

Comprehensive Profiling of Most Widely Used Spices for Their Phenolic Compounds through LC-ESI-QTOF-MS² and their Antioxidant Potential

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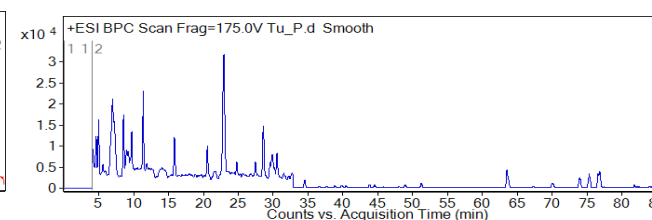
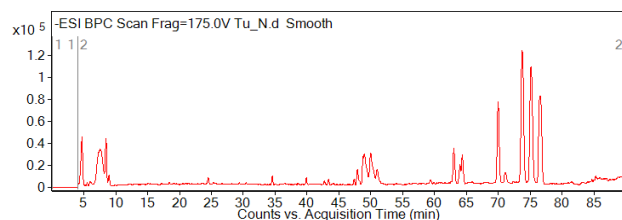
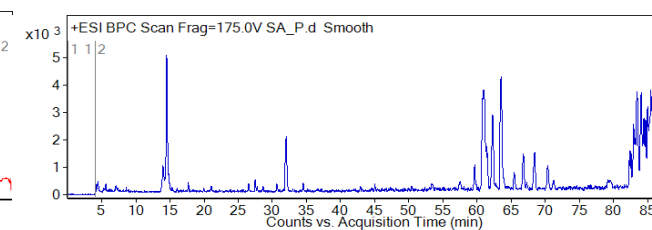
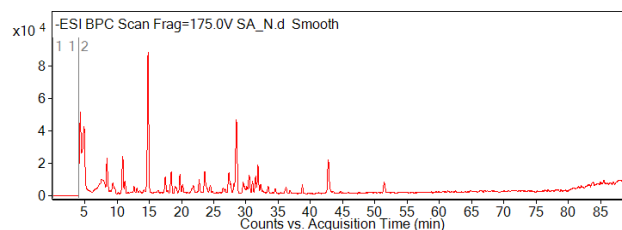
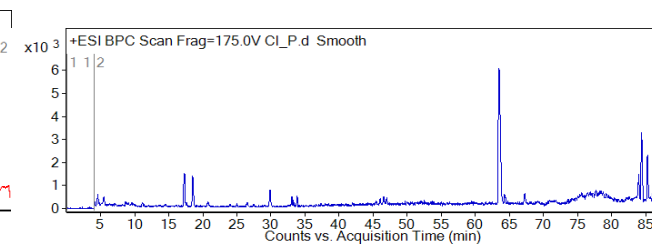
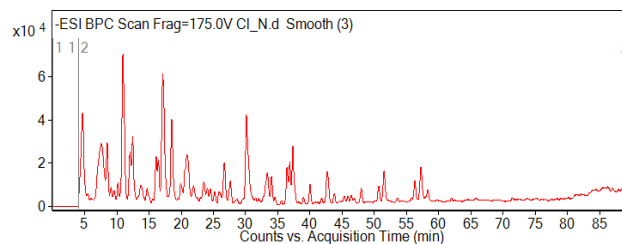
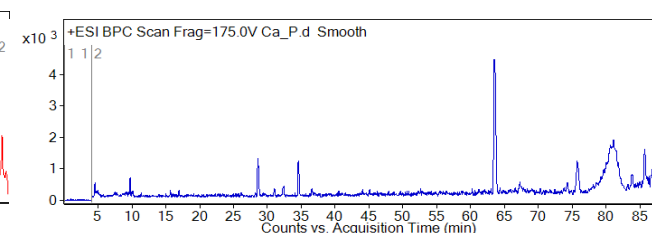
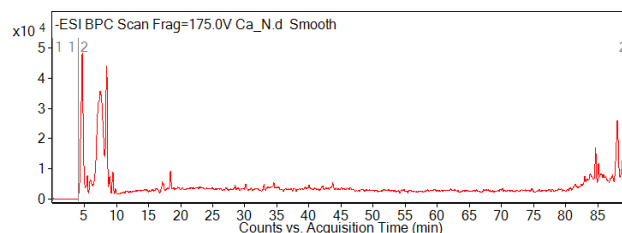
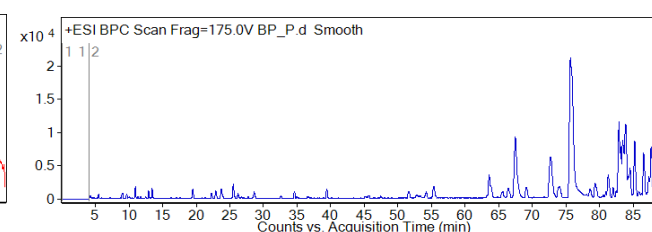
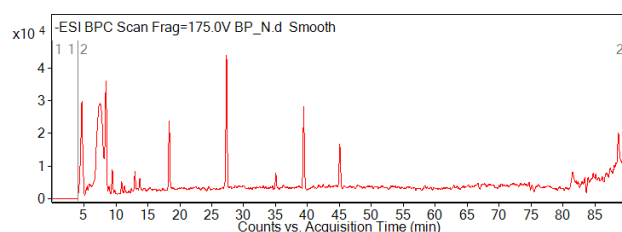
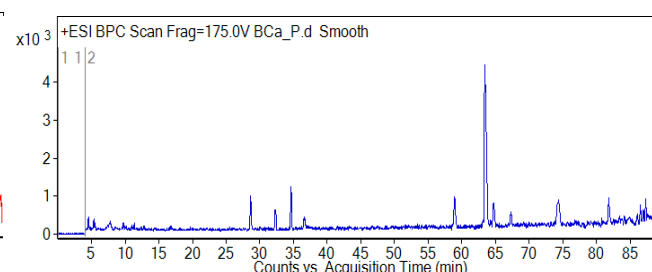
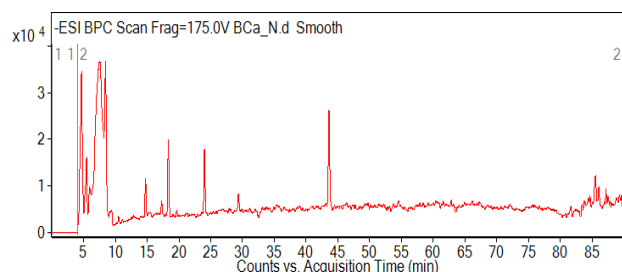
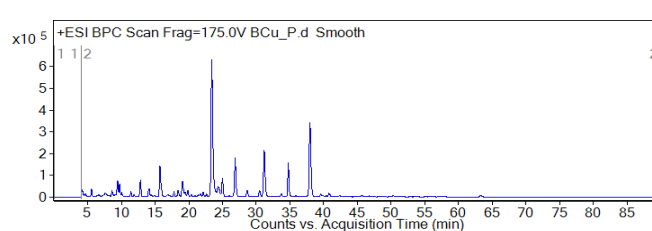
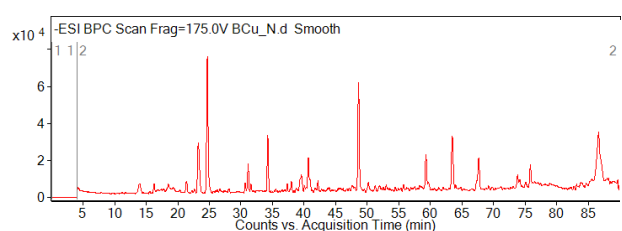
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Abstract: Spices have long been used to improve food flavor, due to their appealing fragrance and sensory attributes. Nowadays, spices-based bioactives, particularly phenolic compounds, have gained attention due to their wide range of significant effects in biological systems. The present study was conducted to characterize the 12 widely used spices (allspice, black cardamom, black cumin, black pepper, cardamom, cinnamon, clove, cumin, fennel, nutmeg, star-anise, and turmeric) for their phenolics with LC-ESI-QTOF-MS², polyphenols estimation, and their antioxidant potential. Total phenolics, total flavonoids, and total tannin content and their antioxidant activities were estimated in all spices. Clove and allspice had the highest value of total polyphenol content (215.14 and 40.49 mg gallic acid equivalent (GAE) per g of sample), while clove and turmeric had the highest total flavonoids (5.59 mg quercetin equivalent (QE) per g of sample) and total tannin contents (23.58 mg catechin equivalent (CE) per g of sample), respectively. On the other hand, black cumin and black pepper had the highest phosphomolybdate activity (15.61 and 15.43 mg ascorbic acid equivalent (AAE) per g of sample), while clove was almost identified with highest free radical scavenging capacity. A positive correlation was observed among phenolic compounds and antioxidant activities. In this quest, a total of 79 phenolic compounds were tentatively characterized by using LC-ESI-QTOF-MS² including 26 phenolic acids, 33 flavonoids, 16 other polyphenols, and 4 lignans. HPLC-PDA quantification of phenolic compounds exhibited higher phenolic acids. These results provided us some valuable information that spices have powerful antioxidant potential that can be further used in human food and animal feed as a supplement for different health promoting applications.

Keywords: spices; polyphenols; antioxidant activities; characterization; identification; quantification; HPLC-PDA; LC-MS/MS



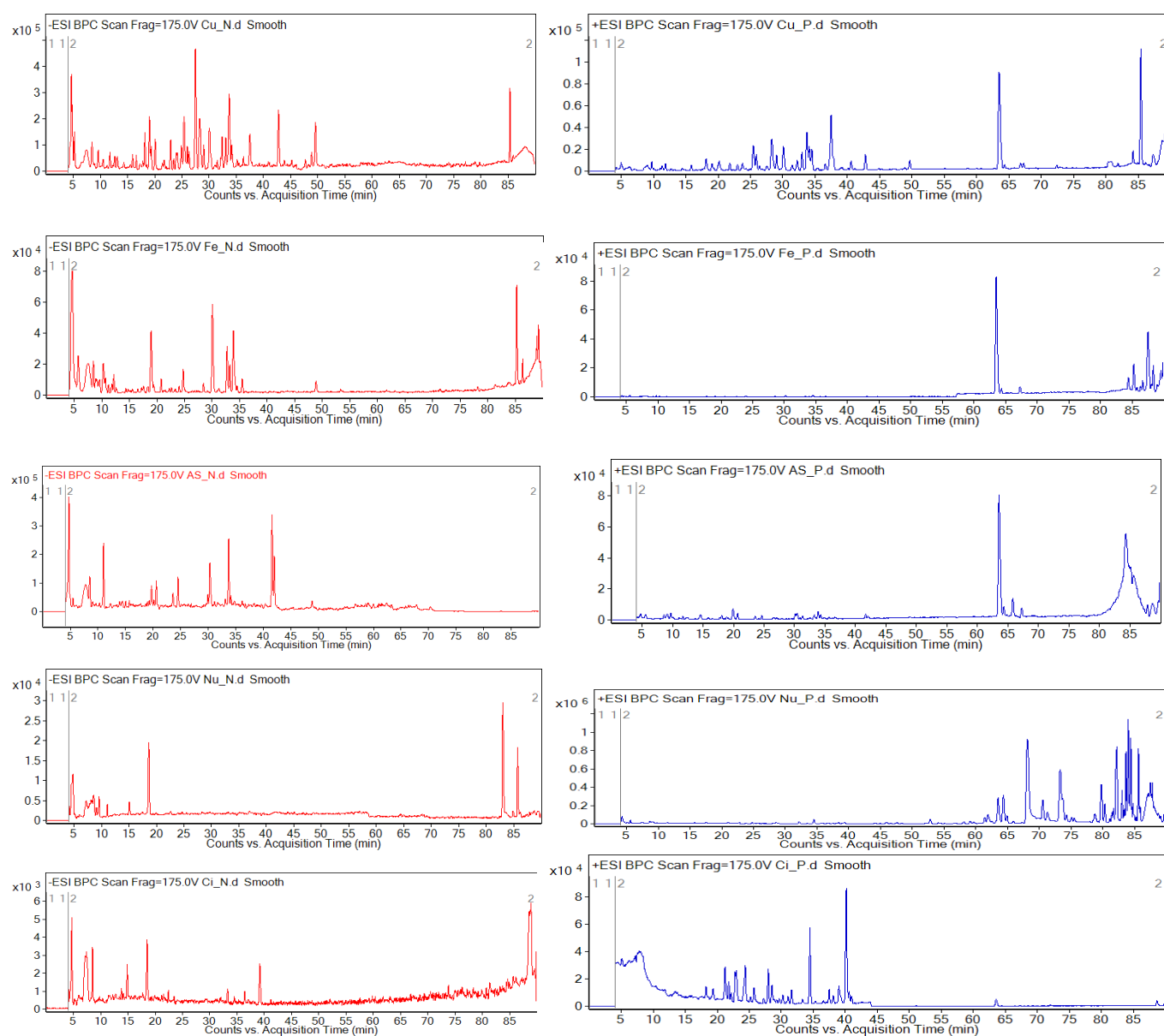
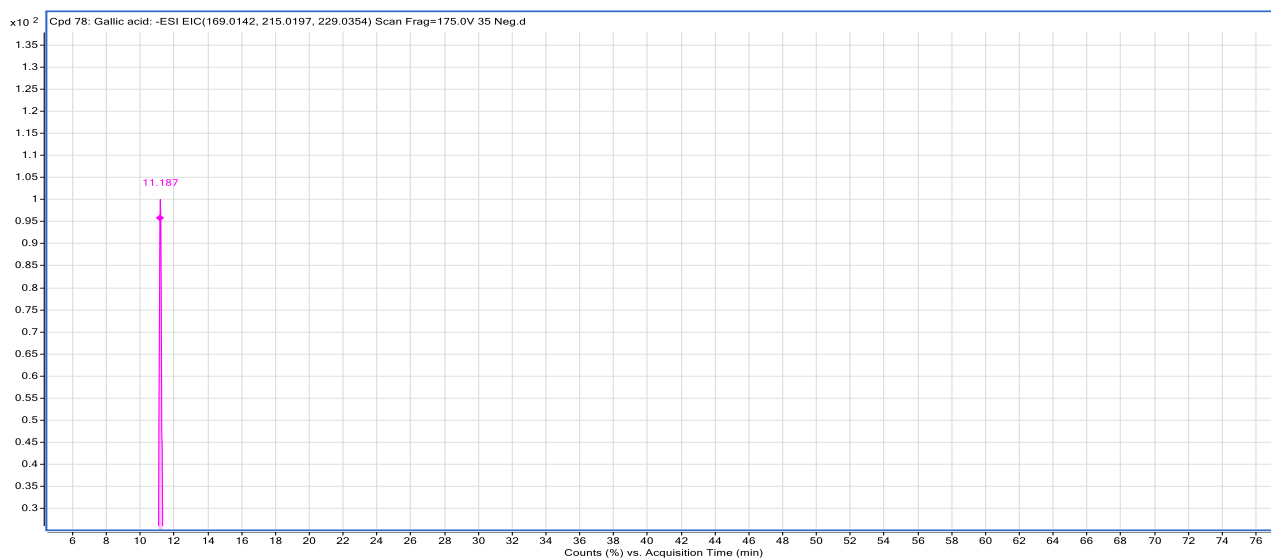


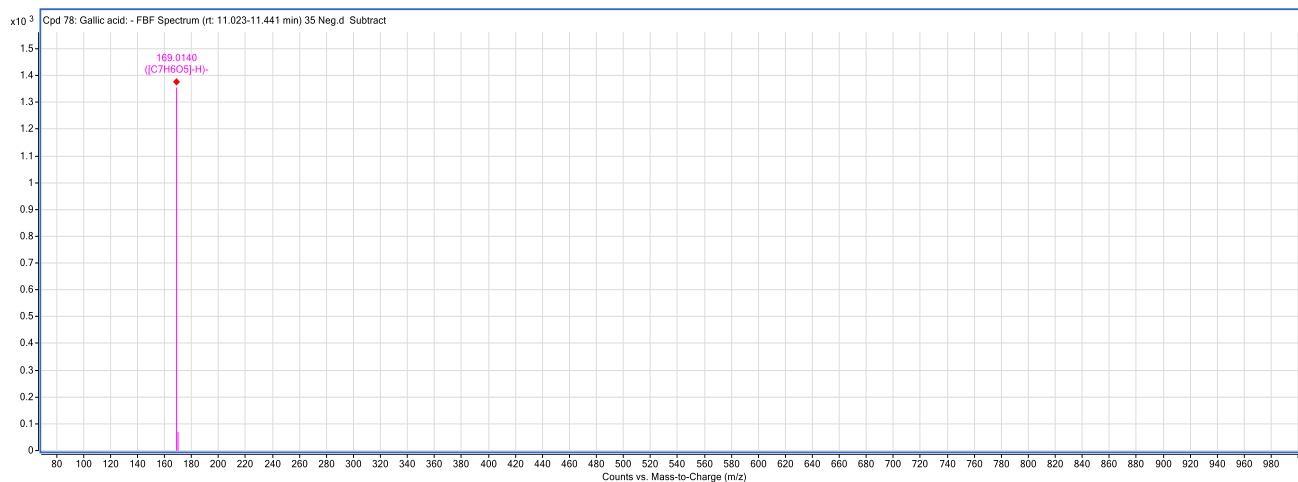
Figure (S1). Base Peak Chromatograms of 12 spices in negative (Red) and positive (Blue) mode.

Abbreviations = AS; Allspice, BCu; Black Cumin, BCa; Black Cardamom, BP; Black Pepper, Ca; Cardamom, Cl; Clove, SA; Star Anise, Tu; Turmeric, Cu; Cumin, Fe; Fennel, Nu; Nutmeg, Ci; Cinnamon.

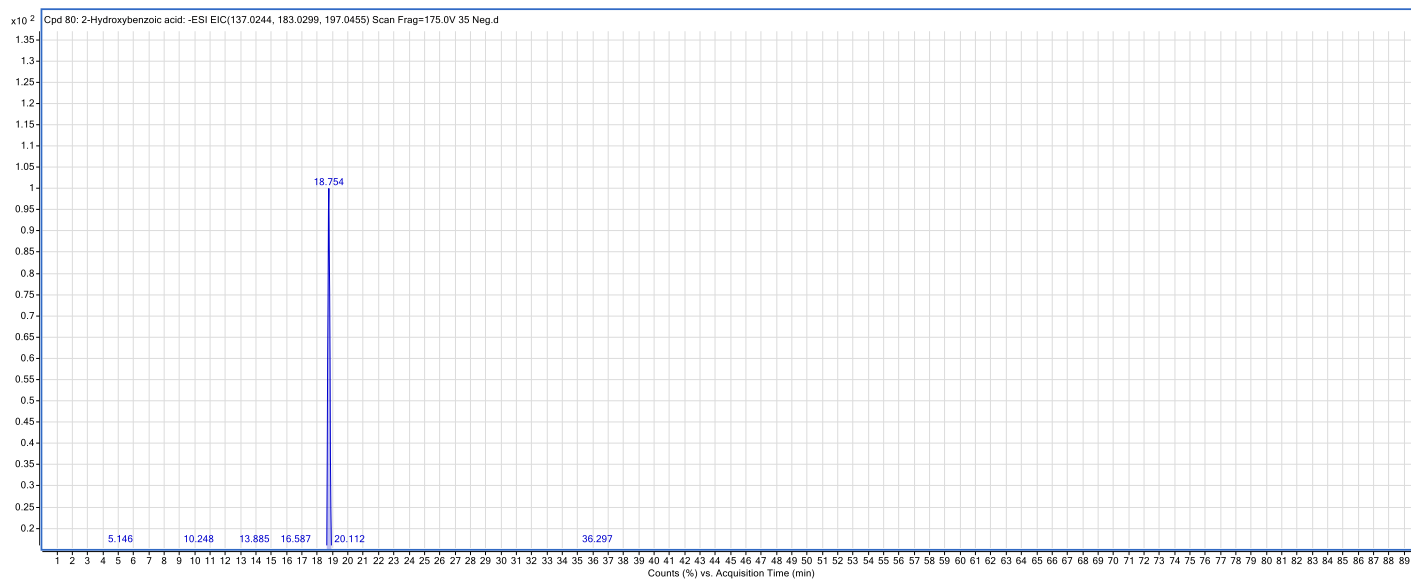
(a)



(b)



(c)



(d)

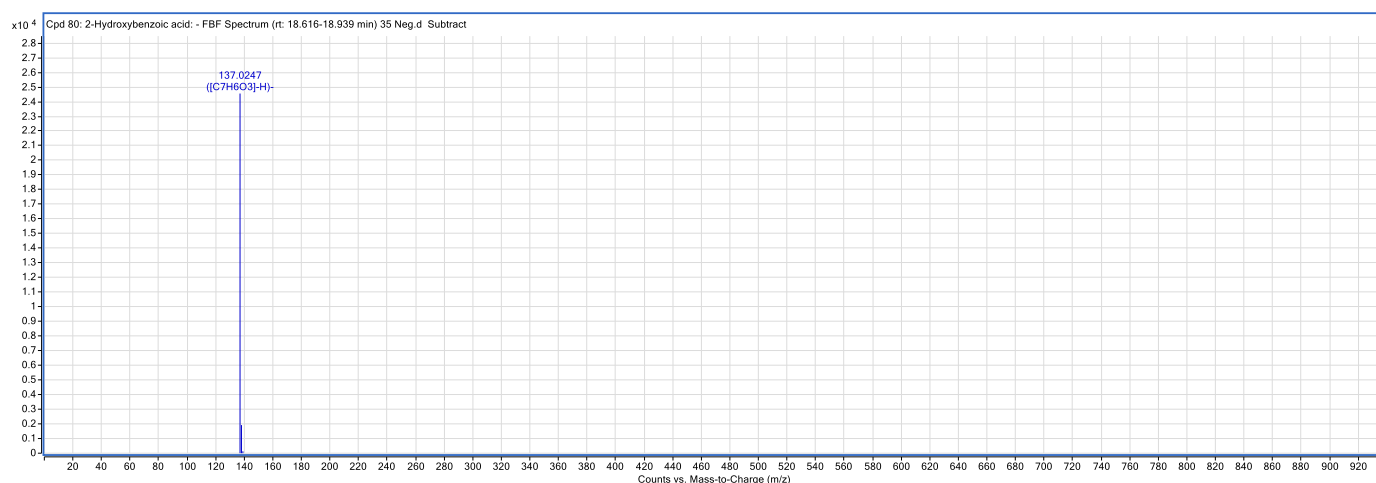


Figure (S2). Extracted ion chromatogram and their mass spectrum. (a) A chromatograph of Gallic acid (Compound 2, Table 2), Retention time (RT = 11.187 min) in the negative mode of ionization (ESI/[M-H]⁻) identified and characterized in cinnamon; **(b)** Mass spectra of Gallic acid showing an observed m/z 169.0140 in cinnamon; **(c)** A chromatograph of 2-Hydroxybenzoic acid (Compound 6, Table 2), Retention time (RT = 18.754 min) in the negative mode of ionization (ESI/[M-H]⁻) identified and characterized in cinnamon; **(d)** Mass spectra of 2-Hydroxybenzoic acid showing an observed m/z 137.0247 in cinnamon.