

Supplementary Materials

Nutritional and Health Values of Tunisian Edible Oils from Less-Used Plant Sources

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Table S1. Operative conditions for the microwave oven digestion.

Step	Time	Temperature	Microwave power
1	15 min	0-180 °C	1000 W
2	15 min	180 °C	1000 W
3	20 min	Cooling	

Table S2. ICP-MS Experimental parameters.

Spectrometer	iCAP Q Thermo scientific with Qcell Reaction System
Nebulizer	0 rps Concentric PFA
RF generator	1550 W
Sample depth	5 mm
Interface	Sample and skimmer cones in Ni
Interface pressure	1.89 E+00 Pa
Carrier gas flow rate	1.1 L min ⁻¹
Plasma gas flow rate	14 L min ⁻¹
Auxiliary gas flow rate	0.8 L min ⁻¹
Helium collision gas flow rate	4.7 L min ⁻¹
Spray chamber temperature	2.7 C°
Scanning condition	Number of replicates: 3, dwell time: 1s
Vacuum	< 7,5E-07 Pa

S.1 Validation of analytical methods

Analytical methods for mineral elements determination were validated with the help of commercial standards in terms of linearity, limit of detection (LOD) and limit of quantification (LOQ), according to Eurachem criteria¹. Linearity was assessed by means of calibration curves of each analyte, constructed according to the linear least-square regression method. Specifically, seven-point calibration curves were obtained using mixed working standard solutions in the following concentrations: 0.5, 1.0, 2.0, 5.0, 10, 20 and 50 µg L⁻¹ for Li, Be, B, Na, Mg, Al, K, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Sr, Mo, Ag, Cd, Sb, Ba, Tl, Pb, and Bi. Each solution was injected six times (n = 6). LODs and LOQs were experimentally calculated as 3.3 σ/S and 10 σ/S, respectively, where σ is the standard deviation of the analytical blank (n=6) and S is the slope of the relative calibration curve. A good linearity was obtained for all elements investigated with R² values ranged from 0.9982 (for Na) to 0.9999 (for V). The limits of detection (LODs) ranged from 0.001 to 0.461 µg kg⁻¹, and limits of quantification (LOQs) ranged from 0.003 to 1.521 µg kg⁻¹. The lowest average recovery was observed for potassium with 91.13%, while the highest was obtained for arsenic with

102.56%. Accuracy was assessed by evaluating six determinations on certified reference material (Pine Needles NIST 1575) and was reported as the percent recovery between the value found with the calibration curve and the true value reported in the certified reference materials. When the element was not certified in the reference material, the matrix was spiked with the known amount of analyte and was analyzed following the procedures discussed before. Based on these results, the analytical characteristic (linearity, sensitivity, and accuracy) can be considered satisfactory for the purposes of the analysis.

Table S3 - Analytical parameters for method validation.

PINE NEEDLES NIST 1575						
Element	LOD ($\mu\text{g/Kg}$)	LOQ ($\mu\text{g/Kg}$)	R ²	Experimental value (mg/kg)	Expected value (mg/kg)	Recovery (%)
Li	0.001	0.003	0.9998	1.95*	2.00*	97.50
Be	0.001	0.003	0.9997	2.00*	2.00*	100.00
B	0.003	0.010	0.9997	9.1	9.6	94.79
Na	0.461	1.521	0.9982	60.00	63.00	95.24
Mg	0.031	0.102	0.9992	0.103	0.106	97.17
Al	0.021	0.069	0.9996	566	580	97.59
K	0.142	0.469	0.9989	0.380	0.417	91.13
Ti	0.002	0.007	0.9997	2.01*	2.00*	100.50
V	0.001	0.003	0.9999	2.02*	2.00*	101.00
Cr	0.001	0.003	0.9998	0.38	0.40	95.00
Mn	0.002	0.007	0.9997	478	488	97.95
Fe	0.021	0.069	0.9996	43.5	46.0	94.57
Co	0.001	0.003	0.9997	0.060	0.061	98.36
Ni	0.001	0.003	0.9998	1.43	1.47	97.28
Cu	0.014	0.046	0.9993	2.7	2.8	96.43
Zn	0.027	0.089	0.9992	37.45	38.00	98.55
As	0.001	0.003	0.9997	0.040	0.039	102.56
Se	0.042	0.139	0.9991	0.095	0.099	95.96
Sr	0.003	0.010	0.9997	1.99*	2.00*	99.50
Mo	0.002	0.007	0.9998	2.00*	2.00*	100.00

Ag	0.001	0.003	0.9998	1.97*	2.00*	98.50
Cd	0.001	0.003	0.9998	0.225	0.233	96.57
Sb	0.002	0.007	0.9997	1.95*	2.00*	97.50
Ba	0.004	0.013	0.9997	6.08	6.00	101.33
Tl	0.002	0.007	0.9997	1.98*	2.00*	99.00
Pb	0.002	0.007	0.9998	0.170	0.167	101.80
Bi	0.003	0.010	0.9996	1.99*	2.00*	99.50
Hg	0.001	0.003	0.9998	0,0404	0.0399	101.25

*Not Present in the certified matrix. Added later to the matrix.

Table S4. Contents (mg/100 g of oil) of single and total sterols in the investigated oils. expressed as mean \pm standard deviation of three samples (N=3). each of them was analysed in triplicate (n=3).

Sterols	Oil samples					
	Apricot kernel	Bitter almond	Nigella	Pumpkin seed	Souchet	Wheat germ
Colesterol	0.68 \pm 0.04 ^a	0.55 \pm 0.01 ^a	1.42 \pm 0.07 ^b	0.52 \pm 0.02 ^a	0.80 \pm 0.05 ^a	1.67 \pm 0.04 ^b
Brassicasterol	1.37 \pm 0.26 ^a	0.00 \pm 0.00 ^b	0.00 \pm 0.00 ^b	0.00 \pm 0.00 ^b	0.33 \pm 0.05 ^c	0.00 \pm 0.00 ^b
Campesterol	10.30 \pm 1.22 ^a	6.22 \pm 0.99 ^b	14.59 \pm 2.37 ^c	7.16 \pm 0.92 ^c	32.80 \pm 3.399 ^c	391.19 \pm 9.01 ^c
Campestanol	1.05 \pm 0.02 ^a	0.61 \pm 0.01 ^a	1.32 \pm 0.08 ^a	0.87 \pm 0.04 ^a	1.04 \pm 0.04 ^a	37.90 \pm 2.25 ^b
Stigmasterol	28.97 \pm 3.17 ^a	8.41 \pm 1.17 ^b	18.22 \pm 2.13 ^c	11.69 \pm 1.31 ^b	35.04 \pm 2.42 ^a	23.66 \pm 2.15 ^a
Δ^7-campesterol	0.86 \pm 0.27 ^a	1.40 \pm 0.27 ^a	1.41 \pm 0.27 ^a	1.54 \pm 0.27 ^a	1.59 \pm 0.27 ^a	31.19 \pm 0.27 ^b
Clerosterol	2.06 \pm 3.23 ^a	2.07 \pm 2.47 ^a	1.10 \pm 2.36 ^a	4.08 \pm 1.21 ^b	1.66 \pm 2.15 ^a	10.19 \pm 1.55 ^c
β-Sitosterolo	209.39 \pm 2.32 ^a	155.23 \pm 3.97 ^b	67.35 \pm 4.27 ^c	107.43 \pm 4.22 ^b	121.57 \pm 3.36 ^b	987.57 \pm 7.98 ^d
Δ^5-avenasterol	25.26 \pm 1.94 ^a	27.75 \pm 1.91 ^a	19.56 \pm 1.52 ^a	8.25 \pm 1.18 ^b	5.84 \pm 0.99 ^b	99.13 \pm 2.33 ^c
$\Delta^{5,24}$-stigmastanol	2.96 \pm 0.09 ^a	2.88 \pm 0.03 ^a	1.51 \pm 0.04 ^a	30.92 \pm 2.27 ^b	1.53 \pm 0.07 ^a	24.73 \pm 2.51 ^b
Δ^7-stigmastenol	6.57 \pm 1.13 ^a	5.33 \pm 0.91 ^a	1.95 \pm 0.89 ^b	20.32 \pm 1.15 ^c	9.78 \pm 1.67 ^a	37.96 \pm 4.45 ^d
Δ^7-avenasterolo	2.85 \pm 0.09 ^a	2.38 \pm 0.08 ^a	2.52 \pm 0.09 ^a	25.37 \pm 2.52 ^b	3.35 \pm 0.05 ^a	67.63 \pm 2.48 ^c
Total Sterols	285.3 \pm 12.52 ^a	212.8 \pm 9.97 ^a	131.0 \pm 5.691 ^b	218.2 \pm 11.05 ^a	215.3 \pm 10.42 ^a	1713.8 \pm 24.62 ^c

Different superscript letters indicate significantly different values ($p < 0.05$ by post hoc Tukey's HSD test); Same superscript letters in the same column indicate not significantly different values ($p > 0.05$ by post hoc Tukey's HSD test).