and HW quince peel extracts.

Peak	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*-deoxyhexoside- hexoside	0.427 ± 0.001	0.490 ± 0.002
Procyanidin with A-type linkage	0.171 ± 0.007	0.120 ± 0.002
Kaempferol-*O*-deoxyhexoside-hexoside	0.435 ± 0.004	0.403 ± 0.003

CONCLUSION

Quince peel could be exploited by industrial sectors in food and beverage formulation due to its composition in fibre, caffeoylquinic acids, and flavonoids, and because of its antioxidant properties, mainly due to its composition in flavan-3-ols. Future work is planned to optimize the extraction processes and assess their effectiveness as natural food preservatives and fortifiers.

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