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Characterization and antioxidant activity of the volatile oils of *Thymus Syriacus Boiss. var syriacus* and *Thymbra spicata L.* grown wild in Kurdistan-Iraq

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Herbs and their essential oils are known for their antimicrobial and antioxidant properties in biological systems^(1,2). Thyme (*Thymus syriacus Boiss. var syriacus*) and thymbra (*Thymbra spicata L.*) grow wild in Kurdistan-Iraq and because of their abundance in the region and use in foods their volatile oils (VO) were extracted by hydro-distillation⁽³⁾, chemically characterised (by GC and GC-MS) and evaluated for their antioxidant activities (using the Cu²⁺-mediated LDL oxidation method^(4,5)). The kinetics of LDL oxidation was monitored by the change in absorbance of conjugated dienes (234 nm) over time (14 h) at 30°C. The antioxidant efficacy of the VO of each herb and their major and minor terpen(oid)s were measured by their ability to extend the lag phase of oxidation v. control^(4,5).

The VO yield of thymbra and thyme was significantly higher (4.15 (SD 0.15) % and 3.75 (SD 0.10) %) in samples grown at higher altitudes (1100 m and 900 m) compared with those grown at lower altitudes (670 m and 400 m; (2.72 (SD 0.08) % and 2.52 (SD 0.12) % respectively; *P*<0.05). The principal components identified in the VO of thyme and thymbra are shown in Table 1. Clear differences were observed for their terpen(oid) content, with the main difference observed in the content of thymol and carvacrol, although the level of γ -terpinene was also much higher in thymbra. Altitude had little effect on VO composition.

Table 1. Major terpen(oid) identified in thyme and thymbra (*n* 6)

Herbs	Thymol		Carvacrol		<i>P</i> -cymene		Borneol		γ -Terpinene		β -Caryophyllene		α -Terpinene	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<i>Thymus syriacus</i>	74.1	2.2	9	1.5	5.3	0.2	2.4	0.3	2	0.3	1.7	0.2	0.7	0.1
<i>Thymbra spicata</i>	0.2	0.1	74.0	3.5	7.5	0.25	0.2	0.1	10.7	1.1	1.6	0.1	1.5	0.3

The VO of thyme and thymbra showed clear antioxidant activity by extending lag phase by 43 and 49% respectively at 1 μ M (Table 2). Pure samples of thymol and carvacrol were shown to be more effective than thyme and thymbra VO by an order of >10-fold. The other pure standards tested however were less efficacious. The effectiveness of the compounds tested as antioxidants in this system were thymol>carvacrol> γ -terpinene> α -terpinene>borneol> β -caryophyllene. Interestingly, α -pinene, myrcene and *p*-cymene were found to be pro-oxidant at the concentrations tested.

Table 2. Effects of thyme and thymbra VO and synthetic terpenoids on extending lag phase to oxidation of copper-mediated LDL oxidation (% increase compared with control oxidation; control lag phase 151 (SD 12) min)

VO or terpenoid concentration (μ M)...	0.025		0.05		0.1		0.25		0.5		1.0		2.0	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Thyme VO	ND													
Thymbra VO							40	10	58	24	82	30	96	27
Thymol							262	46	57	14	78	22	117	26
Carvacrol	78	3	112	10	172	9	70	9						
γ -Terpinene	20	3	38	7	39	13	18	3	27	2	40	3	68	1
α -Terpinene							12	1	15	1	23	1	32	2
Borneol*							6		7		10		10	
β -Caryophyllene*							1		3		3		5	

*Means for two determinations.

These findings may have important implications for the more general use of these herbs in foods.

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