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(RESEARCH ARTICLE)

Chemical composition of isoflavones compounds and antioxidants from *Feijoa sellowiana* leaves

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Abstract

Isoflavonic compounds and antioxidants from the leaves of *Feijoa sellowiana* Berg grown in Casablanca (Morocco) was analyzed by a sensitive and reliable ultra-fast liquid chromatography tandem mass spectrometry (UFLC-MS/MS) method. The identified compounds were rich in phenolics compounds, thus fifteen constituents were found.

Keywords: *Feijoa sellowiana*; Myrtaceae; Polyphenol compounds; Antioxidants; ESI (Electronspray ionization).

1. Introduction

Reactive Oxygen Species (ROS) were produced as a result of oxidative metabolism in the body. They were annihilated by antioxidants, but in case of inversion of the balance in the favor of ROS, they become harmful to organic molecules such as proteins, nucleic acids and lipids. In this case, they present a danger and were at the onset of several diseases such as cardiovascular diseases, cancer, neurodegenerative and diabetic diseases [1, 2, 3]. Modern life with the high-fat and sugar diet in prepared industrial dishes containing synthetic preservative and taste-correcting additives, as well as sedentary lifestyles, makes men more vulnerable and over time they develop more and more diseases. The diet mode rich in fruits and vegetables allow reducing these ROS and their impact on biomolecules. Indeed, fruits and vegetables contained biomolecules, antioxidant polyphenols that help maintained a balance in favor of antioxidants and help preserve good health. A study for importance intake of vegetable, fruit and legumes was associated with reduced risk of mortality in European diabetic population and decreased cardiovascular diseases [4]. Faced with this recrudescence of diseases, many people were to look for products of natural origin. Plants with their different parts, leaves, stems, buds, roots and fruits were a huge field of research because plants were very rich in polyphenols. Owing to their antioxidant capacity and mainly flavonoids [5, 6] and their beneficial implications for human health on different diseases, the interest in using these phenolic compounds in food was increasing. Polyphenols were an important group in plants, vegetables, fruits, cereals and legumes. They were synthesized by plants in response to environmental stresses, whether from pests or other plants or contained in the soil [7]. In recent years a plant native to South America, *Feijoa sellowiana* (*F. sellowiana*), has aroused great interest among scientists because of its high content of polyphenols, particularly the flavonoids. Several studies have shown that these flavonoids could attenuate and inhibit cell oxidative stress, responsible for the installation of several diseases, such as cancer, cardiovascular diseases, neurodegenerative diseases, diabetes [3, 8, 9]. *F. sellowiana* has been shown to have various activities, antibacterial and antioxidant effects [10, 11, 12], antifungal effects [13], due to its composition rich in antioxidants flavonoids. In a previous study carried

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out in our laboratory, leaf and fruit extracts of *F. sellowiana* showed the presence of secondary metabolites such as saponosids, tannins, steroids and terpenes. They have shown antimicrobial activities [12]. *F. sellowiana* belongs to the Myrtaceae family, native to South America where it adapted to a warm temperate climate. It was introduced in Europe and the Mediterranean basin; Spain, France, Portugal, and Italy around the 19th century [14]. Thereafter, *Feijoa* plantations were then established in North Africa, and other countries. Actually thanked to its sweet aromatic fruits, it was widely spread through the world for its ease adaptation to the subtropical climate. In some countries such as Australia, the fruit was used in industry as syrup, jam and other products [15, 16]. The purpose of this study was to investigate the flavonoid and antioxidant compounds in the leaves of the *feijoa* plant (*Acca sellowiana* [Berg] Burret, synonym *Feijoa sellowiana*) found in Morocco and to compare its composition with *feijoa* from other regions.

2. Material and methods

2.1. Plant material

Leaves of *F. sellowiana* Berg (Myrtaceae) were collected in September and November 2017 in Casablanca.

2.2. Extraction and isolation

The extraction was carried out by successive exhaustion of plant materials, using water as solvent. 20 g of *F. sellowiana* leaves were crushed and piled up in a cartridge which was deposited in the Soxhlet device with 250 ml of solvent for each extraction. The temperature of extraction is 100 °C.

Once the extraction was finished, after 16 hours, the solvent were eliminated by evaporation using a rotary evaporator under reduced pressure to avoid any degradation of compounds existing in the extract. Obtained extracts with a volume of 1 ml of water were kept at 4 °C before analysis. The extract (5 µl) was analyzed by a sensitive and reliable ultra fast liquid chromatography tandem mass spectrometry (UFLC-MS/MS) method.

The chromatographic profiles were performed using the BEH-c18 column (50 cm× 2.1 mm × 1.7 µm) with a gradient from 5 to 100% of B , with solvent A (0.1% formic acid in water) and solvent B 0.1% formic acid in methanol. The elution was followed at a flow rate of 1 ml/min and the total time was 15 minutes.

At all times, the profiles were acquired with ESI in negative mode and in Full Scan with a resolution of 70.000. In order to identify we worked with standards, to determine retention times and exact masses. For this reason, we used several solutions containing analytes of different types. This has been analyzed in Trace Finder (analysis software).
The standards have been tested as 100 or 250 ppb.

3. Results and discussion

Analysis of the leaf extract of *F. sellowiana* revealed that it was rich in flavonoids and antioxidants such as cathequin, daidzin, quercetin, ellagic acid, and gallic acid, salicylic acid, caffeic acid. The chromatographic profiles and composition of the phenolic compounds identified from the leaf extract were shown in figure 1 and table 1.

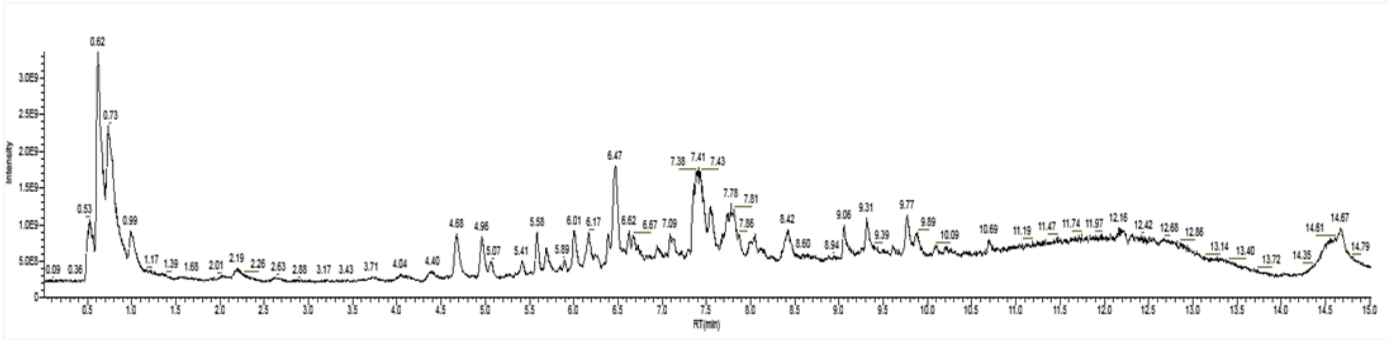

Figure 1 Chromatogram presenting results of UFLC-MS/MS analysis of leaves extract

Table 1 Results of the phenolic composition of the leaves of *F. sellowiana*

Found	Confirmed	Target Name	+/-	Aire	RT	Formula	Expected m/z	Aire standard	Concentration (mg/kg)
X	1 of 1	Gallic acid	-	1.84E+09	1	$C_7H_6O_5$	169.0143	32654111	5.635
X	1 of 1	(+)Gallo catechin	-	124098446	1.55	$C_{15}H_{14}O_7$	305.0667	28774978	0.431
X	1 of 1	(+)Catechin	-	1.221E+09	4.96	$C_{15}H_{14}O_6$	289.0718	87576711	1.4
X	1 of 1	Cafeic acid	-	9727743	5.53	$C_9H_8O_4$	179.035	69709331	0.014
	N/A	Epigallocatechin Gallate	-	N/A	5.76	$C_{22}H_{18}O_{11}$	457,0776		
X	1 of 1	(-)Epicatechin	-	618519160 18989ppm	6	$C_{15}H_{14}O_6$	289.0718	32590602	19
X	1 of 1	Daidzin	-	3175204	6.47	$C_{21}H_{20}O_9$	415.1035	1012018 100 ppb	0.314
X	1 of 1	Epicatechin gallate	-	7614077	6.73	$C_{22}H_{18}O_{10}$	441.0827	19916303	0.380
X	1 of 1	Taxifolin	-	1416976	6.82	$C_{15}H_{12}O_7$	303.051	20053190	0.007
X	1 of 1	Gibberellic acid GA3	-	28820474	7.05	$C_{19}H_{22}O_6$	345.1344	53046145 250 ppb	0.14
	N/A	Genistin	-	N/A	7.08	$C_{21}H_{20}O_{10}$	431.0984	4359976 100 ppb	
X	1 of 1	Ellagic acid	-	3.643E+09	7.36	$C_{14}H_6O_8$	300.999	5463159	66.7
X	1 of 1	Salicilic acid	-	161547050	7.61	$C_7H_6O_3$	137.0244	102762290	0.4
	N/A	Quercetin-Glc	-	N/A	7.72	$C_{21}H_{20}O_{12}$	463.0882	194003749	
X	1 of 1	Kaempferol-Glc	-	363516162	7.79	$C_{21}H_{20}O_{11}$	447.0933	48805580	0.745
	N/A	Eriodyctiol	-	N/A	8.05	$C_{15}H_{12}O_6$	287.0561	603095417	
	N/A	Daidzein	-	N/A	8.27	$C_{15}H_{10}O_4$	253.0506	96053502	
X	1 of 1	Quercetin	-	172099299	8.42	$C_{15}H_{10}O_7$	301.0354	205798683	0.084
X	1 of 1	Naringenin	-	1317830	8.6	$C_{15}H_{12}O_5$	271.0612	93839136	0.0015
	N/A	Genistein	-	N/A	8.75	$C_{15}H_{10}O_5$	269.0456	95366988	
X	1 of 1	Jasmonic acid	-	5285094	9	$C_{12}H_{18}O_3$	209.1183	71870317	0.018
	N/A	Kaempferol	-	N/A	9.01	$C_{15}H_{10}O_6$	285.0405	195349586	
	N/A	Apigenin	-	N/A	9.09	$C_{15}H_{10}O_5$	269.0456	8787744	

The results of analysis of *F. Sellowiana* leaf compounds growing in Casablanca-Morocco, showed a richness in flavonoid compounds. We found fifteen compounds in the leaves of *F. sellowiana* as shown in the table 1, such as flavanols monomeric, catechin, epicatechin, epigalocatechin, galocatechin andtaxifolin, quercetin, ellagic acid, galic acid, salicylic acid and jasmonic acid. Compounds such as quercetin, gallic acid, catechin, flavonoids, daidzin, genistin and others flavonoids daidzein, genistein, prunetin, biochanin, formononetin have been identified in leaf extracts in *F. sellowiana* and other myrtaceae, *Psidium guajava* and *Psidium littorale* Raddi [17]. Poodi et al. [18] found gallic acid, catechin, quercetin, apigenin, rutin and ferulic acid in a leaf ethanol extract. Quercitin, ellagic acid, flavones, isoquecitin, and other flavonoids have been identified in leaves of *Feijoa sellowiana* [19]. We identified and confirmed 15 polyphenols and their concentrations were estimated using standards.

The results showed that the concentrations of the various polyphenols identified were relatively low compared to those reported in the literature [19]. For example, we found values of 5.64; 1.4; 19; 66.7; 0.75; 0.4; 0.018 mg equivalents per kg Gallic acid, (+) Catechin, (-) Epicatechin, Ellagic acid, Kaempferol-Glc, Salicylic acid and Jasmonic acid, respectively (table 1).

Indeed these values were lower than those reported by Aoyama wich found gallic acid at 123 mg/g, quercetin at 41 mg/g in an ethanolic leaf extract. The concentrations of these isoflavones were low, perhaps because the plant was grown in a greenhouse. On the other hand, the method of extraction used, soxhlet device, have shown a low yield compared with other technical extraction. In a study on the Soxhlet method of extracting compounds from *F. sellowiana* leaves, showed that the ultrasonic extraction technique combined with pre-leaching allowed a better yield of phenol concentrations Poodi et al. [18]. Other factors influence the polyphenol composition such as environmental conditions, light, soil type, plant maturity stage and genetic factors. These flavonoids found in the leaves of *F. sellowiana* have shown numerous pharmacological activities, activities mediated by antioxidant and therefore anti-inflammatory reactions, inflammation leading to the development of diseases [20].

4. Conclusion

Polyphenols, through the consumption of fruits, vegetables, cereals, and plants, prevent the onset of diseases by reducing the formation of free radicals. This preventive aspect of the various diseases is an essential point to preserve good health and to reduce diseases. We were interested in *F. sellowiana*, a plant of tropical and subtropical regions and could thus adapt to the subtropical climate of Morocco. Although the quantitative results obtained were very low compared to other studies, whereas the presence of most of the flavonoids found in the leaves of *F. sellowiana* was in agreement, which gave reason to hope a better adapted conditions of cultivation of the plant. This shrub constituted a precious source of polyphenols and that the flavonoids could interest the food, cosmetic or pharmaceutical industries and merited more attention for its cultivation in Morocco.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have declared that no competing interest exists.

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