

## Determination of the antioxidant activity and polyphenol content of different types of *Rhus coriaria* Linn (sumac) from different regions

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*Rhus coriaria* Linn (Sumac) is a spice that is used most notably in Iranian, Turkish and Middle Eastern foods for seasoning and flavouring<sup>(1,2)</sup>. Many herbs and spices such as sumac have been demonstrated to have health benefits including antioxidant and anti-diabetic properties due to their high polyphenol content<sup>(3)</sup>.

The main objective of this study was to determine the antioxidant activity and polyphenol content of sumac from four different regions (Turkey, Palestine, Iran and the UK) in either fresh or dried commercial powder forms.

The fruits of fresh sumac were air-dried and then ground. Sumac, from different regions and in both forms, was extracted using water, acetone (80 %) and ethanol (80 %) solvents. The extracts were analysed for polyphenol content and antioxidant activity (Table 1) using the Folin-Ciocalteu reagent (FCR)<sup>(4)</sup> and the Ferric Ion-Reducing Antioxidant Power (FRAP)<sup>(5)</sup> assay, respectively.

The results of this work indicate that Fresh Brown sumac was high in antioxidant activity and polyphenol content in all types of extractions (water, acetone (80 %) and ethanol (80 %)) compared with all other sumac types (with the exception of Iranian Brown sumac extracted using ethanol (80 %)). Acetone (80 %) was the most efficient solvent to show the polyphenol content of all the sumac samples. Fresh Red, Iranian Brown, Turkish sumac and Fresh Brown sumac could have potential health benefits due to the high polyphenol content and antioxidant activity.

**Table 1.** Polyphenol content (g GAE/g) and total antioxidant activity (mmol/L) of each type and form of sumac

Sumac Type	Test	Water		Acetone (80 %)		Ethanol (80 %)		P-value
		Mean	SD	Mean	SD	Mean	SD	
Turkish	Polyphenol	1387	42	3464	885	2449	550	< .000
	FRAP	3496	246	10401	2572	25195	7754	< .000
Palestinian	Polyphenol	176	18	1665	108	485	274	< .000
	FRAP	762	106	4165	255	12857	2991	< .000
Iranian Red	Polyphenol	437	27	1821	134	436	215	< .000
	FRAP	1186	378	4334	750	9035	3518	< .000
Iranian Brown	Polyphenol	1813	92	5136	306	2708	606	< .000
	FRAP	9017	2662	13851	2112	27576	6268	< .000
Fresh Red	Polyphenol	1237	134	4450	697	2066	829	< .000*
	FRAP	7253	3129	10755	1494	14394	5964	< .003
Fresh Brown	Polyphenol	2895	549	5384	712	3395	1395	< .001*
	FRAP	14081	4992	14185	2144	27351	8618	< .000

Data was tested for normality using the Shapiro-Wilks test. Values are the mean of three independent experiments. A one-way ANOVA and Kruskal Wallis test were used to compare within and between samples. The results were significant at  $p < 0.05$  and  $p < 0.01$ \*(Kruskal Wallis post-hoc tests for pairwise comparisons)

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