資料2

環境がもたらした健康被害

－食品との関係からリスクコミュニケーションを考える－

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1

環境･栄養･健康

- 職業病
- 風土病

  ヒ素中毒　水俣病　イタイイタイ病　四日市喘息

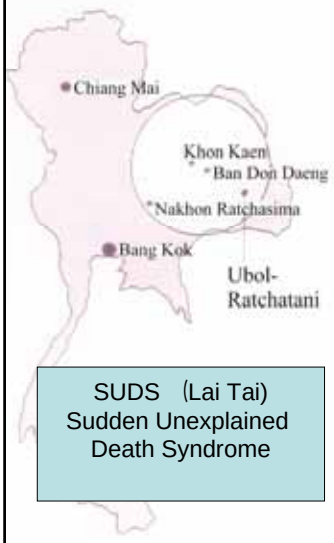
  克山病 (Keshan disease)
- 環境ホルモン
- 化学物質化敏捷
- シックハウス症候群

2

アラル海の縮小に伴う付近住民の健康被害調査

東北タイに見られる突然死症候群

Thailand



SUDS （Lai Tai)
Sudden Unexplained
Death Syndrome

Reported incidence of SUDS among Thai workers in Singapore, 1982 - 1994

1982	11	from Goh K et al. (1993)
83	19	
84	25	
85	23	
86	23	
87	23	
88	40	
89	35	
90	36	subtotal 235
91	32	from Royal Thai Embassy in Singapore (1994)
92	39	
93	59	
94	33*	subtotal 163

Total 398 (* as of 23th May)

4

機内食の食塩中元素濃度

Airline	Mg	K	Ca	Rb	V	Cr	Co	Ni	Cu	As	Mo
	ug/g				ng/g						
Thai Airline											
Tokyo→Bangkok	ND	7	16	ND	24	ND	ND	ND	ND	273	321
Bangkok→Tokyo	ND	22	12	199	565	278	202	462	1361	406	203
Purket→Bangkok	ND	6	4	126	487	160	821	113	342	508	142
JAL	150	679	171	109	383	43	75	420	313	482	59
ANA	563	1399	526	231	378	176	15	162	441	744	35
Singapore Airline	ND	18	17	81	485	116	82	280	575	776	169
Air India											
Delhi→Tokyo	1	9	6	55	475	59	403	755	629	629	123
Tribandarum→Mumbai	1	6	2694	97	491	120	48	370	437	709	271
Air China	160	106	941	296	385	122	21	94	1158	386	175

食事中元素濃度

			Ca	Fe	K	Mg	Na	Zn	P	Se	Cd	Cr	Pb	Sn
Food of male patient	,1990	(exclude rice)	479	26.3	1528	151.2	3390	10.9	803	0.063	ND	0.3	0.24	5.95
Food of male patient	,1990	(include rice)	112	67.5	398	58.5	945	7.6	375	0.031	31.95	0.09	0.23	0.41
Food of male patient	,1989	(exclude rice)	609	19.5	1106	116.5	2614	9.7	357	0.074	2.25	0.4	0.53	3.32
Food of male patient	,1989	(include rice)	57	26.5	246	30.3	848	9.0	97	0.032	0.75	0.06	0.22	1.54
Food of female patient	,1989	(exclude rice)	156	81	1202	89.9	2692	1.9	340	0.036	4.25	0.11	0.25	4.83
Food of female patient	,1989	(include rice)	72	43.2	662	72	1094	3.8	184	0.021	4.8	0.33	0.18	6.03
Food of all villagers	,1989		270	73.4	884	92.7	2372	ND	319	0.004	1.93	0.17	0.38	0.93

コンケン地区の食塩中元素濃度

	Ca	Fe	K	Mg	Na *	Zn	Se	Cd	Cr	Pb	Sn
Salt from diary shop	2413	17.2	18922	905	273	ND	ND	ND	0.28	ND	ND
Iodine salt in Bangkok	258	25.8	4956	1897	281	ND	0.035	ND	1.97	ND	ND
Table salt at restaurant	2845	15.8	5256	791	316	ND	0.014	ND	0.24	ND	ND
Salt from male patient	4214	20.6	7190	868	314	ND	0.076	ND	0.18	ND	ND
Salt from female patient	3076	23	3423	385	268	ND	0.154	ND	0.23	ND	ND
Salt in Japan	144	ND	1971	3605	292	ND	0.031	ND	ND		ND

unit : ug/g wet weight
* : unit mg/g

6

Element Concentrations in Rice Produced in Thailand (TH) and Japan (JP)

	Sticky rice				Regular rice					
	TH (n=2)	TH (n=7)			TH (n=3)			TH (n=7)		JP (n=2)
	Hulled	Unhulled			Hulled			Unhulled		Unhulled
	MEAN	MEAN	±	SD	MEAN	±	SD	MEAN	± SD	MEAN
Ca (ug/g)	88.8	47.8	±	6.5	68.1	±	4.2	39.9	± 13.4	45.7
Cu (ug/g)	1.0	1.1	±	0.3	1.2	±	0.3	1.0	± 0.3	1.3
Fe (ug/g)	4.5	2.0	±	0.5	4.9	±	0.2	1.6	± 0.9	1.4
K (ug/g)	1963	866	±	159	2056	±	197	572	± 319	745
Mg (ug/g)	932	248	±	97	1155	±	162	166	± 126	217
Mn (ug/g)	15.3	9.1	±	1.0	14.1	±	0.8	6.4	± 3.2	6.8
Na (ug/g)	15.1	24.0	±	11.6	34.8	±	19.4	38.0	± 24.0	38.5
Rb (ug/g)	19.6	6.6	±	3.8	8.0	±	2.2	4.4	± 3.8	0.8
Zn (ug/g)	17.1	16.6	±	1.3	15.0	±	2.9	13.0	± 4.0	10.4
Cd (ng/g)	0.3	9.4	±	11.8	ND			14.6	± 25.7	51.6
Se (ng/g)	8.9	86.1	±	52.3	33.9	±	30.4	93.8	± 67.2	ND
Sr (ng/g)	265.6	51.3	±	19.7	210.0	±	46.0	70.9	± 22.5	23.8

7

Fig.1 Remained K or Mg (%) in rice during preparing process

		Sticky rice		Regular rice	
		Without hull(7)	With hull(2)	Without hull(7)	With hull(3)
a		100.0	100.0	100.0	100.0
b	K	20.5	97.8	44.9	101.7
c	K	10.5	78.6	15.6	101.4
d	K	11.7	82.3	21.9	81.8
e	K	7.6	107.1	25.1	105.1
b	Mg	41.6	110.7	63.4	110.5
c	Mg	25.7	93.7	35.0	105.4
d	Mg	24.7	93.9	48.6	102.5
e	Mg	15.1	114.8	36.9	115.0

a : Non treatment

b : Soak in 25℃ water for one night

c : Soak in 35℃ water for one night

d : (b) was steamed for 20 min.

e : (c) was steamed for 20 min.

8

マウスによる動物実験

- マウス (ICR) 8週齢
  (各群8匹)

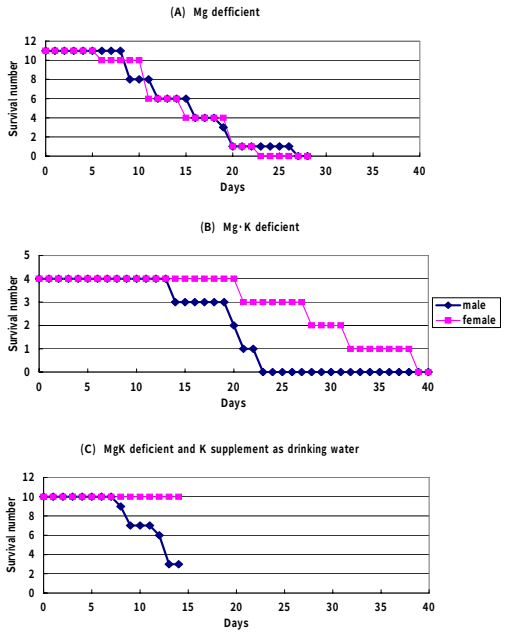
飼料:

♂ Mg欠乏食群
Mg･K欠乏食群
Mg･K欠乏食群

♀ Mg 欠乏食群
Mg･K欠乏食群
Mg･K欠乏食群

飲料水: 脱イオン水
リン酸カリ水溶液

9



Survival number of Mg or Mg･K deficient mice

10

実験

【動物】　：マウス ICR ♂（7週齢）

【飼育条件】

人工気候室　温度：23 ±0.5℃
湿度：60±5%
明暗：7:00-19:00 12時間交代

【実験スケジュール】

1　Control group　通常食　(Mg含量 0.29%)
2　Hypo-Mg group　Mg欠乏食 (Mg含量 0.00%)

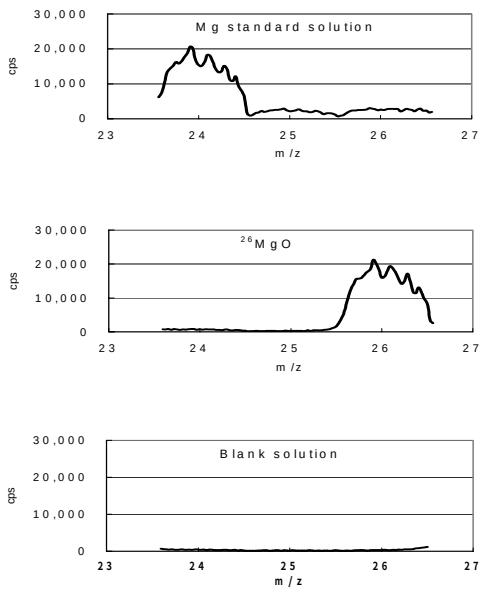
一週間飼育後 ^{26}Mg 負荷：10 mg ^{26}Mg/kg体重 iv投与
（投与液：^{26}MgOを少量の希塩酸溶液に溶解後、NaOH溶液で中和）

【分析用試料の採取】
投与直前、投与後１，６，２０時間後にエーテル麻酔下で血液採取
頚椎脱臼後、各臓器摘出

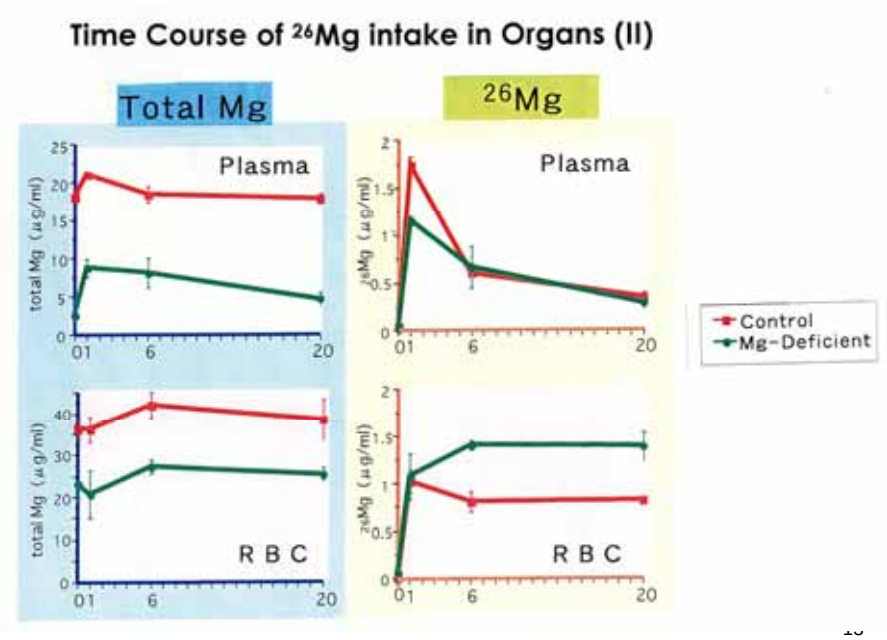
投与後 20時間までの尿および糞をメタボリックケージにて分別採取

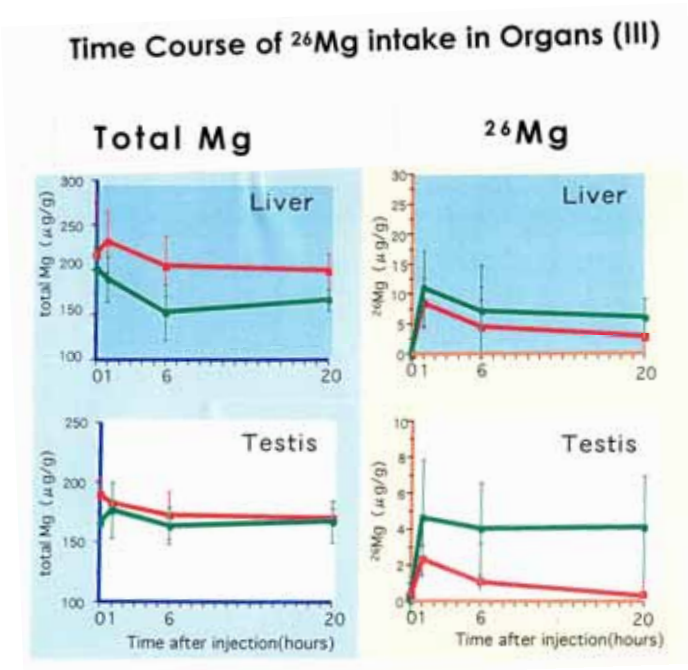
【分析試料】
血液（plasma, RBC)、心臓、腎臓、肝臓、精巣、尿、糞

Spectra of Mg isotopes

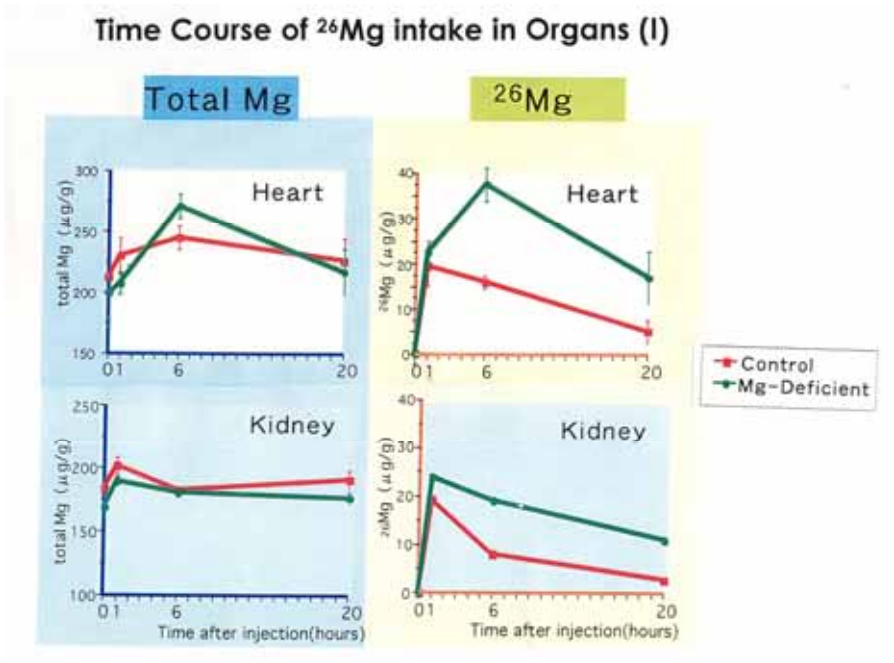


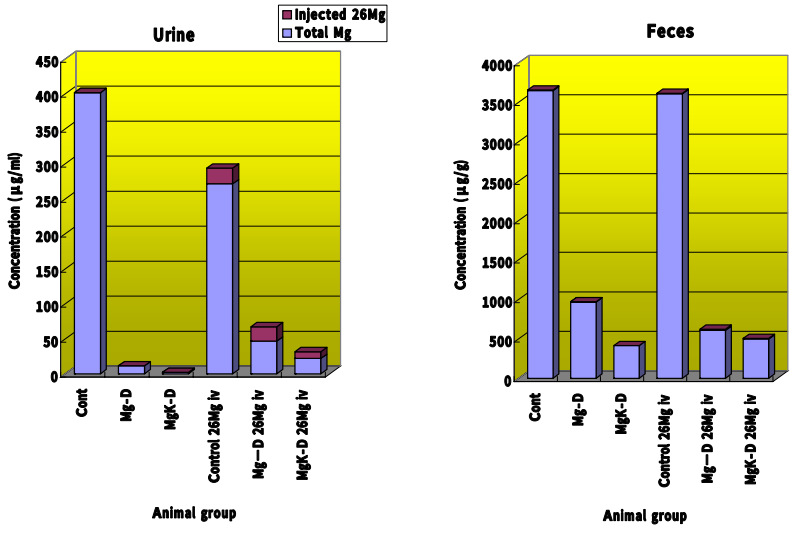
12


Time Course of 26Mg intake in Organs (II)
Total Mg
26Mg
Plasma
Plasma
R B C
R B C
total Mg (μg/ml)
26Mg (μg/ml)
Control
Mg-Deficient
01
6
20


Time Course of 26Mg intake in Organs (III)
Total Mg
26Mg
Liver
Liver
Testis
Testis
total Mg (μg/g)
26Mg (μg/g)
01
6
20
Time after injection(hours)

14





Concentrations of total Mg and ^{26}Mg injected in urine and feces till 20 hrs after iv-injection

16

結　論

- カリウムはマグネシウム欠乏による突然死の性差に関与する
- 遺伝的要因がある可能性がある
- マグネシウムは突然死の要因の一つである

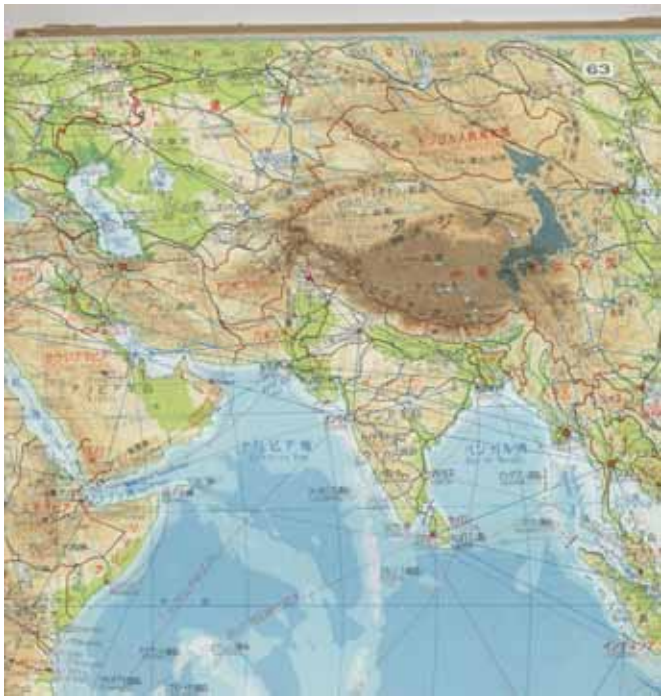
仮　説

Mg Supplementを与えることで出稼ぎ労働者の突然死は防げる

仮説の検証

不可：経済的不況により出稼ぎ労働者が激減した

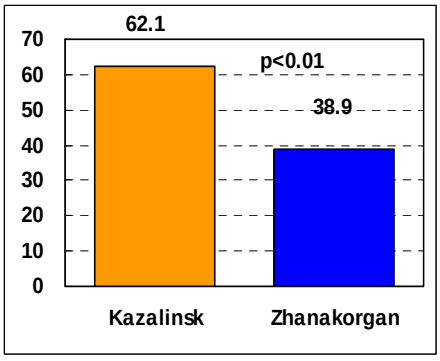
17



18

19

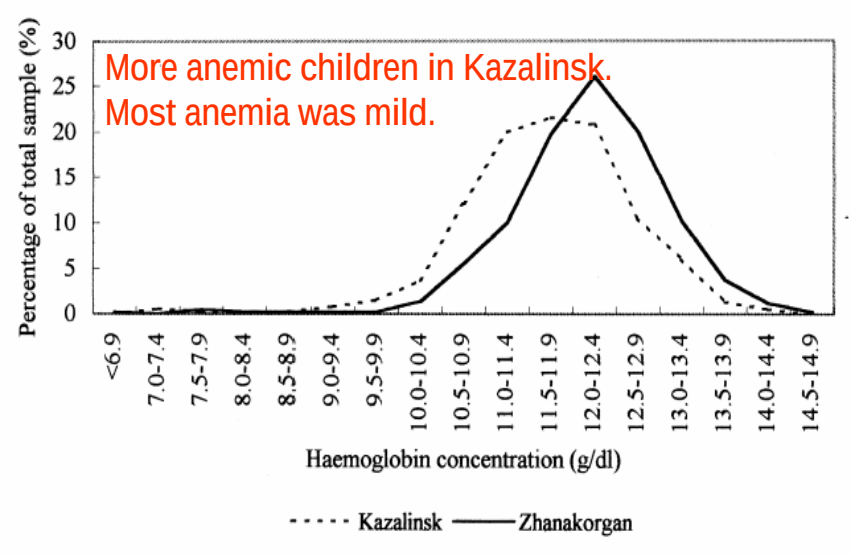
Prevalence of anemia (2000)



% children

Anaemia: Hb concentration below WHO's cut-off (12 g/dl for females and 6-14-year-old males, and 13 g/dl for 15-year-old males) (WHO 1989)

20



Distribution of Hb concentration (g/dl) among schoolchildren in Kazalinsk (n=380) and Zhanakorgan (n=429)

21

Hashizume et al. J Trop Pediatr 2003; 49: 172-7.

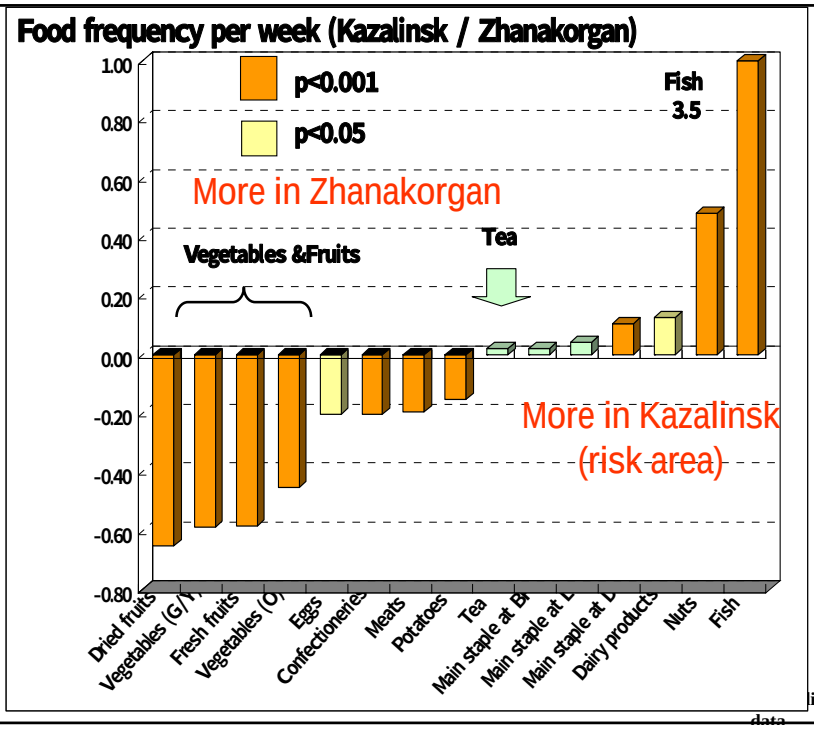
Association between anemia and nutrient intakes of 97 Kazakh children (2 areas combined)

Nutrient*	Anemia (n=49)	Non-anemia (n=48)	Odds ratio (95% CI)
Vitamin C (mg)	7.4	9.9	2.02 (0.84 – 4.89)
Phytate (mg)	67.6	62.4	0.41 (0.17 – 1.00)*
Iron (mg)	0.9	1.0	2.57 (1.08 – 6.13)*
Hem iron (mg)	0.01	0.03	2.11 (0.89 – 5.01)
Non-hem iron (mg)	0.9	1.0	2.32 (0.97 – 5.54)
Bioavailable iron***	0.3	0.4	2.35 (0.99 – 5.59)

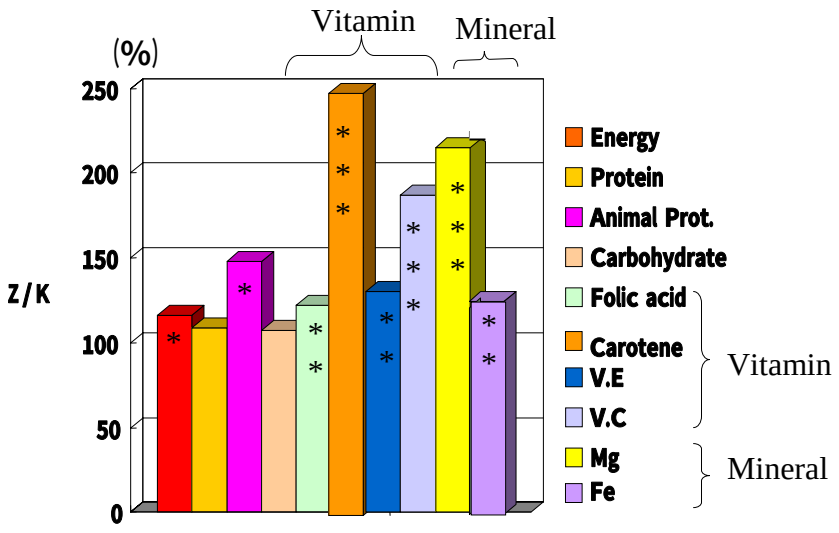
* /1000kcal intake. Based on 24-hour recall.
** Adjusted for sex, age, iron supplement, and menstrual status.
*** Adjusted for enhancers (meat, fish, poultry, vitamin C), and inhibitors (phytate, and tea)

22

Hashizume et al. Int J Food Sci Nutr 2004; 55: 37-43.



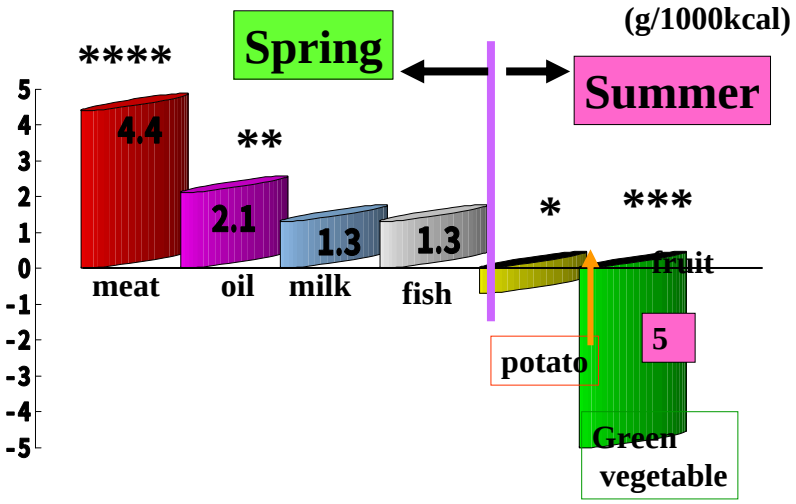
23



Comparison of nutrients intake

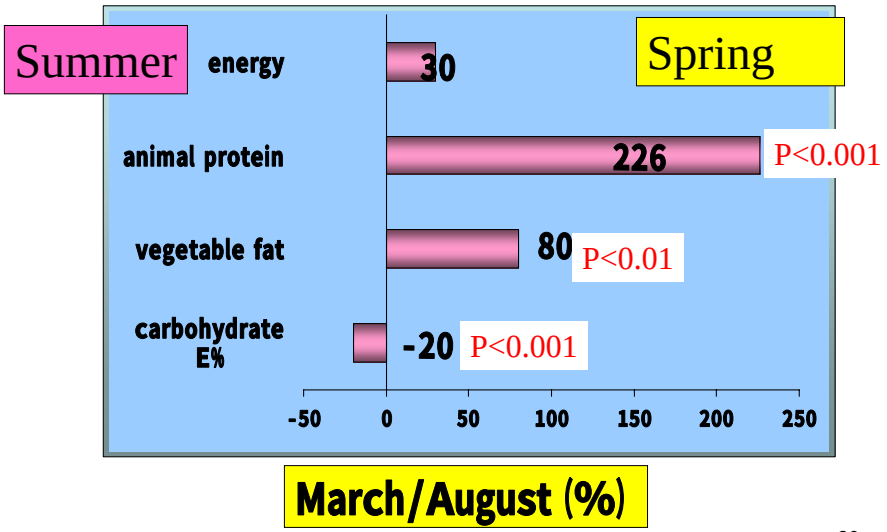
24

Comparison between summer and spring of intake in food groups (n=20)



25

Seasonal comparison in Energy and nutrients

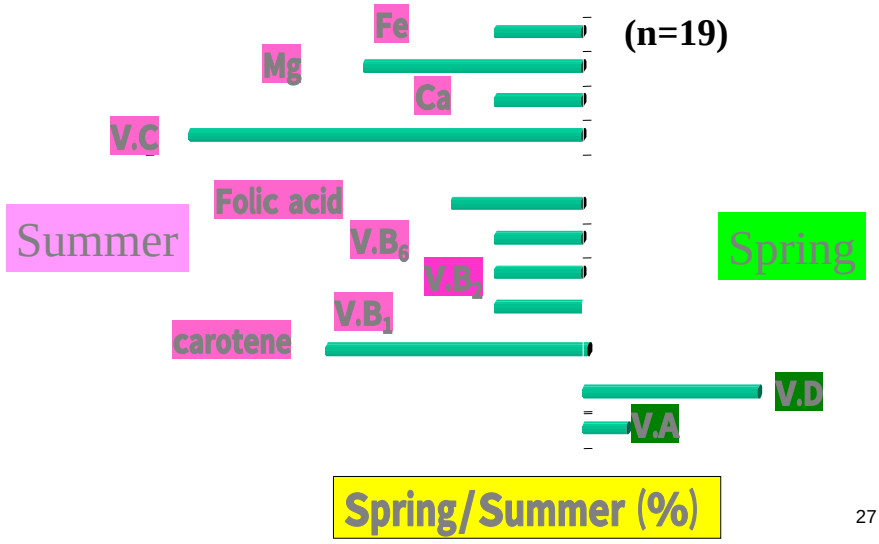


26

Seasonal comparison of mineral and vitamin intake

(mg/1000kcal)

(n=19)



27