

Supplementary tables for

Relation of unprocessed, processed red meat and poultry consumption to blood pressure in East Asian and Western adults

Linda M. OUDE GRIEP, Paraskevi SEFERIDI, Jeremiah STAMLER, Linda VAN HORN, Queenie CHAN, Ioanna TZOULAKI, Lyn M. STEFFEN, Katsuyuki MIURA, Hirotsugu UESHIMA, Nagako OKUDA, Liancheng ZHAO, Sabita S. SOEDAMAH-MUTHU, Martha L. DAVIGLUS, and Paul ELLIOTT, for the INTERMAP Research Group.

Figure S1. Participant flow chart

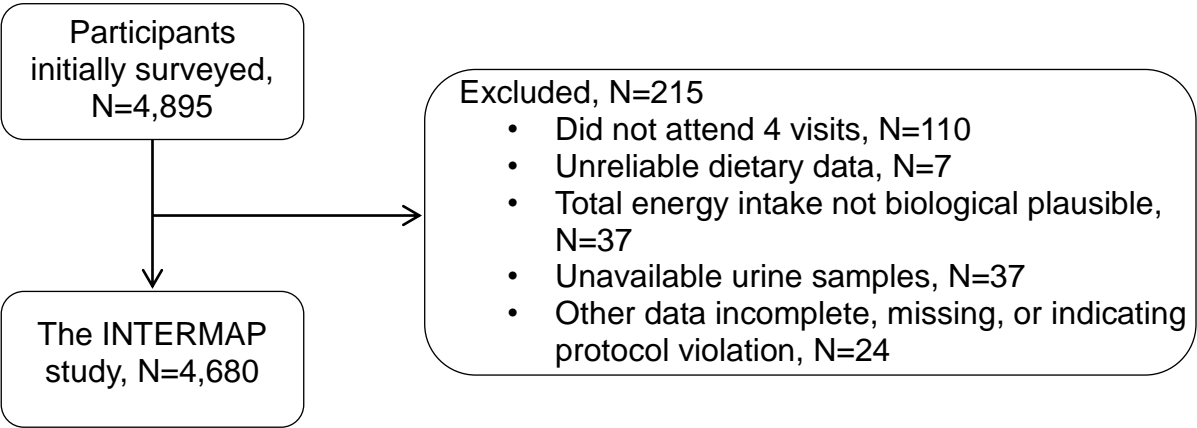


Table S1. Pearson correlation coefficients between consumption of unprocessed and processed red meat or poultry and other dietary factors, for East Asian ($n=1,984$) and Western adults ($n=2,696$) separately

Dietary factor	Unprocessed red meat		Processed red meat	Unprocessed poultry
	East Asian	Western	Western	Western
Total protein, % kcal	0.26	0.39	0.13	0.44
Animal protein, % kcal	0.35	0.46	0.24	0.46
Vegetable protein, % kcal	-0.21	-0.18	-0.23	-0.08
Total fat, % kcal	0.29	0.13	0.28	-0.05
Total saturated fatty acids, % kcal	0.33	0.12	0.28	-0.14
Total mono unsaturated fatty acids, % kcal	0.31	0.16	0.31	-0.03
Cholesterol, mg/1000 kcal	0.14	0.31	0.24	0.16
Total carbohydrates, % kcal	-0.28	-0.29	-0.31	-0.12
Dietary fiber, g/1000 kcal	-0.06	-0.13	-0.22	-0.06
Niacin, mg/1000 kcal	0.22	0.08	-0.04	0.40
Thiamin, mg/1000 kcal	0.21	0.00	-0.06	-0.08
Vitamin B12, µg/1000 kcal	0.09	0.20	0.05	-0.03
Vitamin C, mg/1000 kcal	-0.03	-0.08	-0.16	0.02
Iron, mg/1000 kcal	0.16	0.01	-0.10	0.00
Selenium, µg/1000 kcal	0.11	0.06	-0.04	0.16
Calcium, mg/1000 kcal	-0.04	-0.20	-0.11	-0.13
Magnesium, mg/1000 kcal	-0.05	-0.08	-0.22	0.02
Urinary urea nitrogen, mg/24 hr	0.08	0.13	0.09	0.16
Urinary sodium, mmol/24 hr	-0.01	0.03	0.16	0.01
Urinary sodium to potassium ratio	0.01	0.09	0.21	0.04

Food groups, g/1000 kcal

Raw fruit	0.01	-0.09	-0.14	0.00
Low-fat dairy products	-0.02	-0.11	-0.13	-0.02
Raw and cooked vegetables	-0.01	-0.01	-0.12	0.06
Fiber-rich cereals and grains	0.03	-0.09	-0.12	-0.05
Fish and shell fish	-0.10	-0.06	-0.11	0.03

Table S2. Estimated mean difference in BP associated with consumption of unprocessed or processed meat (per 25 g/1000 kcal) by subcohort

		Systolic BP				Diastolic BP		
		N	Difference	95%CI	P	Difference	95%CI	P
Unprocessed red meat								
Excluding participants with self-reported diagnosis of hypertension and users of antihypertensive drugs ¹								
East Asian participants	Model 3 ⁴	1,690	-0.25	(-1.27,0.76)	0.62	0.34	(-0.34,1.02)	0.33
	Model 4 ⁵	1,690	-0.38	(-1.37,0.60)	0.44	0.22	(-0.43,0.88)	0.50
	Model 5 ⁶	1,690	-0.27	(-1.28, 0.75)	0.61	0.33	(-0.34,1.02)	0.34
Western participants	Model 3 ⁴	1,842	0.71	(0.01,1.40)	0.05	0.75	(0.24,1.25)	<0.01
	Model 4 ⁵	1,842	0.13	(-0.54,0.79)	0.71	0.39	(-0.06,0.72)	0.10
	Model 5 ⁶	1,842	0.68	(-0.01,1.38)	0.05	0.72	(0.22,1.22)	<0.01
Nonhypertensive participants ²								
East Asian participants	Model 3 ⁴	1,602	-0.27	(-1.12,0.57)	0.53	0.23	(-0.39,0.85)	0.47
	Model 4 ⁵	1,602	-0.44	(-1.25,0.38)	0.29	0.09	(-0.50,0.69)	0.76
	Model 5 ⁶	1,602	-0.28	(-1.13,0.56)	0.51	0.22	(-0.39,0.84)	0.48

Western participants	Model 3 ⁴	1,761	0.64	(0.01,1.26)	0.05	0.63	(0.16,1.11)	0.01
	Model 4 ⁵	1,761	0.15	(-0.45,0.75)	0.63	0.32	(-0.14,0.78)	0.18
	Model 5 ⁶	1,761	0.61	(-0.01,1.23)	0.06	0.61	(0.14,1.09)	0.01
Further exclusion of participants with prevalent cardiovascular diseases and diabetes mellitus ³								
East Asian participants	Model 3 ⁴	1,475	-0.34	(-1.21,0.53)	0.44	0.31	(-0.32,0.94)	0.33
	Model 4 ⁵	1,475	-0.50	(-1.34,0.34)	0.24	0.18	(-0.42,0.79)	0.56
	Model 5 ⁶	1,475	-0.32	(-1.19,0.54)	0.46	0.32	(-0.30,0.95)	0.31
Western participants	Model 3 ⁴	1,576	0.78	(0.13,1.44)	0.02	0.72	(0.23,1.21)	<0.01
	Model 4 ⁵	1,576	0.28	(-0.36,0.91)	0.39	0.42	(-0.06,0.99)	0.08
	Model 5 ⁶	1,576	0.75	(0.09,1.41)	0.03	0.73	(0.24,1.22)	<0.01

Processed red meat, Western participants only

Excluding participants with self-reported diagnosis of hypertension and users of antihypertensive drugs¹

Model 3 ⁴	1,842	1.02	(0.14,1.91)	0.02	0.51	(-0.13,1.15)	0.12
Model 4 ⁵	1,842	0.32	(-0.53,1.16)	0.46	0.07	(-0.55,0.69)	0.82
Model 5 ⁶	1,842	0.80	(-0.09,1.69)	0.08	0.36	(-0.28,1.01)	0.27

Nonhypertensive participants²

Model 3 ⁴	1,761	0.91	(0.11,1.71)	0.03	0.46	(-0.14,1.07)	0.13
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Model 4 ⁵	1,761	0.28	(-0.50,1.04)	0.49	0.05	(-0.54,0.64)	0.86
Model 5 ⁶	1,761	0.70	(-0.11,1.50)	0.09	0.32	(-0.29,0.93)	0.30

Further exclusion of participants with prevalent cardiovascular diseases and diabetes mellitus³

Model 3 ⁴	1,576	0.71	(-0.13,1.54)	0.10	0.56	(-0.06,1.18)	0.08
Model 4 ⁵	1,576	0.09	(-0.71,0.90)	0.82	0.20	(-0.41,0.80)	0.52
Model 5 ⁶	1,576	0.48	(-0.37,1.32)	0.27	0.44	(-0.20,1.06)	0.17

¹Subcohort excluding participants with a self-reported diagnosis of hypertension and users of antihypertensive drugs

²Subcohort excluding from foregoing cohort also those with high systolic BP (≥ 140 mmHg) or diastolic BP (≥ 90 mmHg)

³Subcohort excluding from foregoing cohort also those with prevalent cardiovascular diseases and diabetes

⁴Model 3 was adjusted for age, sex, sample, plus intakes of energy (kcal) and alcohol (g/d), smoking status (never, former, current), years of education (years completed), physical activity during leisure time (a lot, moderate, little, none), use of dietary supplements (yes/no), adherence to any special diet (yes/ no), history of cardiovascular disease or diabetes mellitus (yes/ no), family history of cardiovascular disease (yes/no), use of antihypertensive, cardiovascular disease or diabetes medication (yes/no), and intakes (g/1000 kcal) of low-fat dairy products, raw fruits, raw and cooked vegetables, fiber-rich cereals and grains, fish and shell fish, and mutually for the sum of intakes of other meat types.

⁵Model 4 was adjusted as model 3 plus BMI.

⁶Model 5 was adjusted as model 3 plus urinary sodium excretion.

Table S3. Estimated mean difference in BP associated with consumption of unprocessed or processed red meat (per 25 g/1000 kcal) stratified by gender

		Red meat		Systolic BP			Diastolic BP		
		(g/1000 kcal)							
	N	Mean±SD		Difference	95%CI	P	Difference	95%CI	P
Unprocessed red meat									
Total population									
Men	2,359	18±19	Model 3 ¹	0.05	(-0.69,0.79)	0.89	0.17	(-0.35,0.69)	0.53
			Model 4 ²	-0.25	(-0.97,0.48)	0.51	-0.07	(-0.58,0.43)	0.78
			Model 5 ³	0.03	(-0.71,0.77)	0.94	0.15	(-0.37,0.67)	0.56
Women	2,321	16±17	Model 3 ¹	0.91	(0.04,1.77)	0.03	0.98	(0.42,1.55)	≤0.001
			Model 4 ²	0.40	(-0.44,1.24)	0.35	0.75	(0.19,1.31)	≤0.01
			Model 5 ³	0.84	(-0.02,1.70)	0.06	0.97	(0.40,1.53)	≤0.001
East-Asian participants									
Men	990	16±18	Model 3 ¹	0.10	(-1.24,1.43)	0.89	0.56	(-0.31,1.44)	0.21
			Model 4 ²	-0.19	(-1.50,1.13)	0.78	0.26	(-0.59,1.10)	0.55
			Model 5 ³	0.09	(-1.24,1.43)	0.89	0.56	(-0.32,1.44)	0.21

Women	994	13±14	Model 3 ¹	-0.30	(-2.14,1.54)	0.75	-0.01	(-1.20,1.19)	0.99
			Model 4 ²	-0.46	(-2.23,1.29)	0.60	-0.12	(-1.26,1.03)	0.84
			Model 5 ³	-0.28	(-2.11,1.55)	0.76	0.01	(-1.18,1.19)	0.99
Western participants									
Men	1,369	20±19	Model 3 ¹	0.03	(-0.86,0.92)	0.94	-0.04	(-0.69,0.60)	0.89
			Model 4 ²	-0.27	(-1.13,0.59)	0.54	-0.25	(-0.88,0.37)	0.43
			Model 5 ³	-0.01	(-0.89,0.89)	1.00	-0.07	(-0.71,0.58)	0.84
Women	1,327	17±19	Model 3 ¹	1.25	(0.27,2.23)	0.01	1.27	(0.63,1.92)	≤0.001
			Model 4 ²	0.66	(-0.30,1.61)	0.18	1.02	(0.38,1.66)	≤0.01
			Model 5 ³	1.16	(0.18,2.14)	0.02	1.25	(0.60,1.89)	≤0.001
Processed red meat, Western participants only									
Men	1,369	19±16	Model 3 ¹	1.09	(0.01,2.17)	0.05	0.31	(-0.48,1.10)	0.44
			Model 4 ²	0.30	(-0.78,1.36)	0.59	-0.25	(-1.03,0.53)	0.53
			Model 5 ³	0.99	(-0.11,2.09)	0.08	0.25	(-0.56,1.05)	0.55
Women	1,327	16±15	Model 3 ¹	1.35	(0.05,2.64)	0.04	0.34	(-0.51,1.19)	0.43
			Model 4 ²	0.80	(-0.47,2.06)	0.22	0.10	(-0.75,0.94)	0.82
			Model 5 ³	1.08	(-0.23,2.39)	0.11	0.28	(-0.58,1.14)	0.53

¹Model 3 was adjusted for age, sample, intakes of energy (kcal) and alcohol (g/d), smoking status (never, former, or current), years of education (years completed), physical activity during leisure time (a lot, moderate, little, none), use of dietary supplements (yes/no), adherence to any special diet (yes/no), history of cardiovascular disease or diabetes mellitus (yes/no), family history of cardiovascular disease (yes/no), use of antihypertensive, cardiovascular disease or diabetes medication (yes/no), and intakes (g/1000 kcal) of low-fat dairy products, raw fruits, raw and cooked vegetables, fiber-rich cereals and grains, fish and shell fish, and mutually for the sum of intakes of other meat types.

²Model 4 was adjusted as model 3 plus BMI.

³Model 5 was adjusted as model 3 plus 24-hr urinary sodium excretion.

Table S4. Estimated mean difference in BP associated with consumption of unprocessed or processed red meat (per 25 g/1000 kcal) stratified by BMI category¹

		Red meat	BMI	Systolic BP				Diastolic BP		
		(g/1000 kcal)	(kg/m ²)							
	N	Mean±SD	Mean±SD		Difference	95%CI	P	Difference	95%CI	P
Unprocessed red meat										
Total population										
Normal	1,544	15±18	21.8±2.1	Model 3 ²	0.14	(-0.86,1.13)	0.79	0.29	(-0.35,0.94)	0.37
				Model 4 ³	0.17	(-0.83,1.16)	0.74	0.31	(-0.34,0.96)	0.35
Overweight	1,578	18±18	25.7±2.5	Model 3 ²	0.48	(-0.45,1.41)	0.32	0.34	(-0.32,1.00)	0.31
				Model 4 ³	0.51	(-0.42,1.45)	0.28	0.37	(-0.29,1.02)	0.27
Obese	1,558	18±19	31.6±5.6	Model 3 ²	-0.06	(-1.03,0.90)	0.90	0.12	(-0.53,0.77)	0.71
				Model 4 ³	-0.07	(-1.04,0.90)	0.88	0.13	(-0.52,0.77)	0.69
East-Asian participants										
Normal	667	15±17	20.1±1.2	Model 3 ²	0.15	(-1.63,1.94)	0.86	0.05	(-1.04,1.15)	0.92
				Model 4 ³	0.21	(-1.58,1.99)	0.82	0.09	(-1.01,1.18)	0.88
Overweight	669	16±15	23.1±0.7	Model 3 ²	-0.52	(-2.29,1.25)	0.57	0.37	(-0.92,1.67)	0.57

				Model 4 ³	-0.48	(-2.26,1.29)	0.59	0.39	(-0.90,1.68)	0.55
Obese	648	14±15	26.8±2.2	Model 3 ²	0.03	(-1.99,2.05)	0.98	0.34	(-0.86,1.53)	0.58
				Model 4 ³	0.01	(-2.02,2.03)	0.99	0.34	(-0.86,1.53)	0.58
Western participants										
Normal	877	16±18	23.1±1.7	Model 3 ²	0.54	(-0.66,1.74)	0.38	0.64	(-0.16,1.45)	0.12
				Model 4 ³	0.15	(-1.05,1.35)	0.81	0.43	(-0.37,1.23)	0.30
Overweight	909	19±20	27.6±1.3	Model 3 ²	1.64	(0.45,2.83)	0.01	0.57	(-0.25,1.40)	0.17
				Model 4 ³	0.90	(-0.20,2.00)	0.11	0.36	(-0.40,1.12)	0.36
Obese	910	21±20	34.9±4.8	Model 3 ²	0.12	(-0.95,1.19)	0.82	0.51	(-0.23,1.26)	0.18
				Model 4 ³	-0.10	(-1.20,1.00)	0.86	0.04	(-0.73,0.82)	0.91
Processed red meat, Western participants only										
Normal	877	14±14	23.1±1.7	Model 3 ²	0.42	(-1.32,2.16)	0.63	0.04	(-1.12,1.21)	0.94
				Model 4 ³	1.00	(-0.60,2.60)	0.22	0.45	(-0.62,1.52)	0.41
Overweight	909	18±15	27.6±1.3	Model 3 ²	1.69	(0.20,3.17)	0.03	0.69	(-0.34,1.72)	0.19
				Model 4 ³	1.56	(0.12,2.99)	0.03	0.15	(-0.85,1.15)	0.77
Obese	910	21±17	34.9±4.8	Model 3 ²	1.03	(-0.25,2.31)	0.12	0.31	(-0.59,1.21)	0.50
				Model 4 ³	-0.13	(-1.50,1.24)	0.85	-0.34	(-1.30,0.62)	0.49

¹BMI categories are as follows: East Asian participants: normal weight ≤ 21.8 kg/m², overweight >21.8 - ≤ 24.4 kg/m², obese >24.4 kg/m².

Western participants: normal weight ≤ 25.5 kg/m², overweight >25.5 - ≤ 29.9 kg/m², obese >29.9 kg/m².

²Linear regression analyses adjusted as Model 3 including age, sex, sample, plus intakes of energy (kcal) and alcohol (g/d), smoking status (never, former, or current), years of education (years completed), physical activity during leisure time (a lot, moderate, little, none), use of dietary supplements (yes/no), adherence to any special diet (yes/no), history of cardiovascular disease or diabetes mellitus (yes/no), family history of cardiovascular disease (yes/no), use of antihypertensive, cardiovascular disease or diabetes medication (yes/no), and intakes (g/1000 kcal) of low-fat dairy products, raw fruits, raw and cooked vegetables, fiber-rich cereals and grains, fish and shell fish, and mutually for the sum of intakes of other meat types.

³Model 4 was adjusted as model 3 plus 24-hr urinary sodium excretion.

Table S5. Estimated mean difference in BP associated with consumption of unprocessed or processed red meat (per 25 g/1000 kcal) stratified by tertiles of urinary sodium to potassium excretion ratio¹

		Red meat (g/1000 kcal)	Urinary sodium to potassium ratio		Systolic BP			Diastolic BP		
	N	Mean±SD	Mean±SD		Difference	95%CI	P	Difference	95%CI	P
Unprocessed red meat										
Total population										
T1	1,560	17±18	2.1±0.5	Model 3 ¹	0.40	(-0.51,1.31)	0.39	0.39	(-0.23,1.00)	0.22
				Model 4 ²	-0.07	(-0.96,0.82)	0.88	0.13	(-0.48,0.74)	0.68
T2	1,560	18±18	3.4±0.4	Model 3 ¹	0.38	(-0.57,1.34)	0.43	0.38	(-0.28,1.05)	0.26
				Model 4 ²	0.19	(-0.73,1.11)	0.69	0.29	(-0.36,0.94)	0.38
T3	1,560	15±18	6.2±2.1	Model 3 ¹	0.68	(-0.47,1.83)	0.25	0.80	(0.05,1.55)	0.04
				Model 4 ²	0.32	(-0.81,1.46)	0.58	0.47	(-0.26,1.20)	0.21
East-Asian participants										
T1	661	17±16	3.1±0.6	Model 3 ¹	-0.69	(-2.51,1.13)	0.46	-0.39	(-1.56,0.77)	0.51
				Model 4 ²	-1.11	(-4.43,2.20)	0.51	-0.30	(-2.49,1.88)	0.79
T2	662	15±13	4.7±0.5	Model 3 ¹	-1.17	(-3.46,1.13)	0.32	-0.38	(-1.95,1.18)	0.63

				Model 4 ²	0.16	(-1.84,2.16)	0.88	0.21	(-1.10,1.53)	0.75
T3	661	12±18	7.8±2.1	Model 3 ¹	0.93	(-0.76,2.63)	0.28	1.26	(0.18,2.35)	0.02
				Model 4 ²	-0.41	(-1.79,0.97)	0.56	0.34	(-0.53,1.21)	0.44
Western participants										
T1	898	18±19	1.8±0.4	Model 3 ¹	0.18	(-1.00,1.35)	0.77	0.29	(-0.53,1.09)	0.49
				Model 4 ²	0.01	(-0.91,0.94)	0.98	0.17	(-0.47,0.80)	0.61
T2	899	17±19	2.7±0.3	Model 3 ¹	0.91	(-0.24,2.05)	0.12	0.66	(-0.11,1.43)	0.09
				Model 4 ²	0.20	(-0.84,1.23)	0.71	0.32	(-0.43,1.06)	0.41
T3	899	20±20	4.3±1.0	Model 3 ¹	1.08	(-0.08,2.25)	0.07	0.73	(-0.08,1.55)	0.08
				Model 4 ²	1.86	(-0.14,3.85)	0.07	0.77	(-0.57,2.10)	0.26
Processed red meat - Western participants only										
T1	898	14±14	1.8±0.4	Model 3 ¹	0.50	(-1.16,2.15)	0.56	0.91	(-0.23,2.04)	0.12
				Model 4 ²	0.23	(-0.95,1.42)	0.70	0.20	(-0.61,1.01)	0.63
T2	899	18±15	2.7±0.3	Model 3 ¹	0.61	(-0.78,2.01)	0.39	-0.53	(-1.47,0.41)	0.27
				Model 4 ²	0.13	(-1.18,1.45)	0.84	-0.71	(-1.66,0.25)	0.15
T3	899	21±16	4.3±1.0	Model 3 ¹	1.53	(0.10,2.95)	0.04	0.64	(-0.37,1.64)	0.21
				Model 4 ²	1.67	(-0.76,4.10)	0.18	0.35	(-1.27,1.98)	0.67

¹ Model 3 was adjusted for age, sex, sample, intakes of energy (kcal) and alcohol (g/d), smoking status (never, former, current), years of education (years completed), physical activity during leisure time (a lot, moderate, little, or none), use of dietary supplements (yes/no), adherence to any special diet (yes/no), history of cardiovascular disease or diabetes mellitus (yes/no), family history of cardiovascular disease (yes/no), use of antihypertensive, cardiovascular disease or diabetes medication (yes/no), and intakes (g/1000 kcal) of low-fat dairy products, raw fruits, raw and cooked vegetables, fiber-rich cereals and grains, fish and shell fish, and mutually for the sum of intakes of other meat types.

³Model 4 was adjusted as model 3 plus BMI.