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Supplementary Materials

Heavy metal analysis in commercial spices and herbs by inductively coupled plasma mass spectrometry (ICP-MS) and estimated dietary exposure

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Supplementary Table 1. Metal content in spices and herbs by country

Spice & herb	Metal level (mg/kg), mean ± SD (range)								Country	Reference
	Al	As	Cd	Cr	Hg	Ni	Pb	Sr		
Basil										
n = 1	330	0.13	0.023	0.61	0.012	1	0.47	260	Egypt	This study
n = 50	-	0.06 ± 0.03 (< 0.005-0.16)	0.01 ± 0.005 (< 0.005-0.02)	6.34 ± 2.58 (1.76-13.5)	-	-	0.28 ± 0.09 (0.11-0.44)	-	Latvia	Reinholds *et al.*[1]
n = 20	-	-	1.26 ± 0.64	8.75 ± 2.44	-	2.85 ± 1.85	4.45 ± 1.48	-	Egypt	Abou-Arab & Donia[2]
n = 4	-	-	1.7 ± 0.1	5.1 ± 0.1	-	6.7 ± 0.1	-	-	Turkey	Divrikli *et al.*[3]
n = 22	-	0.668 ± 0.427	0.034 ± 0.033	-	0.009 ± 0.005	-	0.271 ± 0.19	-	South Korea	Shim *et al.*[4]
n = 3	-	(0.12-0.55)	(0.03-0.06)	(1.53-3.94)	-	(0.73-1.51)	(0.78-1.21)	-	Turkey	Tokalioglu *et al.*[5]
Chili										
n = 1	43	0.058	0.087	0.15	< 0.005	0.48	0.19	8.6	China	This study

n = 10	108.5 ± 61.1 (16-210)	0.08 ± 0.06 (0.034-0.24)	0.08 ± 0.08 (0.027-0.31)	0.31 ± 0.16 (0.05-0.52)	< 0.005-0.023	1.08 ± 0.43 (0.7-2.1)	0.11 ± 0.05 (0.04-0.19)	12.9 ± 4.6 (3.7-18)	India	This study
n = 3	96.7 ± 25.2 (70-120)	0.08 ± 0.046 (0.039-0.13)	0.08 ± 0.022 (0.056-0.1)	0.72 ± 0.76 (0.22-1.6)	< 0.005-< 0.005	0.76 ± 0.31 (0.5-1.1)	0.11 ± 0.036 (0.08-0.15)	13.1 ± 3.90 (9.2-17)	Malaysia	This study
n = 15	-	1.33 ± 0.5	0.013 ± 0.01	-	-	-	12.76 ± 2.19	-	Pakistan	Akhtar *et al.*[6]
n = 16	-	2.8 ± 0.05 (2.7-2.9)	1.00 ± 0.37 (0.93-1.7)	-	-	5.00 ± 0.125 (4.75-5.25)	1.02 ± 0.05 (0.90-1.14)	-	Pakistan	Baig *et al.*[7]
Cinnamon										
n = 1	11	0.012	0.27	0.13	< 0.005	0.32	0.15	35	China	This study
n = 1	500	0.15	0.37	1.3	0.018	1.2	2.5	29	India	This study
n = 2	350 (160-540)	0.053 (0.034-0.071)	1.93 (0.15-3.7)	0.56 (0.33-0.79)	< 0.005-0.008	0.54 (0.48-0.60)	1.58 (0.75-2.4)	71 (61-81)	Sri Lanka	This study
n = 2	473 (25-920)	0.231 (0.012-0.45)	0.39 (0.29-0.49)	2.02 (0.04-4.0)	< 0.005-0.059	1.23 (0.45-2.0)	3.58 (0.16-7.0)	44 (31-57)	Vietnam	This study
n = 5	-	0.019 ± 0.008	0.118 ± 0.001	-	0.002 ± 0.001	-	0.766 ± 0.017	-	Indonesia	Bua *et al.*[9]

		(0.021-0.027)	(0.117-0.12)		(0.002-0.003)		(0.75-0.79)			
n = 5	-	0.091 ± 0.005 (0.082-0.099)	0.189 ± 0.014 (0.176-0.215)	-	0.044 ± 0.001 (0.043-0.046)	-	2.22 ± 0.71 (2.26-2.92)	-	Vietnam	Bua *et al.*[9]
n = 9	-	0.45 ± 0.05 (0.35-0.55)	2.43 ± 0.38 (1.6-3.23)	-	-	1.00 ± 0.11 (0.75-1.25)	8.00 ± 0.21 (7.6-8.4)	-	Pakistan	Baig *et al.*[7]
n = 3	22.2 ± 5.6	-	0.46 ± 0.31	-	-	-	0.08 ± 0.08	68.5 ± 25.0	Brazil	Caldeirao *et al.*[10]
n = 15	-	0.056 ± 0.000	0.036 ± 0.0003	0.42 ± 0.01	-	0.94 ± 0.01	0.163 ± 0.0016	15.2 ± 0.01	Pakistan	Khan *et al.*[11]
n = 20	-	0.476 ± 0.519	0.315 ± 0.152	-	0.014 ± 0.01	-	0.972 ± 0.892	-	South Korea	Shim *et al.*[4]
n = 13	27.2 ± 0.55	0.005 ± 0.000	0.071 ± 0.001	2.36 ± 0.029	0.002 ± 0.001	2.77 ± 0.012	0.023 ± 0.000	50.6 ± 0.127	Vietnam	Cicero *et al.*[12]
Cinnamon										
n = 4	-	(nd-0.09)	(0.21-0.33)	(0.16-0.76)	-	(nd-0.18)	(0.07-0.66)	-	Turkey	Tokalioglu *et al.*[5]
n = 1	-	0.038 ± 0.004	0.118 ± 0.009	0.52 ± 0.04	-	0.32 ± 0.05	-	45.5 ± 3.25	Turkey	Karadas & Kara[13]
Paprika										
n = 1	190	0.23	0.045	1.1	0.007	1	0.26	61	China	This study

n = 2	140 (110-170)	0.053 (0.047-0.059)	0.058 (0.037-0.079)	0.3 (0.25-0.35)	< 0.005-0.008	0.78 (0.77-0.78)	0.11 (0.10-0.12)	21.5 (21.0-22.0)	India	This study
n = 1	81	0.11	0.045	2.8	< 0.005	1.2	0.09	12	Malaysia	This study
n = 3	147 ± 35 (110-180)	0.16 ± 0.05 (0.11-0.20)	0.05 ± 0.01 (0.042-0.061)	0.70 ± 0.06 (0.65-0.77)	< 0.005- < 0.005	0.73 ± 0.02 (0.71-0.75)	0.23 ± 0.10 (0.13-0.33)	22.3 ± 3.1 (19.0-25.0)	Spain	This study
Black pepper										
n = 2	125 (120-130)	0.86 (0.022-1.7)	0.02 (0.008-0.033)	0.64 (0.27-1.0)	< 0.005- < 0.005	2.15 (1.6-2.7)	0.11 (0.083-0.14)	25.5 (12.0-39.0)	China	This study
n = 4	162 ± 252 (29-540)	0.043 ± 0.038 (0.007-0.081)	0.024 ± 0.02 (0.012-0.054)	0.84 ± 1.1 (0.11-2.7)	0.007-0.017	2.9 ± 1.4 (1.7-4.8)	0.14 ± 0.16 (0.03-0.37)	33.3 ± 9.0 (21.0-42.0)	India	This study
n = 1	57	0.057	0.012	0.14	< 0.005	0.85	0.1	46	Malaysia	This study
n = 1	39	0.072	0.017	0.05	0.006	1.7	0.073	11	Sri Lanka	This study
n = 2	85 (59-110)	0.016 (0.015-0.017)	0.009 (0.009-0.009)	0.24 (0.19-0.28)	0.006-0.006	2.6 (2.4-2.7)	0.06 (0.016-0.10)	30 (29-30)	Vietnam	This study
n = 13	43.1 ± 0.25	0.002 ± 0.000	0.003 ± 0.000	0.096 ± 0.003	0.003 ± 0.001	1.19 ± 0.009	0.008 ± 0.000	8.67 ± 0.047	Vietnam	Cicero *et al.*[12]
n = 9	-	(< LOQ-0.068)	(0.056-0.110)	(0.16-0.302)	-	(1.13-2.99)	(0.020.163)	-	Algeria	Potorti *et al.*[14]

n = 6	-	< LOQ	< LOQ	0.317 ± 0.024	0.131± 0.007	0.417 ± 0.080	0.063 ± 0.009	-	Tunisia	Potorti *et al.*[15]
n = 15	-	0.147 ± 0.13	0.12 ± 0.01	-	-	-	7.94 ± 1.54	-	Pakistan	Akhtar *et al.*[6]
Black pepper										
n = NA	-	(0.02-0.17)	(nd-0.13)	(0.58-3.83)	-	(0.79-6.18)	(nd-0.3)	-	Turkey	Tokalioglu *et al.*[5]
n = 29	-	0.121 ± 0.125	0.039 ± 0.052	-	0.007 ± 0.004	-	0.083 ± 0.209	-	South Korea	Shim *et al.*[4]
n = 3	1770 ± 17	0.143 ± 0.004	0.06 ± 0.031	3.04 ± 0.29	-	0.271 ± 0.051	0.602 ± 0.143	-	Bangladesh	Rahman *et al.*[8]
Sesame										
n = 8	6.18 ± 7.76 (0.10-22)	0.03 ± 0.01 (0.018-0.047)	0.023 ± 0.005 (0.017-0.03)	0.04 ± 0.03 (0.01-0.09)	< 0.005- < 0.005	0.69 ± 0.25 (0.42-1.1)	0.02 ± 0.02 (0.005-0.05)	27.8 ± 36.7 (6.2-100)	India	This study
n = 13	32.5 ± 0.006	0.026 ± 0.001	0.021 ± 0.001	0.152 ± 0.001	0.003 ± 0.001	0.928 ± 0.013	0.015 ± 0.001	55.0 ± 0.49	India	Cicero *et al.*[12]
Turmeric										
n = 7	311 ± 144 (200-600)	0.08 ± 0.07 (0.019-0.22)	0.07 ± 0.07 (0.013-0.20)	0.73 ± 0.42 (0.32-1.4)	< 0.005-< 0.005	0.91 ± 0.52 (0.48-1.7)	0.17 ± 0.15 (0.052-0.41)	11.34 ± 1.68 (8.4-14)	India	This study
n = 1	180	0.037	0.033	0.65	< 0.005	0.57	0.9	14	Fiji	This study

n = 1	110	0.02	0.01	0.56	< 0.005	0.81	0.033	10	Malaysia	This study
n = 13	-	0.193	0.059	-	0.004	-	0.093	-	South Korea	Shim *et al.*[4]
	-	0.119	0.094	-	0.002	-	0.209	-		
n = 5	-	-	0.29 ± 0.004 (0.28-0.29)	-	0.84 ± 0.01 (0.82-0.85)	-	1.38 ± 0.02 (1.35-1.40)	-	Sri Lanka	Bua *et al.*[9]
n = 5	-	0.035 ± 0.001 (0.034-0.037)	0.033 ± 0.007 (0.033-0.035)	-	0.014 ± 0.007 (0.018-0.019)	-	0.171 ± 0.005 (0.164-0.179)	-	India	Bua *et al.*[9]
n = 6	-	0.95 ± 0.79	1.08 ± 0.85	-	-	-	5.54 ± 4.37	-	Malaysia	Nordin & Selamat[16]
n = 12	-	1.00 ± 0.04 (0.9-1.1)	0.15 ± 0.04 (0.08-0.22)	-	-	6.00 ± 0.123 (5.75-6.25)	2.00 ± 0.06 (1.88-2.12)	-	Pakistan	Baig *et al.*[7]
n = 15	-	0.025 ± 0.001	0.04 ± 0.000	1.8 ± 0.03	-	1.14 ± 0.01	0.121 ± 0.002	-	Pakistan	Khan *et al.*[11]
n = 15	-	0.57 ± 0.44	0.13 ± 0.01	-	-	-	9.28 ± 0.74	-	Pakistan	Akhtar *et al.*[6]

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