SUPPLEMENTAL INFORMATION

The Prevalence and Risk Factors Associated with Iodine Deficiency in Canadian Adults

Stellena Mathiaparanam,[1] Adriana Nori de Macedo,[1,2] Andrew Mente,[3] Paul Poirier,[4] Scott A. Lear,[5] Andreas Wielgosz,[6] Koon Teo,[3] Salim Yusuf,[3] Philip Britz-McKibbin[1]*

[1] *Department of Chemistry and Chemical Biology, McMaster University, Hamilton, ON, Canada*
[2] *Departamento de Química, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil*
[3] *Population Health Research Institute, McMaster University and Hamilton Health Sciences, Hamilton, Ontario, Canada*
[4] *Faculté de Pharmacie, Institut Universitaire de Cardiologie et de Pneumologie de Québec, Université Laval, Québec City, Québec, Canada*
[5] *Faculty of Health Sciences, Simon Fraser University, Burnaby and Division of Cardiology, Providence Health Care, Vancouver, British Columbia, Canada*
[6] *University of Ottawa Heart Institute, Ottawa, Ontario, Canada*

* Corresponding author: Philip Britz-McKibbin, britz@mcmaster.ca

Table S1-Table S6, Figure S1

Table S1. Characteristics of PURE-24USE participants categorized by study regions, including Hamilton, Vancouver, Quebec City and Ottawa.

Predictor Variable	Study Site				
	Hamilton (n=217)	**Vancouver (n=200)**	**Quebec City (n=200)**	**Ottawa (n=183)**	**Total (n=800)**
24 h iodine concentration (µg/L) – median ± IQR	122 ± 115	91 ± 84	95 ± 87	128 ± 106	111 ± 98
24 h daily iodine excretion (µg/day) – median ± IQR	272 ± 190	194 ±170	191 ±142	267 ± 242	226 ± 191
24 h thiocyanate concentration (µg/L) – median ± IQR[a]	658 ± 779	649 ± 656	846 ± 841	668 ± 904	680 ± 811
24 h daily thiocyanate excretion (mg/day) – median ± IQR[a]	1.3 ± 1.5	1.3 ± 1.0	1.7 ± 1.8	1.4 ± 1.9	1.4 ± 1.5
24 h nitrate concentration (mg/L) – median ± IQR	67 ± 57	79 ± 72	82 ± 58	67 ± 71	74 ± 64
24 h daily nitrate excretion (mg/day) – median ± IQR	133 ± 104	167 ± 154	164 ± 123	137 ± 132	150 ± 126
24 h sodium concentration (g/L) – median ± IQR	1.5 ± 1.1	1.3 ± 1.1	1.8 ± 1.2	1.3 ± 1.0	1.4 ± 1.1
24 h daily sodium excretion (g/day) – median ± IQR	3.0 ± 1.6	3.0 ± 1.7	3.7 ± 2.0	2.7 ± 1.4	3.1 ± 1.7
Age – years, – median ± IQR	62 ± 13	59 ± 12	59 ± 14	64 ± 13	61 ± 12
BMI (kg/m^2) – median ± IQR[b]	28 ± 7.0	26 ± 6.9	27 ± 6.4	27 ± 6.2	27 ± 6.7
Sex – female:male	113:104	103:97	96:104	100:83	412:388
24 h urine volume (L)	2.1 ± 1.2	2.2 ± 1.1	2.1 ± 1.2	2.3 ± 1.4	2.1 ± 1.2
Iodine supplement – no./total no. (%)	41/217 (19)	31/200 (16)	3/200 (2)	28/183 (15)	103/800 (13)
Thyroxine (T4) intake – no./total no. (%)	11/217 (5)	11/200 (6)	21/200 (11)	18/183 (10)	61/800 (8)
Hypertension/high blood pressure diagnosis – no./total no. (%)	52/217 (24)	35/200 (18)	36/200 (18)	44/183 (24)	167/800 (21)
Dairy intake (g/day) – median ± IQR[c]	345 ± 359	285 ± 330	379 ± 397	320 ± 321	329 ± 359
Starch intake (g/day) – median ± IQR[c]	299 ± 210	290 ± 193	299 ± 192	314 ± 237	299 ± 208
Sodium intake from ffq (mg) – median ± IQR[d]	2.8 ± 1.4	2.5 ± 1.3	3.0 ± 1.4	2.7 ± 1.2	2.7 ± 1.3
Current alcohol consumer – no./total no. (%)	176/217 (81)	152/200 (76)	170/200 (85)	155/183 (85)	653/800 (82)
Current smoker – no./total no. (%)	19/216 (9)	12/200 (6)	16/200 (8)	12/179 (7)	59/800 (7)
AHEI Score[e]	38 ± 11	42 ± 14	37 ± 12	41 ± 14	39 ± 13
Location – urban:rural	211:6	186:14	106:94	182:1	685:115

[a] *Hamilton: n=204, Vancouver: n=184, Quebec City: n=152, Ottawa: n=173, and total: n=713.*
[b] *Hamilton: n=204, Vancouver: n=198, Quebec City: n=195, Ottawa: n=179, and total: n=776.*
[c] *Hamilton: n=207, Vancouver: n=173, Quebec City: n=197, Ottawa: n=182, and total: n=759.*
[d] *Hamilton: n=213, Vancouver: n=174, Quebec City: n=199, Ottawa: n=181, and total: n=767.*
[e] *Hamilton: n=212, Vancouver: n=174, Quebec City: n=199, Ottawa: n=181, and total: n=766.*

Table S2. Summary of figures of merit of CE assay for the determination of urinary iodide, nitrate and thiocyanate from PURE-24USE study participants (n=800).

Figures of Merit	Iodide[a]	Nitrate[b]	Thiocyanate[c]
LOD (S/N = 3)	0.020 µmol/L	0.64 µmol/L	0.12 µmol/L
LOQ (S/N = 10)	0.070 µmol/L	2.12 µmol/L	0.40 µmol/L
Linearity (R^2)	0.996	0.999	0.997
Sensitivity (µmol/L) $^{-1}$	0.045	0.006	0.014
Reproducibility (CV)[d]	5.7%	7.7%	5.3%
Missing data/Non-detects[e]	2.0%	0%	11%

[a] *Calibration curve was normalized to NDS (20 µmol/L) over a 17-fold (6 calibrants) linear dynamic range, respectively. Calibrant concentrations were 0.15, 0.20, 0.50, 1.00, 1.80, 2.60 µmol/L.*

[b] *Calibration curve was normalized to NDS (20 µmol/L) over a 400-fold (6 calibrants) linear dynamic range, respectively. Calibrant concentrations were 0, 50, 100, 200, 300, 400 µmol/L.*

[c] *Calibration curve was normalized to NDS (20 µmol/L) over a 24-fold (6 calibrants) linear dynamic range, respectively. Calibrant concentrations were 0.5, 1.0, 2.0, 4.0, 8.0, 12.0 µmol/L.*

[d] *Reproducibility was assessed based on repeated analysis of a pooled urine samples from PURE as QC every batch of 10 runs.*

[e] *Missing data due to concentrations below method detection limit or matrix spectral interferences from PURE cohort (n=800).*

Table S3. Characteristics of PURE-24USE participants categorized by quintiles using 24 h UIE (μg/day).

Predictor Variable	Quintiles	
	Q1 (<133.5 μg/day; n=160)	**Q2-5 (≥133.5 μg/day; n=640)**
24 h daily iodine excretion (μg/day) – median ± IQR	97 ± 40	263 ± 184
24 h daily thiocyanate excretion (mg/day) – median ± IQR[a]	1.1 ± 1.0	1.5 ± 1.6
24 h daily nitrate excretion (mg/day) – median ± IQR	148 ± 139	151 ± 122
24 h daily sodium excretion (g/day) – median ± IQR	2.7 ± 1.5	3.2 ± 1.7
Age – years, – median ± IQR	60 ± 13	61 ± 13
BMI (kg/m^2) – median ± IQR[b]	26 ± 7	27 ± 6
Sex – female:male	88:72	324:316
24 h urine volume (L)	1.9 ± 1.3	2.2 ± 1.1
Iodine supplement – no./total no. (%)	**6/160 (4)**	**97/640 (15)**
Thyroxine (T4) intake – no./total no. (%)	**4/160 (3)**	**57/640 (9)**
Dairy intake (g/day) – median ± IQR[c]	**246 ± 303**	**352 ± 368**
Starch intake (g/day) – median ± IQR[c]	**286 ± 164**	**311 ± 217**
Study City:		
Hamilton – no./total no. (%)	**29/160 (18)**	**188/640 (29)**
Vancouver – no./total no. (%)	**59/160 (37)**	**141/640 (22)**
Quebec City – no./total no. (%)	**46/160 (29)**	**154/640 (24)**
Ottawa – no./total no. (%)	**26/160 (16)**	**157/640 (25)**
Sodium intake from FFQ (g)[d] – median ± IQR[d]	2.6 ± 1.2	2.8 ± 1.3
Current alcohol consumer – no./total no. (%)	136/160 (85)	517/640 (81)
Current smoker – no./total no. (%)	11/159 (7)	48/636 (8)
AHEI Score[e]	40 ± 14	39 ± 13
Location – urban:rural	138:22	547:93

[a] *Q1: n=135 and Q2-5: n=578.*
[b] *Q1: n=154 and Q2-5: n=622.*
[c] *Q1: n=150 and Q2-5: n=609.*
[d] *Q1: n=149 and Q2-5: n=618.*
[e] *Q1: n=149 and Q2-5: n=617.*

Table S4. Spearman rank correlation analysis of dietary variables associated with daily iodine excretion (µg/day) of PURE-24USE participants from the four different sites in Canada after excluding for iodine supplement and/or T4 use.

Dietary Intake	PURE Study Site								Total (224 µg/day; *n*=611)	
	Hamilton (257 µg/day; *n*=162)		Vancouver (189 µg/day; *n*=137)		Quebec City (191 µg/day; *n*=173)		Ottawa (260 µg/day; *n*=139)			
	r	***p*-value**	***r***	***p*-value**	***r***	***p*-value**	***r***	***p*-value**	***r***	***p*-value**
Dairy (g/day)	**0.39****	**2.15×10^{-7}**	0.15	7.30×10^{-2}	0.09	0.266	**0.34****	**4.33×10^{-5}**	**0.24****	**2.38×10^{-9}**
Bread and cereal (g/day)	**0.18***	**2.02×10^{-2}**	0.002	0.984	**0.15***	**5.31×10^{-2}**	0.05	0.586	**0.10***	**1.63×10^{-2}**
Processed food (g/day)	0.05	0.565	0.01	0.953	**0.22****	**4.22×10^{-3}**	0.04	0.669	**0.11****	**7.93×10^{-3}**
Red and proc. meat (g/day)	0.10	0.208	0.07	0.447	**0.16***	**3.97×10^{-2}**	0.01	0.902	0.06	0.151
Red meat only (g/day)	0.13	9.66×10^{-2}	0.08	0.338	0.14	6.05×10^{-2}	-0.01	0.946	0.06	0.171
Processed meat (g/day)	-0.07	0.378	-0.04	0.613	0.12	0.118	0.06	0.508	0.02	0.679
White meat only (g/day)	0.03	0.679	0.03	0.701	0.04	0.569	-0.03	0.746	0.02	0.607
Vegetable (g/day)	**0.16***	**4.88×10^{-2}**	-0.07	0.440	-0.01	0.910	0.04	0.686	0.01	0.802
Green leafy veg. (g/day)	0.12	0.125	-0.16	5.92×10^{-2}	-0.08	0.318	0.05	0.602	-0.004	0.923
Cruciferous veg. (g/day)	0.11	0.156	0.02	0.779	0.08	0.316	0.07	0.437	0.03	0.467
Dark leafy veg. (g/day)	0.07	0.376	-0.07	0.415	0.02	0.783	-0.02	0.853	-0.01	0.800
Egg (g/day)	0.05	0.568	-0.02	0.842	0.12	0.129	-0.08	0.345	0.05	0.239
Fruit (g/day)	0.04	0.605	-0.03	0.729	0.004	0.961	-0.09	0.270	-0.02	0.676
Fish (g/day)	-0.03	0.686	-0.06	0.454	0.02	0.812	0.02	0.796	-0.02	0.709
Salty food (g/day)[a]	-0.01	0.914	-0.14	0.107	0.10	0.183	-0.02	0.844	0.004	0.925

Participants taking iodine containing supplements and thyroxine (T4) were excluded from the analysis, where r denotes the Spearman rank correlation coefficient.

***Correlation is significant at the 0.01 level (2-tailed).*

** Correlation is significant at the 0.05 level (2-tailed).*

Table S5. Spearman rank correlation analysis of dietary variables associated with daily thiocyanate excretion (µg/day) of participants across four different sites in the PURE-24USE study after excluding for current smokers, including Hamilton, Vancouver, Quebec City and Ottawa.

Dietary Variable	**Study Site**									
	Hamilton (median=1251 µg/day; *n*=176)		**Vancouver (median=1272 µg/day; *n*=152)**		**Quebec City (median=1718 µg/day; *n*=136)**		**Ottawa (median=1281 µg/day; *n*=156)**		**Total (median=1354 µg/day; *n*=620)**	
	r	***p*-value**	***r***	***p*-value**	***r***	***p*-value**	***r***	***p*-value**	***r***	***p*-value**
Processed meat intake (g/day)	0.04	0.645	0.04	0.642	0.16	6.53×10^{-2}	0.12	0.136	**0.10***	**1.85×10^{-2}**
Red and processed meat intake (g/day)	0.04	0.613	0.09	0.280	-0.01	0.889	0.13	0.108	**0.09***	**2.03×10^{-2}**
Cruciferous vegetable intake (g/day)	0.11	0.147	0.13	0.103	0.01	0.917	0.05	0.541	**0.09***	**2.08×10^{-2}**
Egg intake (g/day)	0.13	8.18×10^{-2}	0.08	0.352	**0.18***	**3.86×10^{-2}**	0.05	0.512	**0.09***	**3.30×10^{-2}**
Starch (g/day)	0.03	0.743	0.05	0.582	-0.09	0.305	**0.16***	**4.47×10^{-2}**	0.050	0.232

Participants who self-reported as currently smoking were excluded from the analysis, where r denotes the Spearman rank correlation coefficient.

***Correlation is significant at the 0.01 level (2-tailed).*

** Correlation is significant at the 0.05 level (2-tailed).*

Significant p-values at the 0.01 and 0.05 levels are bolded.

Table S6. Spearman rank correlation analysis of dietary variables associated with daily nitrate excretion (mg/day) of participants across from four different sites in the PURE-24USE study, including Hamilton, Vancouver, Quebec City and Ottawa.

Dietary Variable	Study Site								Total (median=147 mg/day; *n*=759)	
	Hamilton (median=133 mg/day; *n*=207)		Vancouver (median=157 mg/day; *n*=173)		Quebec City (median=162 mg/day; *n*=197)		Ottawa (median=137 mg/day; *n*=182)			
	r	***p*-value**	***r***	***p*-value**	***r***	***p*-value**	***r***	***p*-value**	***r***	***p*-value**
Vegetable intake (g/day)	**0.27****	**1.14×10^{-4}**	0.09	0.217	0.14	5.90×10^{-2}	0.10	0.163	**0.17****	**2.46×10^{-6}**
Green leafy vegetable intake (g/day)	**0.25****	**3.42×10^{-4}**	0.10	0.173	**0.14***	**4.86×10^{-2}**	0.11	0.126	**0.15****	**2.90×10^{-5}**
Other vegetable intake (g/day)	**0.16***	**2.25×10^{-2}**	0.07	0.359	0.12	9.69×10^{-2}	0.03	0.675	**0.11****	**2.77×10^{-3}**
Cruciferous vegetable intake (g/day)	**0.19****	**6.68×10^{-3}**	-0.06	0.399	0.01	0.866	0.06	0.393	**0.07***	**4.99×10^{-2}**
Fruit intake (g/day)	0.13	6.49×10^{-2}	-0.04	0.646	**0.19****	**7.50×10^{-3}**	0.01	0.891	**0.07***	**4.20×10^{-2}**
Processed meat intake (g/day)	**-0.18****	**9.37×10^{-3}**	-0.09	0.228	**0.21****	**3.70×10^{-3}**	-0.003	0.963	-0.02	0.600
Processed food intake (g/day)	**-0.17***	**1.76×10^{-2}**	-0.02	0.812	0.04	0.540	-0.07	0.355	**-0.08***	**3.97×10^{-2}**
Dark yellow vegetable intake (g/day)	**0.16***	**1.83×10^{-2}**	0.03	0.734	0.02	0.811	-0.06	0.417	0.06	0.105
Starch intake (g/day)	0.08	0.266	-0.10	0.191	0.04	0.603	**0.19****	**8.94×10^{-3}**	0.05	0.148

r denotes the Spearman rank correlation coefficient.

***Correlation is significant at the 0.01 level (2-tailed).*

** Correlation is significant at the 0.05 level (2-tailed).*

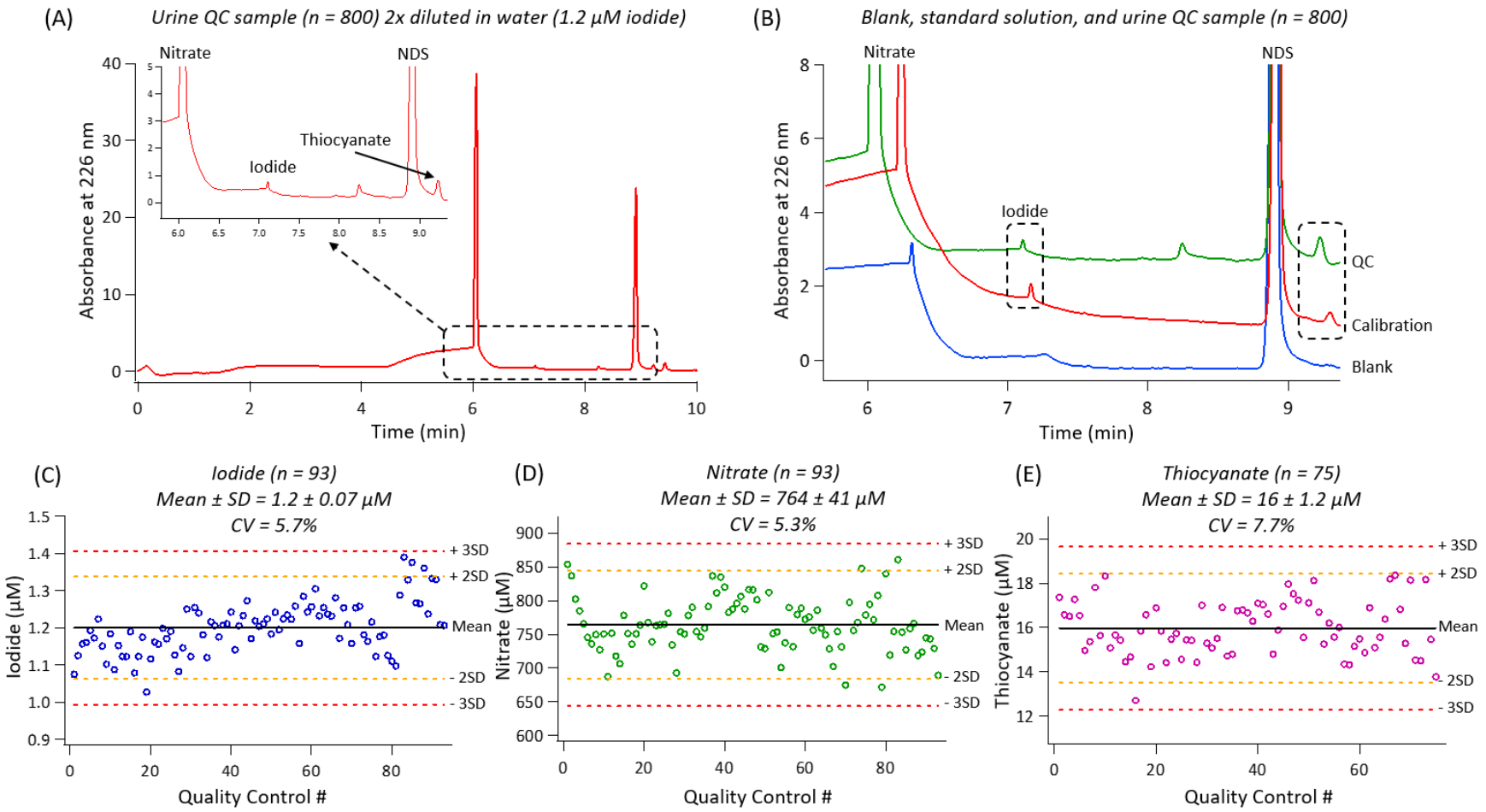

Figure S1. Representative electropherogram overlay of (A) a pooled quality control (*n*=800) and a comparison between a (B) quality control sample, calibrant solution, and blank solution. Also, control charts highlight reliable quantification of (C) iodide, (D) nitrate and (E) thiocyanate in 24 h urine samples with acceptable reproducibility (CV < 8%).