

日本人の無機質摂取量の調査について

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A survey study on mineral intake of Japanese

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Dietary survey was carried out on eight different groups of Japanese and daily intake of various minerals of these groups were calculated from the food tables presented in various literatures.

The average daily intake of seven elements were estimated as follows: Calcium, 548 mg; magnesium, 213 mg; potassium, 2,618 mg; phosphorus, 1,121 mg; iron, 10.3 mg; zinc, 16.2 mg; and copper, 1.21 mg.

Among these groups, amount of mineral intake was especially low in the group of female students.

It is clarified that major food sources for minerals were different between peoples in rural area and urban area and between young generation and old generation.

近年、各種疾患と無機質との因果関係が注目されるようになってきたが、日本では無機質の所要量が決められているのはCaとFeのみで、NaとPの適正摂取量が提示されているに過ぎないのが現状である。又、実際に日本人の各種無機質摂取状況を把握するデータも殆んど見当ら

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ない。

今回は、各種無機質所要量の決定に資することを目的として、正常者各階層日本人の Ca, Mg, P, K, Fe, Zn, Cu の摂取状況について聞き取りによる栄養調査及び食事中無機質の実測により検討を加えた結果を報告する。

方 法

1. 調査対象

A市小学校給食	64食
C短期大学(女子)	40名 (延 280日分)
D女子大学	70名 (延 490日分)
B大学(男子)	27名 (延 189日分)
A市(自宅調理一般食)	6名
A市(市販調理済食)	8名
E市(自宅調理一般食)	57名 (延 399日分)
F市(")	90名 (延 630日分)

上記8群を対象として聞き取り記入式により食事調査を行った。又、A市市販調理済食及びA市自宅調査一般食については実測も併せ行った。

2. 無機質摂取量の算出法

食事調査で記入された各種食品名及び重量をパーソナルコンピュータ(NEC 8801型)に入力し、あらかじめ我々が寺岡ら¹⁾、武ら²⁾、四訂日本食品標準成分分析表³⁾及び当教室にて各種食品を実測して得た各種無機質の値を用いて作成したパーソナルコンピュータ用プログラムを用いて一食分又は一日分の各種無機質摂取量及び各種食品群別無機質摂取量を算出した。同時にその他の各種栄養素摂取量も算出した。

3. 食事中無機質の定量法

食事全量を献立別に適当量の再蒸溜水に加えて、ミキサーにて均一な液状にする。その一部(25~50ml)を灰化用キエルダールフラスコにとり、硝酸-過塩素酸法にて湿式灰化する。灰化後の試料は島津製作所原子吸光分光光度計(AA-646型)を用いて、Ca, Mg, Znは原子吸光法にて、Kは炎光法、又、FeとCuはフレーム原子吸光法にて測定した。PはChenらの方法⁴⁾にて測定した。

結果と考察

1. 実測値と計算値の相関

A市自宅調査一般食及びA市市販調理済食について実測値と計算値との相関々係を検討した結果は図1に示す様に良い相関が得られた。小学校給食，大学学生食堂食についても同様の良

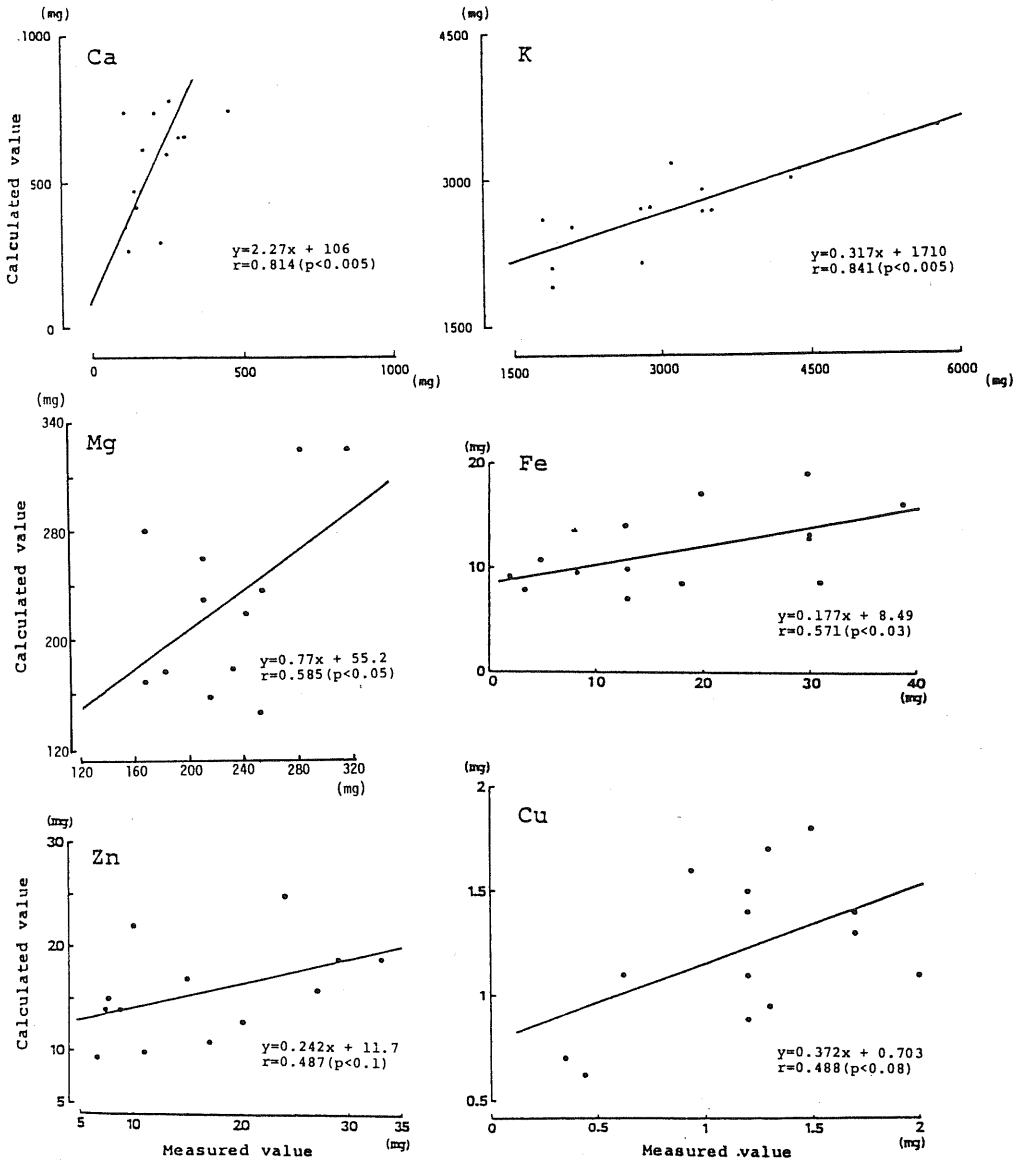


Fig. 1. Correlation between calculated value and measured value of mineral intake

い相関が得られた。従って、計算値から実際の摂取量を推定することは可能と考えられる。但し、Ca は実測値が計算値を下まわる場合が多いので注意が必要であろう。

2. Ca, Mg, K, P, Fe, Zn, Cu の摂取量

各種無機質の摂取量は表1に示す通りである。Caは小学校給食は単純に3倍にすると1041mg/dayとなり充分な量となるが、これはCa含有量が多い牛乳1本(1日にすると3本)

Table 1. Various mineral intake of Japanese in several groups.

	A. City school lunch*	C. College	D. Wemen's College	B. University	A. City	A. City cooked meal	E. City	F. Prefecture
	mean SD	mean SD	mean SD	mean SD	mean SD	mean SD	mean SD	mg/day mean SD
Ca	347 ± 97	485 ± 143	477 ± 163	558 ± 219	710 ± 540	618 ± 154	484 ± 206	507 ± 239
Mg	72 ± 15	155 ± 36	165 ± 53	226 ± 57	234 ± 59	199 ± 46	211 ± 96	300 ± 107
(Ca/Mg)	(4.8)	(3.1)	(2.9)	(2.4)	(3.0)	(3.1)	(2.3)	(1.7)
K	907 ± 173	1904 ± 388	2071 ± 666	2842 ± 732	2915 ± 355	2556 ± 379	2879 ± 952	3158 ± 1081
P	467 ± 69	911 ± 199	913 ± 254	1210 ± 260	1244 ± 474	1172 ± 141	1087 ± 318	1321 ± 491
(P/Ca)	(1.3)	(1.8)	(1.9)	(2.2)	(1.8)	(1.9)	(2.2)	(2.6)
Fe	3.4 ± 1.1	8.0 ± 2.3	8.0 ± 2.3	11.1 ± 2.2	12.2 ± 4.2	11.3 ± 2.7	10.2 ± 3.2	11.0 ± 3.7
Zn	4.8 ± 1.1	13.4 ± 6.2	18.4 ± 13.5	17.0 ± 4.8	22.9 ± 8.2	13.5 ± 3.1	14.8 ± 3.9	13.4 ± 8.7
Cu	0.34 ± 0.07	1.0 ± 0.4	0.9 ± 0.3	1.3 ± 0.3	1.5 ± 0.2	1.0 ± 0.3	1.4 ± 0.4	1.4 ± 0.5

* mg/lunch

が含まれているためである^{5,6)}。その他のグループを平均すると548mg/dayとなり、国民栄養調査結果⁷⁾と同様に600mg/dayの所要量をやゝ下まわる。特に、女子学生及び地方型のE市、F市では低値である。Mgは平均213mg/dayでアメリカの所要量の300mg/dayを大中に下まわり、特に女子学生は約160mg/dayと低値が目立った。又、Ca/Mg比についてみると、小学校給食は4.8と極立って高く、都市型の3.0から地方型では1.7位と低値になっている。食生活の欧米化に伴いCa/Mg比が上昇して来ており、Ca摂取の増加とともにMg摂取の増加も心がけなければならない。Kは平均2618mg/dayであるが、女子学生などは他無機質と同様低値である。Pは平均1121mg/dayでP/Caの比をとってみると都市型の1.3から地方型の2.6までの巾があるが、一応3以下で許容範囲と考えられる。Fe摂取量の平均値は10.3mg/dayと所要量に近い値であったが、女子学生が8.0mg/dayと女子所要量の12mgを大中に下まわっていた。Znは16.2mg/dayと日本のこれまでの文献値⁸⁾より高く、Cuは1.2mg/dayとむしろ低値であった^{1,2)}。

3. Ca, Mg, P, K, Fe, Zn, Cu の食品群別摂取量

各々の無機質の食品群別摂取量について検討を加えた結果は表2~8に示す通りである。即ち、Caについてみると小学校給食、C短大、D女子大、B大学などの若年層では乳類が主な摂取源になっているが、地方型のE市及びF県では乳類、魚介類、豆類、野菜類などから平均

Table 2. Calcium sources for various groups

	A. City school lunch*		C. College		D. Wemen's College		B. University		A. City cooked meal		E. City		F. Prefecture			
	Mean	SO	Mean	SO	Mean	SO	Mean	SO	Mean	SO	Mean	SO	Mean	SO		
cereals	38.74	[17.96]	41.94	[19.79]	33.87	[12.78]	38.66	[16.26]	26.26	[11.83]	35.93	[16.10]	24.42	[11.83]	27.50	[14.98]
potatoes and starches	2.94	[4.52]	6.25	[5.33]	3.27	[2.59]	5.90	[6.49]	9.73	[12.17]	9.13	[12.63]	7.64	[8.55]	5.81	[12.44]
sugars and sweetenings	0.02	[0.03]	0.09	[0.09]	0.09	[0.06]	0.29	[1.21]	0.20	[0.15]	0.30	[0.16]	0.83	[5.90]	0.14	[0.15]
confectioneries	0.00	[0.00]	25.89	[20.73]	19.59	[21.26]	19.35	[21.75]	7.46	[7.22]	3.25	[5.63]	6.94	[11.15]	6.97	[13.63]
fats and oils	0.58	[0.71]	0.43	[0.65]	0.45	[0.63]	0.11	[0.25]	0.00	[0.00]	0.25	[0.33]	0.04	[0.16]	0.05	[0.21]
nuts and seeds	2.91	[7.27]	2.34	[3.81]	3.89	[6.35]	4.82	[7.83]	22.00	[39.45]	31.50	[55.30]	3.29	[11.32]	5.05	[12.12]
pulses	26.80	[91.28]	36.72	[33.04]	38.97	[32.06]	65.62	[50.14]	195.77	[212.76]	43.14	[39.05]	96.17	[68.64]	73.95	[86.75]
fishes and shellfishes	7.59	[11.75]	31.54	[89.22]	25.89	[24.98]	40.48	[46.98]	54.83	[37.48]	85.03	[119.38]	88.42	[102.64]	91.69	[125.37]
meats	1.93	[1.88]	5.36	[2.76]	5.73	[3.06]	10.26	[4.29]	2.36	[2.94]	8.63	[3.78]	4.94	[3.21]	3.07	[5.22]
eggs	2.55	[6.63]	26.22	[12.91]	24.35	[12.23]	23.65	[10.92]	36.03	[18.44]	38.02	[21.28]	22.88	[15.50]	17.99	[20.49]
milk and dairy products	232.88	[59.68]	223.51	[106.36]	228.61	[130.37]	215.22	[214.53]	194.98	[288.80]	268.96	[160.77]	86.02	[104.07]	117.46	[139.03]
fruits	3.08	[5.33]	10.14	[11.05]	11.08	[11.07]	14.12	[14.38]	16.00	[19.28]	11.34	[10.84]	12.91	[16.62]	15.44	[20.50]
fungi	0.10	[0.27]	0.14	[0.20]	0.34	[0.49]	0.18	[0.24]	0.96	[0.99]	0.99	[1.96]	0.31	[0.52]	0.07	[0.17]
algae	2.10	[8.71]	11.89	[23.99]	17.13	[22.81]	22.21	[30.34]	20.59	[28.65]	26.54	[27.52]	42.42	[35.00]	42.82	[48.78]
beverages	0.01	[0.02]	7.98	[7.02]	9.23	[13.41]	12.45	[7.48]	6.34	[3.93]	2.85	[2.94]	6.41	[12.88]	7.60	[11.33]
seasonings and spices	2.40	[2.68]	7.04	[4.02]	9.24	[6.25]	12.10	[6.35]	9.30	[4.00]	12.38	[6.15]	3.01	[3.37]	9.76	[5.39]
prepared foods	0.00	[0.00]	0.00	[0.00]	0.01	[0.08]	1.74	[3.79]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]
vegetables 1 (retinol potency < 1000 IU)	15.49	[9.67]	36.30	[15.79]	37.44	[18.39]	57.57	[25.49]	79.36	[85.05]	32.98	[14.00]	66.66	[28.09]	69.49	[39.87]
vegetables 2 (retinol potency ≥ 1000 IU)	7.17	[8.67]	11.19	[10.39]	7.39	[5.79]	13.26	[11.99]	27.94	[19.10]	6.39	[4.84]	10.42	[14.51]	12.05	[35.98]

*mg/lunch

Table 3. Magnesium sources for various groups

	A. City school lunch*		C. College		D. Wemen's College		B. University		A. City cooked meal		E. City		F. Prefecture			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
cereals.....	14.94	[5.83]	26.06	[9.81]	22.80	[10.02]	27.60	[8.58]	18.87	[3.20]	22.53	[4.74]	20.33	[9.74]	66.97	[27.38]
potatoes and starches.....	4.89	[5.64]	10.14	[6.93]	7.91	[4.37]	12.14	[7.55]	12.06	[14.60]	16.36	[19.00]	12.85	[9.25]	17.17	[23.30]
sugars and sweetenings.....	0.00	[0.01]	0.02	[0.02]	0.02	[0.01]	0.01	[0.01]	0.04	[0.03]	0.06	[0.03]	0.01	[0.01]	0.03	[0.03]
confectioneries.....	0.00	[0.00]	13.79	[16.34]	20.10	[33.17]	9.24	[23.27]	24.32	[44.15]	1.88	[3.25]	8.47	[16.87]	11.14	[31.21]
fats and oils.....	0.60	[0.73]	0.44	[0.67]	0.47	[0.66]	0.12	[0.26]	0.00	[0.00]	0.26	[0.35]	0.04	[0.17]	0.05	[0.22]
nuts and seeds.....	0.80	[2.00]	1.19	[2.48]	1.32	[2.36]	1.94	[4.08]	6.05	[10.85]	8.66	[15.21]	1.05	[3.22]	2.02	[6.52]
pulses.....	3.52	[6.66]	9.14	[8.33]	10.06	[7.85]	15.96	[9.58]	26.93	[18.84]	13.88	[16.00]	27.90	[21.69]	23.73	[21.67]
fishes and shellfishes.....	3.43	[5.78]	8.77	[9.47]	9.30	[6.47]	17.30	[12.69]	21.40	[10.35]	24.41	[25.21]	19.46	[13.11]	38.29	[37.13]
meats.....	5.21	[4.60]	12.26	[6.75]	14.12	[8.01]	27.69	[11.58]	2.75	[3.45]	18.51	[7.44]	14.09	[9.56]	8.77	[15.06]
eggs.....	0.46	[1.21]	4.70	[2.33]	4.40	[2.23]	4.05	[1.97]	6.55	[3.35]	6.91	[3.87]	4.17	[2.84]	3.24	[3.74]
milk and dairy products.....	20.42	[7.05]	18.70	[9.56]	18.89	[11.43]	18.25	[19.78]	19.22	[26.48]	20.63	[15.20]	7.12	[9.12]	10.73	[13.06]
fruits.....	1.64	[3.33]	8.17	[8.47]	8.96	[9.22]	13.08	[9.47]	12.51	[13.70]	7.29	[7.34]	8.56	[10.41]	24.77	[42.20]
fungi.....	0.31	[0.55]	0.60	[0.86]	2.55	[4.33]	0.78	[1.01]	9.12	[9.36]	3.00	[4.56]	3.34	[6.02]	0.79	[1.96]
algae.....	0.78	[3.35]	4.80	[11.64]	3.17	[7.11]	11.60	[21.61]	14.95	[32.63]	16.35	[28.06]	26.15	[40.57]	12.74	[26.30]
beverages.....	0.00	[0.00]	8.11	[9.92]	7.48	[9.47]	16.99	[16.43]	5.57	[3.81]	2.47	[3.19]	14.65	[48.87]	13.94	[24.19]
seasonings and spices.....	3.43	[1.81]	7.51	[5.06]	10.86	[6.52]	13.73	[7.60]	20.28	[11.78]	19.62	[9.66]	3.54	[4.49]	23.57	[12.61]
prepared foods.....	0.00	[0.00]	0.00	[0.00]	0.05	[0.42]	0.31	[0.95]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]
vegetables 1 (retinol potency < 1000 IU).....	7.02	[3.87]	15.05	[6.36]	19.29	[10.42]	26.08	[11.08]	18.98	[4.43]	14.39	[6.29]	34.16	[16.05]	36.67	[24.14]
vegetables 2 (retinol potency ≥ 1000 IU).....	4.68	[9.28]	5.74	[5.26]	3.96	[4.20]	8.81	[11.34]	14.23	[18.94]	1.92	[1.40]	4.82	[6.44]	5.39	[16.74]

*mg/lunch

Table 4. Potassium sources for various groups

	A. City school lunch*		C. College		D. Women's College		B. University		A. City cooked meal		E. City		F. Prefecture			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
cereals	113.08	[27.06]	202.23	[67.46]	168.83	[63.49]	231.95	[64.91]	175.37	[44.13]	210.24	[108.65]	201.47	[52.67]	361.59	[129.23]
potatoes and starches	88.45	[105.53]	188.80	[150.90]	151.44	[90.55]	234.65	[160.78]	274.00	[340.83]	324.17	[368.45]	204.64	[144.11]	280.69	[338.70]
sugars and sweetenings	0.06	[0.10]	0.32	[0.45]	0.30	[0.22]	0.88	[3.71]	0.77	[0.74]	0.89	[0.47]	3.12	[22.30]	0.45	[0.53]
confectioneries	0.00	[0.00]	78.48	[59.49]	52.15	[62.31]	44.39	[49.69]	53.08	[83.91]	11.88	[20.57]	16.46	[28.05]	14.23	[29.18]
fats and oils	2.09	[2.56]	1.56	[2.37]	1.65	[2.31]	0.42	[0.90]	0.00	[0.00]	0.90	[1.21]	0.14	[0.58]	0.18	[0.77]
nuts and seeds	0.99	[2.48]	8.42	[20.97]	4.99	[21.28]	9.47	[18.86]	7.52	[13.48]	10.76	[18.89]	2.42	[9.05]	7.15	[32.37]
pulses	21.63	[65.07]	65.49	[73.04]	63.14	[61.66]	86.07	[65.94]	101.56	[52.51]	175.47	[265.81]	243.14	[268.93]	130.19	[143.98]
fishes and shellfishes	40.49	[63.94]	126.78	[104.52]	152.62	[105.85]	255.62	[143.57]	369.99	[189.90]	256.29	[206.54]	355.79	[231.43]	445.05	[478.80]
meats	61.82	[47.18]	180.14	[91.11]	200.86	[97.67]	362.04	[131.01]	87.83	[105.83]	301.88	[111.70]	194.98	[131.67]	111.85	[166.79]
eggs	5.57	[14.47]	57.28	[28.16]	52.98	[26.62]	52.22	[24.23]	78.60	[40.24]	82.95	[46.42]	50.11	[34.20]	39.11	[44.78]
milk and dairy products	306.13	[64.47]	291.41	[131.79]	303.99	[179.26]	296.79	[295.88]	262.11	[369.96]	353.15	[235.17]	119.39	[144.22]	162.12	[197.99]
fruits	26.70	[44.24]	114.18	[107.71]	169.74	[175.62]	220.25	[191.25]	199.65	[193.79]	88.31	[84.55]	231.27	[261.92]	287.62	[384.72]
fungi	4.21	[7.83]	10.56	[14.41]	38.57	[62.87]	14.24	[18.37]	141.00	[142.03]	38.19	[52.96]	50.81	[89.49]	11.39	[28.56]
algae	12.58	[42.94]	61.33	[139.85]	120.14	[172.32]	127.09	[173.23]	162.17	[243.35]	174.75	[189.33]	302.22	[292.08]	232.55	[271.95]
beverages	0.03	[0.06]	87.96	[73.75]	88.58	[70.97]	171.37	[125.44]	88.98	[62.44]	44.65	[56.61]	103.80	[251.51]	94.42	[143.11]
seasonings and spices	27.33	[19.50]	60.40	[35.88]	77.90	[51.07]	90.76	[51.68]	108.96	[66.23]	131.33	[96.71]	21.94	[25.97]	134.27	[70.33]
prepared foods	0.00	[0.00]	0.00	[0.00]	0.73	[6.10]	13.56	[29.38]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]
vegetables 1 (retinol potency < 1000 IU)	110.93	[56.09]	262.14	[119.87]	342.76	[173.60]	477.58	[180.72]	539.12	[520.68]	290.24	[123.44]	675.01	[286.62]	747.77	[486.07]
vegetables 2 (retinol potency ≥ 1000 IU)	84.42	[117.70]	106.03	[76.39]	79.15	[66.79]	152.29	[156.84]	264.42	[233.53]	59.69	[48.34]	102.20	[117.58]	97.33	[267.76]

*mg/lunch

Table 5. Phosphor sources for various groups

	A. City school lunch*		C. College		D. Women's College		B. University		A. City		A. City cooked meal		E. City		F. Prefecture mg/day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
cereals.....	88.49	[12.41]	168.61	[52.17]	146.54	[53.96]	203.16	[52.22]	187.88	[42.52]	162.06	[44.55]	205.49	[46.21]	431.34	[164.56]
potatoes and starches.....	10.51	[12.11]	20.54	[14.13]	17.19	[9.85]	25.87	[14.65]	25.22	[28.18]	38.18	[42.18]	21.97	[15.64]	33.45	[39.52]
sugars and sweetenings.....	0.00	[0.00]	0.02	[0.13]	0.01	[0.05]	0.00	[0.02]	0.09	[0.21]	0.00	[0.00]	0.04	[0.20]	0.02	[0.11]
confectioneries.....	0.00	[0.00]	44.89	[40.72]	39.51	[34.46]	31.66	[30.65]	24.26	[26.63]	6.25	[10.83]	14.97	[20.75]	13.92	[27.55]
fats and oils.....	0.52	[0.64]	0.39	[0.59]	0.41	[0.58]	0.10	[0.23]	0.00	[0.00]	0.23	[0.30]	0.04	[0.15]	0.04	[0.19]
nuts and seeds.....	1.36	[3.39]	4.83	[10.75]	3.69	[11.05]	6.37	[10.10]	10.27	[18.41]	14.70	[25.81]	1.79	[5.47]	5.11	[17.82]
pulses.....	20.50	[59.05]	40.05	[38.24]	37.60	[26.77]	58.94	[38.49]	187.35	[222.03]	65.28	[80.35]	117.03	[90.68]	75.39	[70.85]
fishes and shellfishes.....	29.13	[38.92]	97.38	[87.85]	105.91	[71.12]	171.28	[103.34]	247.99	[135.33]	181.90	[152.62]	251.61	[173.58]	285.32	[281.11]
meats.....	42.83	[32.17]	118.06	[54.32]	130.75	[65.23]	237.87	[85.38]	67.47	[80.62]	191.14	[97.13]	132.00	[86.94]	69.13	[101.67]
eggs.....	9.28	[24.11]	95.36	[46.94]	88.54	[44.46]	87.35	[40.43]	131.00	[67.07]	138.25	[77.37]	83.23	[56.42]	65.42	[74.49]
milk and dairy products.....	225.66	[66.26]	222.95	[107.93]	215.73	[123.75]	212.19	[200.67]	182.46	[281.27]	255.24	[148.29]	80.54	[98.41]	112.15	[136.81]
fruits.....	2.87	[4.55]	10.89	[10.32]	15.73	[16.28]	20.83	[20.34]	18.22	[18.82]	10.12	[9.78]	19.34	[22.40]	23.87	[30.59]
fungi.....	0.89	[1.67]	2.09	[3.05]	5.51	[8.10]	2.53	[3.78]	18.60	[18.67]	6.13	[8.03]	6.93	[11.81]	1.47	[3.68]
algae.....	0.46	[1.54]	5.75	[11.25]	8.46	[9.55]	11.33	[13.15]	10.68	[13.19]	6.06	[6.39]	22.38	[17.78]	17.22	[22.51]
beverages.....	0.02	[0.06]	13.84	[13.57]	10.85	[12.61]	36.17	[37.55]	7.09	[4.10]	4.09	[3.84]	24.91	[62.33]	33.95	[60.07]
seasonings and spices.....	7.61	[4.23]	17.35	[10.04]	20.59	[13.24]	22.24	[11.28]	42.69	[24.56]	46.45	[25.74]	7.81	[6.94]	44.62	[24.90]
prepared foods.....	0.00	[0.00]	0.00	[0.00]	0.09	[0.78]	5.03	[10.47]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]
vegetables 1 (retinol potency < 1000 IU).....	19.56	[11.26]	38.85	[15.58]	48.91	[25.75]	64.21	[12.37]	57.78	[40.15]	40.75	[14.78]	88.18	[35.83]	100.73	[63.04]
vegetables 2 (retinol potency ≥ 1000 IU).....	7.19	[9.51]	9.09	[6.32]	6.87	[5.65]	12.84	[12.93]	25.06	[21.59]	5.41	[4.28]	9.17	[10.73]	7.73	[17.74]

*mg/lunch

Table 6. Iron sources for various groups

	A. City school lunch*		C. College		D. Women's College		B. University		A. City cooked meal		E. City		F. Prefecture			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
cereals.	1.07	[0.43]	1.43	[0.59]	1.26	[0.48]	1.46	[0.51]	1.02	[0.22]	1.29	[0.40]	1.04	[0.36]	1.82	[0.66]
potatoes and starches	0.12	[0.12]	0.25	[0.20]	0.19	[0.12]	0.31	[0.21]	0.37	[0.42]	0.44	[0.46]	0.26	[0.18]	0.33	[0.38]
sugars and sweetenings	0.00	[0.00]	0.01	[0.03]	0.01	[0.01]	0.01	[0.01]	0.03	[0.04]	0.03	[0.02]	0.03	[0.16]	0.02	[0.03]
confectioneries	0.00	[0.00]	0.50	[0.74]	0.36	[0.31]	0.26	[0.24]	0.30	[0.43]	0.04	[0.06]	0.18	[0.27]	0.19	[0.35]
fats and oils	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]
nuts and seeds	0.02	[0.06]	0.04	[0.06]	0.04	[0.08]	0.06	[0.08]	0.18	[0.33]	0.26	[0.46]	0.03	[0.10]	0.05	[0.13]
pulses	0.37	[1.03]	0.74	[0.67]	0.71	[0.50]	1.07	[0.68]	2.97	[2.98]	1.29	[1.66]	2.10	[1.57]	1.43	[1.24]
fishes and shellfishes.	0.18	[0.28]	0.74	[0.74]	0.66	[0.50]	1.18	[0.98]	1.49	[1.03]	1.47	[1.56]	1.41	[0.89]	1.75	[1.67]
meats	0.46	[0.38]	1.25	[0.74]	1.40	[0.76]	2.61	[1.04]	0.41	[0.59]	2.66	[2.93]	1.35	[0.90]	0.76	[1.21]
eggs	0.08	[0.22]	0.86	[0.43]	0.80	[0.40]	0.78	[0.36]	1.18	[0.60]	1.24	[0.70]	0.75	[0.51]	0.59	[0.67]
milk and dairy products.	0.22	[0.03]	0.21	[0.09]	0.22	[0.12]	0.20	[0.20]	0.16	[0.26]	0.27	[0.18]	0.08	[0.10]	0.11	[0.13]
fruits.	0.08	[0.14]	0.12	[0.12]	0.22	[0.29]	0.28	[0.27]	0.20	[0.20]	0.07	[0.06]	0.29	[0.28]	0.51	[0.67]
fungi.	0.01	[0.02]	0.03	[0.06]	0.09	[0.14]	0.04	[0.05]	0.26	[0.27]	0.24	[0.49]	0.10	[0.17]	0.02	[0.05]
algae	0.04	[0.28]	0.25	[0.57]	0.20	[0.21]	0.36	[0.48]	0.21	[0.27]	0.45	[0.88]	0.57	[0.56]	0.71	[1.16]
beverages.	0.00	[0.00]	0.15	[0.25]	0.21	[0.30]	0.08	[0.13]	0.11	[0.12]	0.00	[0.00]	0.21	[1.24]	0.01	[0.11]
seasonings and spices	0.16	[0.13]	0.45	[0.28]	0.56	[0.37]	0.77	[0.44]	0.70	[0.37]	0.79	[0.41]	0.18	[0.24]	0.87	[0.44]
prepared foods.	0.00	[0.00]	0.00	[0.00]	0.00	[0.01]	0.07	[0.14]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]
vegetables 1 (retinol potency < 1000 IU). . .	0.27	[0.13]	0.57	[0.23]	0.76	[0.46]	1.03	[0.38]	1.34	[1.72]	0.58	[0.22]	1.27	[0.53]	1.44	[0.90]
vegetables 2 (retinol potency ≥ 1000 IU). . .	0.31	[0.60]	0.40	[0.36]	0.27	[0.27]	0.58	[0.73]	1.30	[1.11]	0.13	[0.11]	0.35	[0.45]	0.36	[1.11]

*mg/lunch

Table 7. Zinc sources for various groups

	A. City school lunch*		C. College		D. Women's College		B. University		A. City cooked meal		E. City		F. Prefecture			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
cereals	1647.14	[588.36]	4537.92	[2228.35]	3467.80	[1312.41]	5899.00	[1902.18]	6097.05	[2955.45]	4366.27	[2065.05]	7001.68	[1689.70]	4806.24	[2032.97]
potatoes and starches	96.63	[109.85]	166.84	[99.98]	134.68	[73.94]	233.86	[189.32]	311.58	[416.92]	301.55	[333.93]	235.98	[196.06]	259.67	[303.55]
sugars and sweetenings	5.44	[8.70]	25.39	[21.64]	24.77	[16.03]	13.39	[11.38]	53.71	[37.49]	80.54	[43.09]	10.99	[16.30]	37.58	[39.32]
confectioneries	0.00	[0.00]	106.81	[117.71]	115.23	[130.49]	96.09	[152.05]	146.18	[217.00]	0.00	[0.00]	163.72	[330.08]	154.15	[531.71]
fats and oils	30.84	[30.47]	31.22	[30.71]	32.81	[29.31]	20.42	[14.56]	15.97	[3.47]	32.24	[16.26]	4.76	[8.25]	12.14	[15.20]
nuts and seeds	26.64	[66.65]	34.84	[71.34]	35.51	[59.86]	66.13	[134.45]	201.67	[361.59]	288.75	[506.89]	33.49	[105.26]	46.89	[122.39]
pulses	140.26	[281.52]	468.19	[414.51]	439.92	[321.44]	799.30	[491.51]	2638.87	[2677.06]	425.68	[514.89]	1118.42	[885.44]	1097.84	[1205.81]
fishes and shellfishes	109.68	[180.70]	1564.85	[3923.21]	315.18	[308.46]	1116.28	[2183.60]	726.11	[729.37]	1131.28	[1347.22]	640.55	[984.21]	1213.66	[1258.21]
neats	774.29	[916.79]	2098.81	[1156.36]	2015.33	[1088.25]	3671.62	[1386.67]	702.08	[863.01]	1927.86	[1165.98]	2144.05	[1663.35]	1082.36	[1941.88]
eggs	134.58	[349.60]	1362.56	[675.42]	1277.97	[647.18]	1170.30	[564.14]	1899.50	[972.51]	2004.63	[1121.89]	1167.63	[793.27]	941.62	[1084.28]
milk and dairy products	1406.70	[636.31]	1395.60	[812.31]	1229.78	[735.47]	1216.45	[1203.35]	1159.08	[1849.21]	1369.87	[820.00]	438.06	[586.37]	683.00	[932.52]
fruits	19.66	[58.90]	55.73	[62.25]	66.87	[61.62]	119.75	[112.20]	73.92	[86.83]	20.45	[31.90]	102.72	[141.14]	402.88	[728.86]
fungi	6.53	[14.36]	19.12	[26.82]	67.41	[116.42]	27.33	[37.48]	245.10	[251.47]	71.18	[96.13]	89.87	[161.97]	21.19	[52.78]
algae	35.79	[242.44]	134.03	[463.27]	58.25	[93.46]	184.95	[398.31]	107.45	[210.60]	406.44	[762.63]	229.23	[383.28]	151.62	[310.01]
beverages	0.00	[0.00]	721.94	[1039.05]	8340.65	[12815.60]	1176.98	[2176.77]	7061.68	[7483.07]	77.96	[84.27]	532.57	[1937.49]	1178.56	[6709.75]
seasonings and spices	84.09	[69.57]	198.60	[110.22]	277.17	[178.69]	316.80	[150.16]	522.87	[285.14]	610.70	[344.70]	116.06	[102.75]	469.28	[247.05]
prepared foods	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	8.15	[30.47]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]
vegetables 1 (retinol potency < 1000 IU)	155.83	[79.39]	312.52	[130.96]	385.27	[203.02]	540.15	[216.94]	401.85	[84.62]	331.83	[136.99]	631.47	[268.48]	696.75	[433.22]
vegetables 2 (retinol potency ≥ 1000 IU)	144.75	[328.62]	175.85	[177.86]	116.70	[140.22]	275.12	[394.29]	492.42	[661.63]	36.39	[26.72]	140.68	[217.79]	138.97	[476.88]

*µg/lunch

Table 8. Copper sources for various groups

	A. City school lunch*		C. College		D. Women's College		B. University		A. City cooked meal		E. City		F. Prefecture			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
cereals	184.84	[55.29]	477.34	[207.33]	391.84	[147.80]	631.66	[206.40]	642.48	[300.98]	463.87	[196.45]	764.23	[189.65]	631.72	[269.20]
potatoes and starches	25.39	[30.35]	49.57	[34.99]	39.98	[24.11]	61.19	[35.46]	57.25	[69.94]	82.53	[102.23]	58.95	[43.49]	93.91	[129.19]
sugars and sweetenings	0.60	[0.96]	2.70	[2.11]	2.66	[1.71]	1.47	[1.25]	5.54	[3.66]	8.85	[4.74]	1.16	[1.74]	4.06	[4.21]
confectioneries	0.00	[0.00]	34.10	[29.07]	23.02	[31.87]	27.28	[59.44]	26.32	[41.93]	0.00	[0.00]	15.77	[32.09]	9.70	[24.37]
fats and oils	1.99	[1.45]	2.60	[1.89]	2.82	[1.74]	2.50	[1.22]	2.38	[0.52]	3.69	[1.54]	0.52	[0.70]	1.56	[1.81]
nuts and seeds	4.12	[10.30]	5.56	[11.63]	5.50	[9.34]	9.80	[19.01]	31.17	[55.88]	44.63	[78.34]	6.16	[19.03]	7.38	[19.53]
pulses	18.92	[37.38]	59.65	[55.40]	59.88	[39.12]	100.15	[57.75]	248.57	[290.74]	61.29	[72.66]	158.33	[125.05]	156.73	[134.97]
fishes and shellfishes	8.32	[15.30]	100.54	[242.42]	31.26	[26.08]	83.72	[132.74]	86.11	[52.09]	52.48	[58.69]	59.19	[73.44]	158.83	[173.70]
meats	16.97	[15.17]	53.28	[32.72]	54.27	[35.48]	107.24	[61.92]	20.54	[26.60]	58.86	[36.09]	51.77	[36.14]	27.33	[42.96]
eggs	4.04	[10.49]	40.87	[20.26]	38.32	[19.41]	35.09	[16.92]	56.99	[29.18]	60.14	[33.66]	35.03	[23.80]	28.23	[32.54]
milk and dairy products	26.03	[11.40]	26.62	[14.92]	25.03	[14.24]	23.89	[22.40]	26.62	[34.10]	25.55	[15.39]	8.58	[11.18]	14.14	[17.22]
fruits	6.06	[11.53]	29.00	[29.53]	24.20	[21.86]	50.04	[56.28]	50.90	[43.44]	5.60	[9.70]	46.74	[66.19]	88.00	[132.18]
fungi	1.82	[4.01]	4.90	[6.84]	19.13	[32.56]	8.10	[10.77]	68.40	[70.18]	27.39	[42.39]	25.24	[45.10]	5.91	[14.73]
algae	0.55	[2.36]	2.58	[5.90]	2.72	[4.48]	5.61	[10.25]	6.61	[13.44]	8.78	[11.39]	12.03	[16.58]	7.88	[13.18]
beverages	0.00	[0.00]	32.37	[49.85]	78.50	[105.84]	34.55	[32.93]	57.23	[57.49]	3.20	[3.10]	52.03	[264.15]	29.40	[64.65]
seasonings and spices	10.96	[11.80]	25.22	[15.60]	44.12	[28.18]	57.14	[34.96]	43.75	[18.71]	59.66	[46.33]	11.83	[19.82]	48.53	[26.49]
prepared foods	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	1.48	[5.54]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]	0.00	[0.00]
vegetables 1 (retinol potency < 1000 IU)	20.48	[11.32]	40.70	[17.76]	63.28	[36.35]	82.65	[32.33]	49.35	[12.67]	44.58	[20.86]	122.45	[59.66]	119.69	[83.25]
vegetables 2 (retinol potency ≥ 1000 IU)	12.29	[20.96]	15.80	[13.89]	10.83	[10.35]	23.07	[26.26]	33.55	[43.15]	7.02	[5.09]	13.51	[16.14]	13.00	[33.57]

*µg/lunch

的に摂取している。一般に Mg の主な摂取源は穀類であり、次いで、野菜、魚介、肉、乳類等から平均的に摂取しているが、小学校給食は乳類への偏よりが大きく、女子学生では菓子類の摂食が多いため菓子類も大きく寄与している。次いで、K は小学校給食及び女子学生では乳類からの摂取が大きな割合を占めるが、一般には穀類、いも、魚介、肉、乳、野菜類等から平均して摂取している。P も小学校給食、女子学生は主摂取源を乳類に依存しているが、他は、穀物、豆、魚介、乳類が主摂取源となっている。Fe は穀類を主摂取源として、小学校給食を除く都市型は魚介、肉類など動物性食品を中心に、地方型は豆、野菜類を含めた動植物両食品より摂取している。特に女子学生では野菜類の摂取不足が Fe 不足の一因となっていると考えられる。Zn は穀類を筆頭に、豆、魚介、肉、卵、乳類及び嗜好飲料類等 巾広く種々の食品より摂取されている。次に、Cu は穀類依存型の代表的な無機質であり、その他、豆類、野菜類など植物性食品からの摂取が多かった。

結 論

1. 各種年齢層の 8 つのグループを対象として Ca, Mg, K, P, Fe, Zn, Cu の 7 種の無機質の摂取量を検討した。
2. これら無機質の平均一日摂取量は Ca 548mg, Mg 213mg, K 2618mg, P 1121mg, Fe 10.3 mg, Zn 16.2mg, Cu 1.21mg であった。女子学生では Ca, Mg, K, P, Fe の摂取量の低値が顕著であった。
3. これら無機質の食品群別摂取量をみると、都会又は地方、若年層又は成人層などの違いによってその摂取源が異なることが明らかとなった。

文 献

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