SUPPLEMENTAL MATERIAL

Glutamic Acid – the Main Dietary Amino Acid – and Blood Pressure: The INTERMAP Study

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Table S.1. Descriptive Statistics by Country and for All 4,680 INTERMAP participants

Variable	Japan (N=1,145)		P.R. China (N=839)		UK (N=501)		USA (N=2,195)		All (N=4,680)	
	Mean	(s.d.)	Mean	(s.d.)	Mean	(s.d.)	Mean	(s.d.)	Mean	(s.d.)
Age (years)	49.4	(5.3)	49.0	(5.8)	49.1	(5.6)	49.1	(5.4)	49.2	(5.5)
Systolic BP (mm Hg)	117	(14)	121	(17)	120	(15)	119	(14)	119	(15)
Diastolic BP (mm Hg)	74	(10)	73	(10)	77	(10)	73	(10)	74	(10)
Glutamic Acid, g/day	14.2	(3.2)	15.0	(5.1)	16.8	(4.9)	16.5	(5.3)	15.7	(4.9)
Cystine, g/day	1.26	(0.28)	1.33	(0.38)	1.15	(0.34)	1.14	(0.37)	1.20	(0.36)
Proline, g/day	4.50	(1.07)	3.93	(1.89)	5.69	(1.69)	5.45	(1.83)	4.97	(1.79)
Phenylalanine, g/day	3.57	(0.83)	3.07	(0.95)	3.68	(1.09)	3.69	(1.22)	3.55	(1.10)
Serine, g/day	3.54	(0.83)	2.99	(0.93)	3.76	(1.11)	3.80	(1.26)	3.59	(1.14)
Glutamic Acid, % kJ	2.81	(0.36)	2.94	(0.48)	3.19	(0.54)	3.02	(0.56)	2.97	(0.51)
Cystine, % kJ	0.25	(0.03)	0.26	(0.04)	0.22	(0.04)	0.21	(0.04)	0.23	(0.04)
Proline, % kJ	0.89	(0.14)	0.76	(0.27)	1.08	(0.19)	0.99	(0.20)	0.94	(0.22)
Phenylalanine, % kJ	0.71	(0.09)	0.61	(0.10)	0.70	(0.13)	0.67	(0.13)	0.67	(0.12)
Serine, % kJ	0.70	(0.10)	0.59	(0.10)	0.71	(0.13)	0.69	(0.14)	0.68	(0.13)

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Glutamic Acid, % total protein	17.8	(1.4)	24.1	(4.4)	20.5	(1.6)	19.8	(1.7)	20.1	(3.1)
Cystine, % total protein	1.59	(0.12)	2.16	(0.21)	1.39	(0.11)	1.35	(0.10)	1.56	(0.33)
Proline, % total protein	5.67	(0.77)	6.32	(2.47)	6.93	(0.75)	6.53	(0.82)	6.32	(1.33)
Phenylalanine, % total protein	4.45	(0.17)	4.90	(0.20)	4.43	(0.16)	4.36	(0.17)	4.48	(0.26)
Serine, % total protein	4.41	(0.18)	4.76	(0.24)	4.54	(0.23)	4.49	(0.24)	4.52	(0.25)
Energy, kJ/day	8530	(1879)	8518	(2413)	9070	(2644)	9390	(2923)	8989	(2613)
Total Protein, g/day	80.7	(19.9)	63.0	(19.7)	83.5	(25.1)	84.9	(28.4)	79.8	(26.0)
Animal Protein, g/day	45.1	(16.0)	12.8	(13.2)	51.4	(20.7)	55.9	(23.6)	45.1	(25.4)
Vegetable Protein, g/day	35.6	(8.4)	50.2	(15.6)	32.1	(10.7)	28.0	(10.8)	34.3	(13.9)
Total Fat, g/day	56.8	(16.6)	45.9	(20.4)	81.0	(31.7)	84.4	(33.9)	70.4	(32.3)
Total SFA, g/day	15.0	(5.1)	11.5	(5.9)	29.4	(13.6)	28.0	(12.5)	22.1	(12.7)
Total MFA, g/day	20.6	(6.7)	18.5	(8.6)	27.3	(11.0)	31.9	(13.5)	26.2	(12.5)
Oleic Acid, g/day	18.3	(6.2)	15.4	(8.2)	24.8	(10.0)	29.8	(12.6)	23.8	(12.0)
Total PFA, g/day	14.6	(4.6)	13.5	(7.0)	15.2	(6.9)	17.9	(8.1)	16.0	(7.3)
Linoleic Acid, g/day	11.3	(3.9)	12.2	(6.6)	13.3	(6.3)	15.8	(7.3)	13.8	(6.7)
Total Omega-3, g/day	3.06	(1.12)	1.24	(0.92)	1.76	(0.80)	1.87	(0.93)	2.04	(1.15)

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Total Omega-6, g/day	11.5	(3.9)	12.2	(6.7)	13.5	(6.3)	16.0	(7.3)	13.9	(6.7)
Total TFA, g/day	0.99	(0.67)	0.42	(0.80)	3.34	(1.93)	5.03	(2.83)	3.03	(2.92)
Total Carbohydrate, g/day	273	(64)	327	(99)	253	(77)	274	(92)	281	(88)
Starch, g/day	179	(54)	283	(90)	145	(49)	125	(45)	169	(82)
Estimated Total Sugars, g/day	93	(27)	44	(31)	108	(43)	149	(66)	112	(64)
Total Dietary Fiber, g/day	15.6	(4.8)	28.1	(9.5)	25.5	(9.2)	19.1	(7.9)	20.6	(8.9)
Calcium, mg/day	606	(221)	303	(143)	933	(319)	791	(372)	674	(362)
Magnesium, mg/day	269	(66)	308	(115)	320	(94)	319	(112)	305	(103)
Phosphorus, mg/day	1134	(282)	879	(307)	1392	(410)	1295	(441)	1192	(416)
Total Iron, mg/day	10.7	(2.8)	15.8	(5.7)	13.1	(4.2)	16.9	(7.1)	14.8	(6.3)
Non-Heme Iron, mg/day	9.6	(2.6)	15.3	(5.4)	12.3	(4.1)	15.8	(6.9)	13.8	(6.1)
Copper, mg/day	1.36	(0.41)	2.37	(0.72)	1.37	(0.45)	1.46	(0.57)	1.59	(0.67)
Selenium, µg/day	171	(75)	34	(14)	95	(38)	132	(65)	120	(75)
14-day Alcohol, g/day	17.0	(22.6)	8.6	(21.4)	14.7	(19.2)	6.9	(13.7)	10.5	(18.8)
Total Protein, % kJ	16.0	(2.3)	12.4	(1.9)	15.8	(3.1)	15.5	(3.2)	15.1	(3.1)
Animal Protein, % kJ	8.9	(2.4)	2.5	(2.4)	9.8	(3.3)	10.2	(3.2)	8.4	(4.1)

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Vegetable Protein, % kJ	7.1	(1.1)	9.9	(1.3)	6.1	(1.4)	5.2	(1.6)	6.6	(2.2)
Total Fat, % kJ	24.9	(5.0)	20.0	(6.1)	32.8	(6.5)	32.9	(6.9)	28.6	(8.2)
Total SFA, % kJ	6.6	(1.8)	5.0	(2.0)	12.1	(3.3)	10.7	(2.8)	8.8	(3.6)
Total MFA, % kJ	9.0	(2.2)	8.1	(2.8)	11.0	(2.5)	12.2	(2.9)	10.5	(3.2)
Oleic Acid, % kJ	8.0	(2.0)	6.7	(2.8)	10.0	(2.3)	11.6	(2.8)	9.6	(3.2)
Total PFA, % kJ	6.4	(1.5)	5.8	(2.2)	6.2	(1.9)	7.0	(2.2)	6.5	(2.1)
Linoleic Acid, % kJ	4.9	(1.3)	5.3	(2.1)	5.4	(1.8)	6.2	(2.0)	5.7	(2.0)
Total Omega-3, % kJ	1.35	(0.38)	0.55	(0.37)	0.73	(0.26)	0.75	(0.31)	0.86	(0.44)
Total Omega-6, % kJ	5.0	(1.3)	5.3	(2.1)	5.5	(1.8)	6.3	(2.0)	5.7	(2.0)
Total TFA, % kJ	0.44	(0.30)	0.18	(0.34)	1.36	(0.61)	1.94	(0.80)	1.20	(0.98)
Total Carbohydrate, % kJ	54.2	(7.3)	65.0	(10.0)	44.5	(6.6)	49.4	(8.1)	52.9	(10.3)
Starch, % kJ	35.5	(7.3)	56.5	(10.3)	25.5	(5.2)	22.8	(5.7)	32.2	(14.3)
Estimated Total Sugars, % kJ	18.7	(4.7)	8.5	(5.2)	20.3	(6.0)	16.7	(8.2)	20.8	(9.5)
Total Dietary Fiber, g/1,000 kJ	1.9	(0.5)	3.4	(0.9)	2.9	(0.9)	2.2	(0.8)	2.4	(1.0)
Calcium, mg/1,000 kJ	73.0	(26.0)	35.7	(13.4)	106.5	(28.4)	86.8	(33.9)	76.3	(35.6)
Magnesium, mg/1,000 kJ	32.1	(6.0)	37.0	(11.1)	36.6	(8.4)	35.4	(9.6)	35.0	(9.2)

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Phosphorus, mg/1,000 kJ	135	(23)	105	(27)	158	(30)	141	(30)	135	(32)
Total Iron, mg/1,000 kJ	1.3	(0.3)	1.9	(0.4)	1.5	(0.4)	1.9	(0.6)	1.7	(0.6)
Non-Heme Iron, mg/1,000 kJ	1.1	(0.3)	1.8	(0.4)	1.4	(0.4)	1.7	(0.6)	1.6	(0.5)
Copper, mg/1,000 kJ	0.16	(0.04)	0.28	(0.04)	0.16	(0.04)	0.16	(0.05)	0.18	(0.06)
Selenium, µg/1,000 kJ	20.2	(7.8)	4.0	(1.0)	10.7	(3.4)	14.3	(6.0)	13.5	(7.8)
Urinary Sodium, mmol/24-hr	198	(56)	228	(100)	145	(49)	163	(59)	181	(72)
Urinary Potassium, mmol/24-hr	49	(14)	38	(13)	68	(20)	58	(21)	53	(20)
Urinary Sodium/Potassium Ratio	4.23	(1.24)	6.32	(2.83)	2.23	(0.80)	3.04	(1.20)	3.83	2.07
Height, m	1.61	(0.09)	1.59	(0.08)	1.69	(0.09)	1.68	(0.10)	1.65	(0.10)
Weight, kg	61.2	(10.2)	58.9	(10.0)	78.2	(15.3)	82.3	(19.6)	72.5	(19.0)
Body Mass Index, kg/m^2	23.4	(2.9)	23.1	(3.4)	27.5	(4.6)	28.9	(5.9)	26.4	(5.5)
Physical Activity, hours/day										
moderate + heavy activity	2.5	(3.6)	6.0	(3.8)	2.2	(2.4)	3.2	(3.1)	3.4	(3.5)

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	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Family history of hypertension in any first degree relative										
-Yes	528	(46.1)	298	(35.5)	242	(48.3)	1,491	(67.9)	2,559	(54.7)
-Unknown	406	(35.5)	188	(22.4)	188	(37.5)	489	(22.3)	1,271	(27.2)
Current alcohol drinkers	1,039	(90.7)	382	(45.5)	444	(88.6)	1,533	(69.8)	3,398	(72.6)
Special diet: weight loss, weight gain, vegetarian, salt reduced, diabetic, fat modified, or other	76	(6.6)	45	(5.4)	106	(21.2)	401	(18.3)	628	(13.4)
Taking dietary supplement	243	(21.2)	34	(4.1)	191	(38.1)	1,136	(51.8)	1,604	(34.3)
High blood pressure*	153	(13.4)	145	(17.3)	116	(23.2)	595	(27.1)	1,009	(21.6)
History of heart attack, other heart disease, stroke, or diabetes	131	(11.4)	59	(7.0)	54	(10.8)	343	(15.6)	587	(12.5)
Taking prescribed drug treatment for high BP, CVD†, diabetes, or affecting cardiovascular system	124	(10.8)	86	(10.3)	98	(19.6)	644	(29.3)	952	(20.3)

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Table S.1. continued, page 7

BP: blood pressure; SFA: saturated fatty acids; MFA: monounsaturated fatty acids; PFA: polyunsaturated fatty acids; TFA: trans fatty acids; CVD: cardiovascular diseases.

*Systolic BP ≥140 mm Hg or diastolic BP ≥90 mm Hg or reporting use of medication for high BP

†Includes lipid-lowering drugs

Table S.2. Reliability and its Potential Effect on Regression Coefficients[†] for Dietary Amino Acids and Blood Pressure, for Participants of the INTERMAP Study, Men and Women Combined and Separately

Variable (units)		Japan		PR China		UK		USA		Overall	
		Ratio*	(%)[†]	Ratio	(%)	Ratio	(%)	Ratio	(%)	Ratio	(%)
					Men and women combined (N=4,680)						
Glutamic Acid	(g/day)	1.97	(67.0)	1.41	(73.9)	2.00	(66.7)	1.97	(67.0)	1.87	(68.1)
	(% kJ)	3.28	(55.0)	2.13	(65.2)	2.23	(64.2)	2.50	(61.5)	2.59	(60.7)
	(% Protein)	2.90	(58.0)	0.56	(87.7)	3.53	(53.1)	3.01	(57.1)	2.60	(60.6)
Cystine	(g/day)	1.80	(69.0)	1.57	(71.8)	2.28	(63.7)	2.20	(64.5)	2.00	(66.7)
	(% kJ)	3.61	(52.6)	1.45	(73.4)	2.20	(64.6)	2.62	(60.4)	2.61	(60.5)
	(% Protein)	2.61	(60.6)	2.09	(65.6)	2.85	(58.4)	3.97	(50.2)	3.18	(55.7)
Proline	(g/day)	2.04	(66.3)	0.76	(84.0)	1.82	(68.8)	1.82	(68.8)	1.68	(70.4)
	(% kJ)	2.53	(61.3)	0.59	(87.2)	2.06	(66.0)	2.32	(63.3)	2.03	(66.3)
	(% Protein)	2.63	(60.3)	0.25	(94.1)	3.11	(56.2)	2.47	(61.8)	2.18	(64.7)
Phenylalanine	(g/day)	1.86	(68.3)	1.97	(67.0)	2.15	(65.0)	2.12	(65.3)	2.03	(66.3)
	(% kJ)	3.07	(56.6)	1.95	(67.3)	2.35	(63.0)	2.69	(59.8)	2.61	(60.5)
	(% Protein)	2.33	(63.2)	1.91	(67.7)	2.53	(61.3)	2.71	(59.6)	2.46	(61.9)

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Table S.2. continued, page 2

Serine	(g/day)	1.88	(68.0)	1.82	(68.8)	2.05	(66.1)	2.09	(65.7)	1.99	(66.8)
	(% kJ)	3.16	(55.9)	1.72	(69.9)	2.29	(63.5)	2.57	(60.9)	2.53	(61.2)
	(% Protein)	3.52	(53.2)	2.01	(66.5)	3.33	(54.5)	3.88	(50.8)	3.40	(54.1)
Systolic BP	(mm Hg)	0.22	(94.9)	0.23	(94.5)	0.24	(94.4)	0.26	(94.0)	0.24	(94.3)
Diastolic BP	(mm Hg)	0.27	(93.7)	0.32	(92.6)	0.31	(92.8)	0.31	(92.9)	0.30	(93.0)
					Men (N=2,359)						
Glutamic Acid	(g/day)	1.56	(71.9)	1.50	(72.7)	1.91	(67.7)	1.81	(68.8)	1.56	(71.9)
	(% kJ)	1.85	(68.3)	2.18	(64.7)	2.30	(63.5)	2.32	(63.3)	1.85	(68.3)
	(% Protein)	0.48	(89.4)	2.52	(61.4)	2.72	(59.5)	2.40	(62.5)	0.48	(89.4)
Cystine	(g/day)	1.78	(69.1)	1.66	(70.7)	2.18	(64.7)	1.96	(67.1)	1.78	(69.1)
	(% kJ)	1.30	(75.4)	2.03	(66.3)	2.43	(62.2)	2.35	(63.0)	1.30	(75.4)
	(% Protein)	1.93	(67.5)	2.11	(65.5)	3.82	(51.2)	2.91	(57.9)	1.93	(67.5)
Proline	(g/day)	0.82	(83.0)	1.37	(74.5)	1.75	(69.6)	1.62	(71.2)	0.82	(83.0)
	(% kJ)	0.56	(87.7)	1.94	(67.4)	2.06	(66.0)	1.80	(68.9)	0.56	(87.7)
	(% Protein)	0.24	(94.3)	2.52	(61.3)	2.30	(63.5)	2.10	(65.5)	0.24	(94.3)

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Phenylalanine	(g/day)	2.31	(63.4)	1.60	(71.5)	2.06	(66.1)	2.01	(66.5)	2.31	(63.4)
	(% kJ)	1.88	(68.0)	2.22	(64.3)	2.44	(62.1)	2.44	(62.1)	1.88	(68.0)
	(% Protein)	1.89	(67.9)	2.37	(62.8)	2.51	(61.5)	2.22	(64.3)	1.89	(67.9)
Serine	(g/day)	2.10	(65.6)	1.53	(72.3)	2.09	(65.7)	1.99	(66.8)	2.10	(65.6)
	(% kJ)	1.59	(71.5)	2.23	(64.2)	2.38	(62.7)	2.39	(62.6)	1.59	(71.5)
	(% Protein)	1.75	(69.6)	2.73	(59.4)	3.44	(53.7)	2.88	(58.2)	1.75	(69.6)
Systolic BP	(mm Hg)	0.23	(94.6)	0.21	(94.9)	0.22	(94.9)	0.29	(93.3)	0.25	(94.1)
Diastolic BP	(mm Hg)	0.27	(93.7)	0.30	(93.1)	0.33	(92.4)	0.31	(92.9)	0.30	(93.1)
					Women (N=2,321)						
Glutamic Acid	(g/day)	2.00	(66.7)	1.26	(76.0)	2.56	(61.0)	2.03	(66.3)	1.93	(67.4)
	(% kJ)	3.80	(51.3)	2.40	(62.5)	2.28	(63.7)	2.70	(59.7)	2.87	(58.2)
	(% Protein)	2.67	(60.0)	0.64	(86.2)	4.67	(46.1)	3.30	(54.8)	2.80	(58.8)
Cystine	(g/day)	1.81	(68.9)	1.36	(74.6)	2.99	(57.2)	2.22	(64.3)	2.04	(66.2)
	(% kJ)	4.12	(49.2)	1.60	(71.5)	2.38	(62.7)	2.81	(58.8)	2.87	(58.2)
	(% Protein)	2.97	(57.4)	2.26	(63.9)	3.68	(52.1)	4.11	(49.3)	3.45	(53.7)

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Table S.2. continued, page 4

Proline	(g/day)	2.00	(66.7)	0.70	(85.0)	2.33	(63.2)	1.89	(68.0)	1.74	(69.6)
	(% kJ)	2.91	(57.9)	0.61	(86.8)	2.21	(64.4)	2.59	(60.7)	2.27	(63.8)
	(% Protein)	2.39	(62.6)	0.27	(93.8)	3.78	(51.4)	2.63	(60.3)	2.26	(63.9)
Phenylalanine	(g/day)	1.82	(68.8)	1.64	(71.0)	2.78	(59.0)	2.19	(64.6)	2.06	(66.0)
	(% kJ)	3.19	(55.6)	2.01	(66.6)	2.49	(61.6)	2.94	(57.6)	2.79	(58.9)
	(% Protein)	2.84	(58.5)	1.93	(67.4)	2.71	(59.6)	2.92	(57.8)	2.70	(59.7)
Serine	(g/day)	1.84	(68.5)	1.54	(72.2)	2.64	(60.3)	2.09	(65.7)	1.98	(66.8)
	(% kJ)	3.26	(55.1)	1.86	(68.3)	2.37	(62.8)	2.76	(59.2)	2.68	(59.9)
	(% Protein)	4.38	(47.7)	2.28	(63.7)	4.01	(49.9)	4.32	(48.1)	3.93	(50.4)
Systolic BP	(mm Hg)	0.20	(95.2)	0.26	(94.0)	0.26	(93.9)	0.23	(94.6)	0.23	(94.6)
Diastolic BP	(mm Hg)	0.26	(93.8)	0.34	(92.2)	0.29	(93.2)	0.30	(92.9)	0.30	(93.0)

* Ratio of intra-individual to inter-individual variance estimated separately for 8 country-gender subgroups and pooled by N-1, to prevent between-country and -gender differences from inflating between-person variance and spuriously reducing the ratio

† Observed regression coefficient as a percentage of a theoretical regression coefficient in univariate regression analysis, based on 4 repeat measures (for BP, 4× mean of 2 consecutive readings), calculated from the formula 1/[1+(reliability ratio/4)]×100

Table S.3. Partial correlation* of dietary amino acids (grams/day) and other variables

Variable	Glutamic Acid, g/day	Cystine, g/day	Proline, g/day	Phenylalanine, g/day	Serine, g/day
Glutamic Acid, g/day	1	0.84	0.90	0.88	0.87
Cystine, g/day	0.84	1	0.65	0.88	0.87
Proline, g/day	0.90	0.65	1	0.74	0.74
Phenylalanine, g/day	0.88	0.88	0.74	1	0.98
Serine, g/day	0.87	0.87	0.74	0.98	1
Total Protein, g/day	0.86	0.86	0.71	0.97	0.96
Animal Protein, g/day	0.62	0.63	0.54	0.80	0.80
Vegetable Protein, g/day	0.33	0.32	0.23	0.19	0.16
Total Fat, g/day	0.04	0.03	0.04	0.11	0.13
Total SFA, g/day	0.06	-0.02	0.12	0.10	0.12
Total MFA, g/day	0.01	0.03	-0.01	0.08	0.10
Oleic Acid, g/day	-0.01	0.01	-0.02	0.06	0.08
Total PFA, g/day	0.002	0.02	-0.04	0.04	0.03
Linoleic Acid, g/day	-0.02	-0.01	-0.05	-0.004	-0.01

continued on next page

Table S.3. continued, page 2

Total Omega-3, g/day	0.08	0.10	0.01	0.14	0.14
Total Omega-6, g/day	-0.02	-0.001	-0.05	0.004	-0.001
Total TFA, g/day	-0.05	-0.08	0.001	-0.09	-0.09
Total Carbohydrate, g/day	-0.18	-0.16	-0.16	-0.31	-0.31
Starch, g/day	0.12	0.19	0.05	-0.02	-0.04
Estimated Total Sugars, g/day	-0.31	-0.37	-0.20	-0.31	-0.29
Total Dietary Fiber, g/day	0.14	0.16	0.12	0.11	0.10
Calcium, mg/day	0.40	0.17	0.52	0.39	0.42
Magnesium, mg/day	0.32	0.34	0.28	0.38	0.36
Phosphorus, mg/day	0.60	0.56	0.60	0.70	0.71
Total Iron, mg/day	0.36	0.35	0.31	0.38	0.37
Non-Heme Iron, mg/day	0.32	0.31	0.28	0.32	0.31
Copper, mg/day	0.21	0.28	0.12	0.23	0.22
Selenium, µg/day	0.38	0.40	0.29	0.40	0.42
14-day Alcohol, g/day	-0.13	-0.17	-0.10	-0.08	-0.09

continued on next page

Table S.3. continued, page 3

Urinary Sodium, mmol/24-hr	0.17	0.17	0.14	0.16	0.16
Urinary Potassium, mmol/24-hr	0.22	0.15	0.24	0.22	0.22
Urinary Sodium/Potassium Ratio	-0.03	0.02	-0.07	-0.05	-0.04
Height, m	0.02	0.02	0.04	0.02	0.02
Weight, kg	0.09	0.11	0.07	0.12	0.11
Body Mass Index, kg/m^2	0.08	0.10	0.06	0.11	0.11
Systolic BP, mm Hg	-0.02	0.003	-0.02	-0.001	0.001
Diastolic BP, mm Hg	-0.03	-0.02	-0.02	-0.01	-0.01

SFA: saturated fatty acids; MFA: monounsaturated fatty acids; PFA: polyunsaturated fatty acids; TFA: trans fatty acids; BP: blood pressure.

* Pooled by country (weighted by N), adjusted for age, gender, center, energy

Table S.4. Partial correlation* of dietary amino acids (% kJ) and other variables

Variable	Glutamic Acid, % kJ	Cystine, % kJ	Proline, % kJ	Phenylalanine, % kJ	Serine, % kJ
Glutamic Acid, % kJ	1	0.84	0.89	0.89	0.88
Cystine, % kJ	0.84	1	0.65	0.88	0.88
Proline, % kJ	0.89	0.65	1	0.75	0.75
Phenylalanine, % kJ	0.89	0.88	0.75	1	0.98
Serine, % kJ	0.88	0.88	0.75	0.98	1
Total Protein, % kJ	0.87	0.86	0.73	0.97	0.96
Animal Protein, % kJ	0.65	0.64	0.57	0.81	0.81
Vegetable Protein, % kJ	0.35	0.35	0.24	0.23	0.20
Total Fat, % kJ	0.01	-0.01	0.02	0.06	0.08
Total SFA, % kJ	0.02	-0.07	0.10	0.05	0.07
Total MFA, % kJ	-0.03	-0.02	-0.03	0.02	0.04
Oleic Acid, % kJ	-0.04	-0.03	-0.03	0.01	0.03
Total PFA, % kJ	-0.02	-0.01	-0.06	0.01	0.001
Linoleic Acid, % kJ	-0.04	-0.03	-0.07	-0.03	-0.03

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Table S.4. continued, page 2

Total Omega-3, % kJ	0.07	0.10	-0.01	0.14	0.14
Total Omega-6, % kJ	-0.04	-0.02	-0.06	-0.02	-0.03
Total TFA, % kJ	-0.08	-0.12	-0.03	-0.13	-0.12
Total Carbohydrate, % kJ	-0.19	-0.15	-0.17	-0.28	-0.29
Starch, % kJ	0.12	0.21	0.04	0.002	-0.02
Estimated Total Sugars, % kJ	-0.30	-0.38	-0.19	-0.31	-0.28
Total Dietary Fiber, g/1,000 kJ	0.17	0.19	0.16	0.16	0.14
Calcium, mg/1,000 kJ	0.39	0.17	0.53	0.38	0.41
Magnesium, mg/1,000 kJ	0.35	0.36	0.32	0.40	0.38
Phosphorus, mg/1,000 kJ	0.62	0.57	0.62	0.71	0.72
Total Iron, mg/1,000 kJ	0.37	0.35	0.33	0.39	0.38
Non-Heme Iron, mg/1,000 kJ	0.33	0.31	0.31	0.33	0.32
Copper, mg/1,000 kJ	0.24	0.30	0.16	0.26	0.25
Selenium, µg/1,000 kJ	0.40	0.42	0.31	0.43	0.44
14-day Alcohol, g/day	-0.14	-0.18	-0.10	-0.11	-0.11

continued on next page

Table S.4. continued, page 3

Urinary Sodium, mmol/24-hr	0.10	0.11	0.08	0.10	0.10
Urinary Potassium, mmol/24-hr	0.18	0.10	0.21	0.18	0.18
Urinary Sodium/Potassium Ratio	-0.05	0.01	-0.09	-0.06	-0.06
Height, m	-0.01	-0.01	0.01	-0.001	0.003
Weight, kg	0.06	0.07	0.05	0.09	0.08
Body Mass Index, kg/m^2	0.06	0.08	0.05	0.09	0.09
Systolic BP, mm Hg	-0.03	-0.01	-0.03	-0.01	-0.01
Diastolic BP, mm Hg	-0.03	-0.03	-0.03	-0.02	-0.02

SFA: saturated fatty acids; MFA: monounsaturated fatty acids; PFA: polyunsaturated fatty acids; TFA: trans fatty acids; BP: blood pressure.

* Pooled by country (weighted by N), adjusted for age, gender, center

Table S.5. Partial correlation* of dietary amino acids (% Total Protein) and other variables

Variable	Glutamic Acid, % Total Protein	Cystine, % Total Protein	Proline, % Total Protein	Phenylalanine, % Total Protein	Serine, % Total Protein
Glutamic Acid, % Total Protein	1	0.45	0.80	0.47	0.37
Cystine, % Total Protein	0.45	1	0.16	0.43	0.39
Proline, % Total Protein	0.80	0.16	1	0.39	0.36
Phenylalanine, % Total Protein	0.47	0.43	0.39	1	0.80
Serine, % Total Protein	0.37	0.39	0.36	0.80	1
Total Protein, % kJ	-0.37	-0.41	-0.30	-0.28	-0.23
Animal Protein, % kJ	-0.53	-0.54	-0.35	-0.42	-0.30
Vegetable Protein, % kJ	0.36	0.35	0.14	0.34	0.18
Total Fat, % kJ	-0.08	-0.11	-0.04	0.02	0.08
Total SFA, % kJ	-0.02	-0.20	0.11	0.05	0.13
Total MFA, % kJ	-0.09	-0.06	-0.08	-0.02	0.06
Oleic Acid, % kJ	-0.08	-0.04	-0.06	-0.01	0.06
Total PFA, % kJ	-0.02	0.03	-0.07	0.05	0.03
Linoleic Acid, % kJ	0.03	0.07	-0.03	0.08	0.05

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Table S.5. continued, page 2

Total Omega-3, % kJ	-0.16	-0.12	-0.20	-0.07	-0.07
Total Omega-6, % kJ	0.02	0.07	-0.04	0.08	0.05
Total TFA, % kJ	0.14	0.08	0.15	0.07	0.08
Total Carbohydrate, % kJ	0.33	0.37	0.21	0.27	0.20
Starch, % kJ	0.39	0.55	0.15	0.37	0.21
Estimated Total Sugars, % kJ	0.001	-0.14	0.11	-0.08	0.01
Total Dietary Fiber, g/1,000 kJ	0.06	0.09	0.03	0.11	0.03
Calcium, mg/1,000 kJ	0.09	-0.35	0.31	0.23	0.27
Magnesium, mg/1,000 kJ	-0.10	-0.12	-0.07	0.04	-0.04
Phosphorus, mg/1,000 kJ	-0.18	-0.32	-0.03	0.07	0.10
Total Iron, mg/1,000 kJ	-0.01	-0.05	-0.01	0.02	-0.01
Non-Heme Iron, mg/1,000 kJ	0.05	0.004	0.04	0.09	0.05
Copper, mg/1,000 kJ	-0.05	0.04	-0.13	0.02	-0.02
Selenium, µg/1,000 kJ	-0.10	-0.05	-0.12	-0.15	-0.05
14-day Alcohol, g/day	-0.17	-0.21	-0.08	-0.23	-0.22

continued on next page

Table S.5. continued, page 3

Urinary Sodium, mmol/24-hr	-0.04	-0.02	-0.05	-0.04	-0.03
Urinary Potassium, mmol/24-hr	-0.06	-0.21	0.01	-0.05	-0.04
Urinary Sodium/Potassium Ratio	0.01	0.16	-0.05	0.01	0.01
Height, m	-0.01	-0.02	0.02	0.01	0.01
Weight, kg	-0.08	-0.05	-0.06	-0.04	-0.04
Body Mass Index, kg/m^2	-0.08	-0.05	-0.07	-0.04	-0.04
Systolic BP, mm Hg	-0.08	-0.03	-0.06	-0.07	-0.05
Diastolic BP, mm Hg	-0.06	-0.04	-0.03	-0.07	-0.05

SFA: saturated fatty acids; MFA: monounsaturated fatty acids; PFA: polyunsaturated fatty acids; TFA: trans fatty acids; BP: blood pressure.

* Pooled by country (weighted by N), adjusted for age, gender, center

Table S.6. Estimated Mean Difference in Blood Pressure, Proline Intake (% Total Protein) from Foods Higher by 2 s.d., Multiple Regression Analyses

Model	Systolic BP		Diastolic BP	
	Difference, mm Hg	(Z-value)	Difference, mm Hg	(Z- value)
Main Analyses – All 4,680 Participants				
4	-1.56	(-2.16)	-0.81*	(-1.67)
5a - P	-1.50	(-2.03)	-0.76	(-1.52)
5b - Mg	-1.88	(-2.58)	-1.05*	(-2.13)
5c - Ca	-0.28	(-0.35)	-0.05	(-0.10)
5d - Fe	-1.45	(-2.00)	-0.79*	(-1.62)
5e - Fiber	-1.61	(-2.24)	-0.83*	(-1.72)

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Table S.6. continued, page 2

Sensitivity Analyses				
Adjusted also for Education (years), and Current Smoking (yes/no) – N=4,680				
4	-1.52	(-2.11)	-0.85	(-1.76)
5b - Mg	-1.85	(-2.53)	-1.10	(-2.23)
Adjusted also for Month of Field Survey – N=4,680				
4	-1.52	(-2.11)	-0.75	(-1.54)
5b - Mg	-1.85	(-2.53)	-0.97	(-1.98)
Adjusted also for Season of Field Survey – N=4,680				
4	-1.52	(-2.11)	-0.76	(-1.57)
5b - Mg	-1.85	(-2.53)	-1.00	(-2.03)

continued on next page

Table S.6. continued, page 3

Adjusted also for Total Energy (kJ/day) – (N=4,680)				
4	-1.61	(-2.24)	-0.81*	(-1.68)
5b - Mg	-1.92	(-2.63)	-1.05*	(-2.14)
Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) instead of Urinary Na and Urinary K (mmol/24-h) – (N=4,680)				
4	-1.38	(-1.92)	-0.68*	(-1.40)
5b - Mg	-1.68	(-2.30)	-0.88	(-1.79)
Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
4	-1.30	(-1.73)	-0.76*	(-1.52)
5b - Mg	-1.35	(-1.78)	-0.90*	(-1.77)

continued on next page

Table S.6. continued, page 4

Adjusted also for Starch (% kJ) – (N=4,680)				
4	-1.22	(-1.66)	-0.54*	(-1.10)
5b - Mg	-1.64	(-2.20)	-0.83	(-1.65)
Censored normal regression adjusting for antihypertensive treatment – (N=4,680)				
4	-2.18*	(-2.72)	-1.14*	(-2.14)
5b - Mg	-2.49	(-3.06)	-1.37*	(-2.51)
Nonhypertensive Persons – (N=3,671)				
4	-1.49	(-2.53)	-0.48	(-1.09)
5b - Mg	-1.75	(-2.92)	-0.69	(-1.55)
Excluding Persons with High Day-to-day Variability in Nutrient Intake and/or BP – (N=3,473)				
4	-2.10	(-2.44)	-1.25	(-2.15)
5b - Mg	-2.29	(-2.64)	-1.44	(-2.45)

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Table S.6. continued, page 5

Proline Expressed as grams/day (instead of % Total Protein) – (N=4,680)				
4 + Total Energy (kJ/day)	-1.74	(-2.18)	-0.96	(-1.78)
5b - Mg + Total Energy (kJ/day)	-0.60	(-0.70)	-0.48*	(-0.84)
4 + Total Energy + Height + Weight	-1.80	(-2.37)	-1.00	(-1.93)
5b - Mg + Total Energy + Height + Weight	-1.47	(-1.81)	-1.01	(-1.81)
Proline Expressed as % kJ (instead of % Total Protein) – (N=4,680)				
4	-1.18	-2.32	-0.70*	-2.03
5b - Mg	-0.34	-0.61	-0.38*	-1.00
4 + Height + Weight	-1.11	-2.28	-0.64*	-1.91
5b - Mg + Height + Weight	-0.85	-1.60	-0.66*	-1.82

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Table S.6. continued, page 6

Model 4: Controlled for Sample, Age, Gender, Diet (Yes/No), Supplement Intake (Yes/No), CVD-DM Diagnosis (Yes/No), Physical Activity (Medium + Heavy, hours/day), Family History of High BP (Yes, No or Unknown), Urinary Na and Urinary K (mmol/24-h), 14-day Alcohol (grams/day), Cholesterol (mg/1,000 kJ), Total SFA and Total PFA (% kJ)

Model 5a-5e, Main Analyses: Controlled for Model 4 variables + each stipulated nutrient (expressed per 1,000 kJ)

Sensitivity Analyses: controlled for Model 4 variables + each stipulated variable, or variables in Model 5b - Mg + each stipulated variable

Month of field survey: mid-point between first and fourth clinic visit. Season of field survey: Winter = December/January/February; Spring = March/April/May; Summer = June/July/August; Fall = September/October/November

Z-value=regression coefficient/standard error; Z-value $\geq$1.96: uncorrected p $\leq$0.05; $\geq$2.58: uncorrected p $\leq$0.01; $\geq$3.29: uncorrected p $\leq$0.001

2 s.d. higher proline intake for % Total Protein – 2.54%; for grams/day – 3.34; for % Total Kilocalories – 0.40%

*Test for cross-country heterogeneity significant, p <0.05.

Table S.7. Estimated Mean Difference in Blood Pressure, Phenylalanine Intake (% Total Protein) from Foods Higher by 2 s.d., Multiple Regression Analyses

Model	Systolic BP		Diastolic BP	
	Difference, mm Hg	(Z- value)	Difference, mm Hg	(Z- value)
Main Analyses – All 4,680 Participants				
4	-1.49	(-3.35)	-1.03	(-3.40)
5a - P	-1.13	(-2.46)	-0.81	(-2.59)
5b - Mg	-1.31	(-2.89)	-0.98	(-3.16)
5c - Ca	-0.90	(-1.89)	-0.70	(-2.17)
5d - Fe	-1.33	(-2.97)	-0.96	(-3.14)
5e - Fiber	-1.28	(-2.83)	-0.94	(-3.05)

continued on next page

Table S.7. continued, page 2

Sensitivity Analyses				
Adjusted also for Education (years), and Current Smoking (yes/no) – N=4,680				
4	-1.47	(-3.29)	-1.07	(-3.52)
5b - Mg	-1.30	(-2.85)	-1.03	(-3.31)
Adjusted also for Month of Field Survey – N=4,680				
4	-1.47	(-3.27)	-1.04	(-3.40)
5b - Mg	-1.28	(-2.80)	-0.98	(-3.15)
Adjusted also for Season of Field Survey – N=4,680				
4	-1.47	(-3.30)	-1.04	(-3.41)
5b - Mg	-1.30	(-2.84)	-0.98	(-3.17)

continued on next page

Table S.7. continued, page 3

Adjusted also for Total Energy (kJ/day) – (N=4,680)				
4	-1.57	(-3.52)	-1.04	(-3.42)
5b - Mg	-1.37	(-3.00)	-0.98	(-3.14)
Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) instead of Urinary Na and Urinary K (mmol/24-h) – (N=4,680)				
4	-1.44	(-3.23)	-1.00	(-3.30)
5b - Mg	-1.34	(-2.94)	-0.98	(-3.16)
Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
4	-1.36*	(-2.85)	-1.09	(-3.36)
5b - Mg	-0.88	(-1.79)	-0.92	(-2.74)

continued on next page

Table S.7. continued, page 4

Adjusted also for Starch (% kJ) – (N=4,680)				
4	-1.36	(-2.80)	-0.87	(-2.62)
5b - Mg	-1.18	(-2.40)	-0.79	(-2.36)
Censored normal regression adjusting for antihypertensive treatment – (N=4,680)				
4	-2.01*	(-3.98)	-1.41	(-4.13)
5b - Mg	-1.80	(-3.49)	-1.33	(-3.81)
Nonhypertensive Persons – (N=3,671)				
4	-0.58*	(-1.55)	-0.63	(-2.25)
5b - Mg	-0.48*	(-1.24)	-0.61	(-2.13)
Excluding Persons with High Day-to-day Variability in Nutrient Intake and/or BP – (N=3,473)				
4	-1.38	(-2.59)	-0.88	(-2.42)
5b - Mg	-1.21	(-2.22)	-0.85	(-2.29)

continued on next page

Table S.7. continued, page 5

Phenylalanine Expressed as grams/day (instead of % Total Protein) – (N=4,680)				
4 + Total Energy (kJ/day)	-0.97	(-1.17)	-0.61	(-1.08)
5b - Mg + Total Energy (kJ/day)	0.95	(1.03)	0.34	(0.54)
4 + Total Energy + Height + Weight	-1.49	(-1.88)	-0.97	(-1.77)
5b - Mg + Total Energy + Height + Weight	-0.75	(-0.85)	-0.73	(-1.20)
Phenylalanine Expressed as % kJ (instead of % Total Protein) – (N=4,680)				
4	-0.80	(-1.68)	-0.53	(-1.62)
5b - Mg	0.38	(0.71)	-0.0004	(-0.01)
4 + Height + Weight	-0.99	(-2.17)	-0.64	(-2.05)
5b - Mg + Height + Weight	-0.56	(-1.08)	-0.58	(-1.62)

continued on next page

Table S.7. continued, page 6

Model 4: Controlled for Sample, Age, Gender, Diet (Yes/No), Supplement Intake (Yes/No), CVD-DM Diagnosis (Yes/No), Physical Activity (Medium + Heavy, hours/day), Family History of High BP (Yes, No or Unknown), Urinary Na and Urinary K (mmol/24-h), 14-day Alcohol (grams/day), Cholesterol (mg/1,000 kJ), Total SFA and Total PFA (% kJ)

Model 5a-5e, Main Analyses: Controlled for Model 4 variables + each stipulated nutrient (expressed per 1,000 kJ)

Sensitivity Analyses: controlled for Model 4 variables + each stipulated variable, or variables in Model 5b - Mg + each stipulated variable

Month of field survey: mid-point between first and fourth clinic visit. Season of field survey: Winter = December/January/February; Spring = March/April/May; Summer = June/July/August; Fall = September/October/November

Z-value=regression coefficient/standard error; Z-value=regression coefficient/standard error; Z-value $\geq$1.96: uncorrected p $\leq$0.05; $\geq$2.58: uncorrected p $\leq$0.01; $\geq$3.29: uncorrected p $\leq$0.001

2 s.d. higher phenylalanine intake for % Total Protein – 0.35%; for grams/day – 2.16; for % Total Kilocalories – 0.24%

*Test for cross-country heterogeneity significant, p <0.05.

Table S.8. Estimated Mean Difference in Blood Pressure, Serine Intake (% Total Protein) from Foods Higher by 2 s.d., Multiple Regression Analyses

Model	Systolic BP		Diastolic BP	
	Difference, mm Hg	(Z- value)	Difference, mm Hg	(Z- value)
Main Analyses – All 4,680 Participants				
4	-1.29	(-2.95)	-0.85	(-2.87)
5a - P	-0.99	(-2.20)	-0.66	(-2.18)
5b - Mg	-1.18	(-2.67)	-0.84	(-2.80)
5c - Ca	-0.55	(-1.15)	-0.44	(-1.33)
5d - Fe	-1.21	(-2.75)	-0.82	(-2.73)
5e - Fiber	-1.10	(-2.51)	-0.77	(-2.56)

continued on next page

Table S.8. continued, page 2

Sensitivity Analyses				
Adjusted also for Education (years), and Current Smoking (yes/no) – N=4,680				
4	-1.28	(-2.94)	-0.88	(-2.97)
5b - Mg	-1.18	(-2.67)	-0.88	(-2.92)
Adjusted also for Month of Field Survey – N=4,680				
4	-1.30	(-2.97)	-0.86	(-2.90)
5b - Mg	-1.19	(-2.68)	-0.85	(-2.81)
Adjusted also for Season of Field Survey – N=4,680				
4	-1.29	(-2.95)	-0.86	(-2.89)
5b - Mg	-1.18	(-2.66)	-0.84	(-2.81)

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Table S.8. continued, page 3

Adjusted also for Total Energy (kJ/day) – (N=4,680)				
4	-1.39*	(-3.18)	-0.87	(-2.91)
5b - Mg	-1.26	(-2.81)	-0.85	(-2.78)
Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) instead of Urinary Na and Urinary K (mmol/24-h) – (N=4,680)				
4	-1.13	(-2.58)	-0.75	(-2.53)
5b - Mg	-1.08	(-2.45)	-0.76	(-2.54)
Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
4	-1.14*	(-2.39)	-0.93	(-2.86)
5b - Mg	-0.69	(-1.42)	-0.80	(-2.39)

continued on next page

Table S.8. continued, page 4

Adjusted also for Starch (% kJ) – (N=4,680)				
4	-1.14	(-2.52)	-0.70	(-2.27)
5b - Mg	-1.05	(-2.29)	-0.69	(-2.22)
Censored normal regression adjusting for antihypertensive treatment – (N=4,680)				
4	-2.01*	(-4.03)	-1.37	(-4.10)
5b - Mg	-1.87*	(-3.70)	-1.34	(-3.93)
Nonhypertensive Persons – (N=3,671)				
4	-0.50*	(-1.35)	-0.51	(-1.86)
5b - Mg	-0.44	(-1.17)	-0.53	(-1.89)
Excluding Persons with High Day-to-day Variability in Nutrient Intake and/or BP – (N=3,473)				
4	-1.18	(-2.29)	-0.71	(-2.04)
5b - Mg	-1.06	(-2.04)	-0.72	(-2.04)

continued on next page

Table S.8. continued, page 5

Serine Expressed as grams/day (instead of % Total Protein) – (N=4,680)				
4 + Total Energy (kJ/day)	-1.15	(-1.33)	-0.69	(-1.18)
5b - Mg + Total Energy (kJ/day)	0.90	(0.94)	0.30	(0.46)
4 + Total Energy + Height + Weight	-1.46	(-1.79)	-0.92	(-1.63)
5b - Mg + Total Energy + Height + Weight	-0.68	(-0.74)	-0.69	(-1.08)
Serine Expressed as % kJ (instead of % Total Protein) – (N=4,680)				
4	-0.91	(-1.83)	-0.60	(-1.76)
5b - Mg	0.36	(0.63)	-0.05	(-0.14)
4 + Height + Weight	-1.00	(-2.11)	-0.65	(-1.98)
5b - Mg + Height + Weight	-0.54	(-0.99)	-0.60	(-1.60)

continued on next page

Table S.8. continued, page 6

Model 4: Controlled for Sample, Age, Gender, Diet (Yes/No), Supplement Intake (Yes/No), CVD-DM Diagnosis (Yes/No), Physical Activity (Medium + Heavy, hours/day), Family History of High BP (Yes, No or Unknown), Urinary Na and Urinary K (mmol/24-h), 14-day Alcohol (grams/day), Cholesterol (mg/1,000 kJ), Total SFA and Total PFA (% kJ)

Model 5a-5e, Main Analyses: Controlled for Model 4 variables + each stipulated nutrient (expressed per 1,000 kJ)

Sensitivity Analyses: controlled for Model 4 variables + each stipulated variable, or variables in Model 5b - Mg + each stipulated variable

Month of field survey: mid-point between first and fourth clinic visit. Season of field survey: Winter = December/January/February; Spring = March/April/May; Summer = June/July/August; Fall = September/October/November

Z-value=regression coefficient/standard error; Z-value=regression coefficient/standard error; Z-value $\geq$1.96: uncorrected p $\leq$0.05; $\geq$2.58: uncorrected p $\leq$0.01; $\geq$3.29: uncorrected p $\leq$0.001

2 s.d. higher serine intake for % Total Protein – 0.45%; for grams/day – 2.20; for % Total Kilocalories – 0.24%

*Test for cross-country heterogeneity significant, p <0.05.

Table S.9. Sensitivity Analyses: Two Amino Acids Regressed Simultaneously, Model 5b - Mg

Amino Acids, Analysis	Systolic BP		Diastolic BP	
	Difference, mm Hg	(Z- value)	Difference, mm Hg	(Z- value)
Adjusted also for Total Energy (kJ/day) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.70	(-2.50)	-2.01	(-2.83)
Proline (% Total Protein)	0.27	(0.23)	0.55*	(0.72)
Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) – (N=4,680)				
Glutamic Acid (% Total Protein)	-3.18	(-2.94)	-2.20	(-3.11)
Proline (% Total Protein)	0.91	(0.78)	0.92	(1.20)
Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.71	(-2.51)	-1.98	(-2.79)
Proline (% Total Protein)	0.26	(0.22)	0.54	(0.70)
Adjusted also for Starch (% kJ) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.81	(-2.54)	-1.87	(-2.58)
Proline (% Total Protein)	0.30	(0.26)	0.46	(0.59)
Nonhypertensive Persons – (N=3,671)				
Glutamic Acid (% Total Protein)	-0.97	(-1.08)	-1.51	(-2.29)
Proline (% Total Protein)	-1.11	(-1.18)	0.51	(0.75)

continued on next page

Table S.9. continued, page 2

Excluding Persons with High Day-to-day Variability in Nutrient Intake/BP – (N=3,473)				
Glutamic Acid (% Total Protein)	-2.82	(-2.11)	-1.43	(-1.63)
Proline (% Total Protein)	0.03	(0.02)	-0.32	(-0.34)
Amino Acids as g/day – (N=4,680)				
Glutamic Acid + Energy (kJ/day)	2.01	(1.01)	0.31	(0.23)
Proline + Total Energy (kJ/day)	-2.20	(-1.18)	-0.51	(-0.41)
Glutamic Acid + Energy + Height + Weight	-0.24	(-0.13)	-1.09	(-0.84)
Proline + Energy + Height + Weight	-1.20	(-0.67)	0.12	(0.10)
Amino Acids as % kJ – (N=4,680)				
Glutamic Acid	0.39	(0.36)	0.03	(0.04)
Proline	-0.63	(-0.53)	-0.20*	(-0.25)
Glutamic Acid + Height + Weight	-0.61	(-0.58)	-0.59	(-0.85)
Proline + Height + Weight	-0.14	(-0.13)	0.13*	(0.17)
Adjusted also for Total Energy (kJ/day) – (N=4,680)				
Glutamic Acid (% Total Protein)	-1.96	(-2.43)	-1.25	(-2.34)
Phenylalanine (% Total Protein)	-0.78	(-1.42)	-0.63	(-1.69)
Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.03	(-2.52)	-1.21	(-2.26)
Phenylalanine (% Total Protein)	-0.73	(-1.35)	-0.64	(-1.74)

continued on next page

Table S.9. continued, page 3

Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.01	(-2.50)	-1.25	(-2.33)
Phenylalanine (% Total Protein)	-0.72	(-1.30)	-0.60	(-1.60)
Adjusted also for Starch (% kJ) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.09	(-2.57)	-1.23	(-2.28)
Phenylalanine (% Total Protein)	-0.74	(-1.33)	-0.55	(-1.46)
Nonhypertensive Persons – (N=3,671)				
Glutamic Acid (% Total Protein)	-1.40	(-2.09)	-0.81	(-1.64)
Phenylalanine (% Total Protein)	0.18	(0.39)	-0.24	(-0.71)
Excluding Persons with High Day-to-day Variability in Nutrient Intake/BP – (N=3,473)				
Glutamic Acid (% Total Protein)	-2.56	(-2.62)	-1.29	(-1.98)
Phenylalanine (% Total Protein)	-0.34	(-0.52)	-0.39	(-0.89)
Amino Acids as g/day – (N=4,680)				
Glutamic Acid + Energy (kJ/day)	-5.53	(-2.57)	-3.83	(-2.68)
Phenylalanine + Total Energy (kJ/day)	5.78	(2.56)	4.04	(2.66)
Glutamic Acid + Energy + Height + Weight	-4.38	(-2.12)	-3.04	(-2.28)
Phenylalanine + Energy + Height + Weight	2.92	(1.35)	2.14	(1.46)

continued on next page

Table S.9. continued, page 4

Amino Acids as % kJ – (N=4,680)				
Glutamic Acid	-2.89	(-2.42)	-1.70	(-2.14)
Phenylalanine	3.22	(2.47)	1.84	(2.08)
Glutamic Acid + Height + Weight	-2.02	(-1.76)	-1.11	(-1.45)
Phenylalanine + Height + Weight	1.39	(1.11)	0.64	(0.75)
Adjusted also for Total Energy (kJ/day) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.22	(-2.77)	-1.38	(-2.59)
Serine (% Total Protein)	-0.59	(-1.09)	-0.40	(-1.10)
Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.43	(-3.04)	-1.41	(-2.67)
Serine (% Total Protein)	-0.35	(-0.66)	-0.31	(-0.85)
Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.28	(-2.85)	-1.37	(-2.59)
Serine (% Total Protein)	-0.53	(-0.98)	-0.38	(-1.03)
Adjusted also for Starch (% kJ) – (N=4,680)				
Glutamic Acid (% Total Protein)	-2.37	(-2.93)	-1.33	(-2.48)
Serine (% Total Protein)	-0.50	(-0.94)	-0.35	(-0.96)

continued on next page

Table S.9. continued, page 5

Nonhypertensive Persons – (N=3,671)				
Glutamic Acid (% Total Protein)	-1.65	(-2.48)	-0.93	(-1.90)
Serine (% Total Protein)	0.26	(0.57)	-0.07	(-0.22)
Excluding Persons with High Day-to-day Variability in Nutrient Intake/BP – (N=3,473)				
Glutamic Acid (% Total Protein)	-2.78	(-2.86)	-1.40	(-2.16)
Serine (% Total Protein)	-0.13	(-0.21)	-0.19	(-0.45)
Amino Acids as g/day – (N=4,680)				
Glutamic Acid + Energy (kJ/day)	-4.95	(-2.28)	-3.66	(-2.54)
Serine + Total Energy (kJ/day)	5.53	(2.33)	4.03	(2.50)
Glutamic Acid + Energy + Height + Weight	-4.71	(-2.27)	-3.43	(-2.48)
Serine + Energy + Height + Weight	3.67	(1.62)	2.76	(1.78)
Amino Acids as % kJ – (N=4,680)				
Glutamic Acid	-2.58	(-2.15)	-1.51	(-1.88)
Serine	3.14	(2.28)	1.70	(1.81)
Glutamic Acid + Height + Weight	-2.11	(-1.84)	-1.18	(-1.52)
Serine + Height + Weight	1.73	(1.31)	0.77	(0.85)
Adjusted also for Total Energy (kJ/day) – (N=4,680)				
Proline (% Total Protein)	-1.00	(-1.13)	-0.44	(-0.72)
Phenylalanine (% Total Protein)	-0.85	(-1.48)	-0.69	(-1.76)

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Table S.9. continued, page 6

Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) – (N=4,680)				
Proline (% Total Protein)	-0.73	(-0.83)	-0.21	(-0.35)
Phenylalanine (% Total Protein)	-0.94	(-1.67)	-0.77	(-2.00)
Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
Proline (% Total Protein)	-1.06	(-1.19)	-0.43	(-0.72)
Phenylalanine (% Total Protein)	-0.77	(-1.34)	-0.64	(-1.64)
Adjusted also for Starch (% kJ) – (N=4,680)				
Proline (% Total Protein)	-1.07	(-1.20)	-0.47	(-0.77)
Phenylalanine (% Total Protein)	-0.78	(-1.33)	-0.55	(-1.38)
Nonhypertensive Persons – (N=3,671)				
Proline (% Total Protein)	-1.24	(-1.71)	-0.08	(-0.14)
Phenylalanine (% Total Protein)	-0.17	(-0.36)	-0.46	(-1.30)
Excluding Persons with High Day-to-day Variability in Nutrient Intake/BP – (N=3,473)				
Proline (% Total Protein)	-1.82	(-1.71)	-0.98	(-1.36)
Phenylalanine (% Total Protein)	-0.31	(-0.46)	-0.35	(-0.76)

continued on next page

Table S.9. continued, page 7

Amino Acids as g/day – (N=4,680)				
Proline + Energy (kJ/day)	-3.00	(-2.24)	-1.55*	(-1.72)
Phenylalanine + Total Energy (kJ/day)	3.72	(2.51)	2.25	(2.22)
Proline + Energy + Height + Weight	-2.27	(-1.77)	-1.08*	(-1.25)
Phenylalanine + Energy + Height + Weight	1.28	(0.90)	0.67	(0.68)
Amino Acids as % kJ – (N=4,680)				
Proline	-1.47	(-1.68)	-0.73*	(-1.24)
Phenylalanine	1.86	(2.15)	1.09	(1.84)
Proline + Height + Weight	-0.96	(-1.14)	-0.38*	(-0.67)
Phenylalanine + Height + Weight	0.47	(0.56)	0.19	(0.34)
Adjusted also for Total Energy (kJ/day) – (N=4,680)				
Proline (% Total Protein)	-1.38	(-1.51)	-0.59	(-0.95)
Serine (% Total Protein)	-0.60	(-1.02)	-0.42	(-1.04)
Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) – (N=4,680)				
Proline (% Total Protein)	-1.28	(-1.40)	-0.46	(-0.75)
Serine (% Total Protein)	-0.51	(-0.87)	-0.39	(-0.99)
Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
Proline (% Total Protein)	-1.44	(-1.57)	-0.58	(-0.94)
Serine (% Total Protein)	-0.53	(-0.88)	-0.38	(-0.93)

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Table S.9. continued, page 8

Adjusted also for Starch (% kJ) – (N=4,680)				
Proline (% Total Protein)	-1.50	(-1.63)	-0.61	(-0.98)
Serine (% Total Protein)	-0.48	(-0.81)	-0.30	(-0.75)
Nonhypertensive Persons – (N=3,671)				
Proline (% Total Protein)	-1.55	(-2.09)	-0.15	(-0.28)
Serine (% Total Protein)	-0.02	(-0.04)	-0.28	(-0.76)
Excluding Persons with High Day-to-day Variability in Nutrient Intake/BP – (N=3,473)				
Proline (% Total Protein)	-2.09	(-1.90)	-1.00	(-1.34)
Serine (% Total Protein)	0.06	(0.08)	-0.05	(-0.10)
Amino Acids as g/day – (N=4,680)				
Proline + Energy (kJ/day)	-3.06	(-2.17)	-1.59*	(-1.68)
Serine + Total Energy (kJ/day)	4.20	(2.54)	2.63	(2.33)
Proline + Energy + Height + Weight	-2.54	(-1.88)	-1.25*	(-1.38)
Serine + Energy + Height + Weight	1.95	(1.23)	1.16	(1.07)
Amino Acids as % kJ – (N=4,680)				
Proline	-1.45	(-1.59)	-0.66*	(-1.07)
Serine	2.14	(2.21)	1.25	(1.88)
Proline + Height + Weight	-1.03	(-1.17)	-0.36*	(-0.62)
Serine + Height + Weight	0.79	(0.85)	0.38	(0.59)

continued on next page

Table S.9. continued, page 9

Adjusted also for Total Energy (kJ/day) – (N=4,680)				
Phenylalanine (% Total Protein)	-1.29	(-1.52)	-0.90	(-1.58)
Serine (% Total Protein)	-0.25	(-0.30)	-0.09	(-0.17)
Adjusted for Urinary Na/Creatinine and K/Creatinine Ratio (mmol/mmol) – (N=4,680)				
Phenylalanine (% Total Protein)	-1.65	(-1.94)	-1.12	(-1.96)
Serine (% Total Protein)	0.23	(0.27)	0.17	(0.30)
Adjusted also for Total Carbohydrate (% kJ) – (N=4,680)				
Phenylalanine (% Total Protein)	-1.28	(-1.50)	-0.89	(-1.56)
Serine (% Total Protein)	-0.24	(-0.28)	-0.09	(-0.15)
Adjusted also for Starch (% kJ) – (N=4,680)				
Phenylalanine (% Total Protein)	-1.33	(-1.53)	-0.79	(-1.35)
Serine (% Total Protein)	-0.15	(-0.19)	-0.10	(-0.18)
Nonhypertensive Persons – (N=3,671)				
Phenylalanine (% Total Protein)	-0.54	(-0.75)	-0.58	(-1.08)
Serine (% Total Protein)	0.16	(0.23)	0.08	(0.16)
Excluding Persons with High Day-to-day Variability in Nutrient Intake/BP – (N=3,473)				
Phenylalanine (% Total Protein)	-1.245	(-1.21)	-0.75	(-1.08)
Serine (% Total Protein)	-0.17	(-0.17)	-0.08	(-0.12)

continued on next page

Table S.9. continued, page 10

Amino Acids as g/day – (N=4,680)				
Phenylalanine + Energy (kJ/day)	2.91	(0.61)	1.33	(0.41)
Serine + Total Energy (kJ/day)	-2.41	(-0.48)	-1.19	(-0.35)
Phenylalanine + Energy + Height + Weight	-2.73	(-0.60)	-2.28	(-0.73)
Serine + Energy + Height + Weight	1.79	(0.37)	1.50	(0.46)
Amino Acids as % kJ – (N=4,680)				
Phenylalanine	1.36	(0.50)	1.03	(0.56)
Serine	-1.21	(-0.42)	-1.19	(-0.61)
Phenylalanine + Height + Weight	-1.28	(-0.49)	-0.66	(-0.37)
Serine + Height + Weight	0.68	(0.22)	-0.01	(-0.01)

Model 5b: Sample, Age, Gender, Special Diet, Supplement Intake, CVD-DM Diagnosis, Physical Activity, Family History of High BP, Urinary Na, Urinary K, 7-Alcohol, Cholesterol, Total SFA, Total PFA, Magnesium

Sensitivity Analyses: controlled for Model 5b - Mg + each stipulated variable

Z-value=regression coefficient/standard error; Z-value ≥1.96: uncorrected p ≤0.05; ≥2.58: uncorrected p ≤0.01; ≥3.29: uncorrected p ≤0.01

2 s.d. higher glutamic acid intake for % Total Protein – 4.72%; for grams/day – 9.60; for % Total Kilocalories – 1.00%

2 s.d. higher proline intake for % Total Protein – 2.54%; for grams/day – 3.34; for % Total Kilocalories – 0.40%

2 s.d. higher phenylalanine intake for % Total Protein – 0.35%; for grams/day – 2.16; for % Total Kilocalories – 0.24%

2 s.d. higher serine intake for % Total Protein – 0.45%; for grams/day – 2.20; for % Total Kilocalories – 0.24%

*Test for cross-country heterogeneity significant, p <0.05.

Table S.10. Estimated Mean Difference in Blood Pressure, by Gender, Glutamic Acid Intake (% Total Protein) from Foods Higher by 2 s.d., Multiple Regression Analyses

	Systolic BP				Diastolic BP			
	Men (N=2,359)		Women (N=2,321)		Men (N=2,359)		Women (N=2,321)	
	Difference, mm Hg	(Z-value)	Difference, mm Hg	(Z-value)	Difference, mm Hg	(Z-value)	Difference, mm Hg	(Z-value)
1	-2.06*	(-2.56)	-3.98	(-4.55)	-1.10	(-1.98)	-1.83	(-3.31)
2	-2.01*	(-2.52)	-3.43	(-3.97)	-1.13	(-2.04)	-1.77	(-3.21)
3	-0.82	(-1.01)	-3.01	(-3.49)	-0.54	(-0.96)	-1.51	(-2.73)
4	-1.19	(-1.30)	-2.29	(-2.41)	-1.03	(-1.62)	-1.34	(-2.20)
5a - P	-1.82	(-1.94)	-2.50	(-2.54)	-1.39	(-2.11)	-1.51	(-2.39)
5b - Mg	-2.00	(-2.11)	-2.45	(-2.47)	-1.56	(-2.33)	-1.66	(-2.60)
5c - Ca	-0.79	(-0.85)	-1.76	(-1.81)	-0.95	(-1.45)	-0.99	(-1.58)
5d - Fe	-1.17	(-1.27)	-1.85	(-1.92)	-1.02	(-1.59)	-1.19	(-1.92)
5e - Fiber	-1.12	(-1.20)	-2.15	(-2.23)	-1.04	(-1.59)	-1.29	(-2.08)

Model 1: Controlled for Sample, Age

Model 2: Model 1 Variables + Special Diet (Yes/No), Supplement Intake (Yes/No), CVD-DM Diagnosis (Yes/No), Physical Activity (Medium + Heavy, hours/day), Family History of High BP (Yes, No or Unknown)

Model 3: Model 2 Variables + Urinary Na and Urinary K (mmol/24-h), 14-day Alcohol (grams/day)

Model 4: Model 3 Variables + Cholesterol (mg/1,000 kJ), Total SFA and Total PFA (% kJ)

Model 5a-5e: Controlled for Model 4 variables + each stipulated nutrient (expressed per 1,000 kJ)

Z-value = regression coefficient/standard error; Z-value $\geq$1.96: uncorrected p $\leq$0.05; $\geq$2.58: uncorrected p $\leq$0.01; $\geq$3.29: uncorrected p $\leq$0.001

2 s.d. higher glutamic acid intake 4.72 % Total Protein

*Test for cross-country heterogeneity significant, p <0.05.

Table S.11. Estimated Mean Difference in Blood Pressure, by Age Group (40-49 and 50-59 years), Glutamic Acid Intake (% Total Protein) from Foods Higher by 2 s.d., Multiple Regression Analyses

	Systolic BP				Diastolic BP			
	40-49 years (N=2,365)		50-59 years (N=2,315)		40-49 years (N=2,365)		50-59 years (N=2,315)	
	Difference, mm Hg	(Z-value)	Difference, mm Hg	(Z-value)	Difference, mm Hg	(Z-value)	Difference, mm Hg	(Z-value)
1	-3.19	(-4.13)	-2.93	(-3.24)	-1.65	(-3.04)	-1.24	(-2.21)
2	-3.08	(-4.01)	-2.58	(-2.87)	-1.55	(-2.86)	-1.33	(-2.35)
3	-2.27	(-2.91)	-1.99	(-2.21)	-1.06	(-1.94)	-1.07	(-1.87)
4	-1.67	(-1.94)	-2.25	(-2.22)	-0.86	(-1.42)	-1.70	(-2.67)
5a - P	-2.00	(-2.26)	-2.88	(-2.76)	-0.99	(-1.57)	-2.17	(-3.29)
5b - Mg	-2.21	(-2.47)	-2.79	(-2.65)	-1.15	(-1.81)	-2.26	(-3.38)
5c - Ca	-1.07	(-1.22)	-2.08	(-2.01)	-0.60	(-0.96)	-1.60	(-2.44)
5d - Fe	-1.61	(-1.85)	-2.13	(-2.07)	-0.81	(-1.32)	-1.66	(-2.57)
5e - Fiber	-1.41	(-1.61)	-2.48	(-2.41)	-0.67	(-1.09)	-1.93	(-2.96)

Model 1: Controlled for Sample, Gender

Model 2: Model 1 Variables + Special Diet (Yes/No), Supplement Intake (Yes/No), CVD-DM Diagnosis (Yes/No), Physical Activity (Medium + Heavy, hours/day), Family History of High BP (Yes, No or Unknown)

Model 3: Model 2 Variables + Urinary Na and Urinary K (mmol/24-h), 14-day Alcohol (grams/day)

Model 4: Model 3 Variables + Cholesterol (mg/1,000 kJ), Total SFA and Total PFA (% kJ)

Model 5a-5e: Controlled for Model 4 variables + each stipulated nutrient (expressed per 1,000 kJ)

Z-value = regression coefficient/standard error; Z-value $\geq$1.96: uncorrected p $\leq$0.05; $\geq$2.58: uncorrected p $\leq$0.01; $\geq$3.29: uncorrected p $\leq$0.001

2 s.d. higher glutamic acid intake 4.72 % Total Protein

No significant cross-country heterogeneity detected