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Heavy Metals in Common Foodstuff: Daily Intake

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Lately, toxic effects of some heavy metals (Pb, Cd) as well as desirable ones of some others (Ni, Mn, Zn) have been a field of thorough investigation. The main way of human body fortification in metals is through foodchain depending on the kind and quantity of the consumed food, according to dietary habbits (Spivey 1972).

The purpose of this study is the calculation of metals daily intake through common foodstuff of greek inhabitants. The calculation is based on results from quantitative analysis of Pb, Cd, Ni, Mn, and Zn in common foodstuff from the market of the city of Thessaloniki. The daily food consumption data is derived from three sources : a)answers to a questionnaire distributed to families of the city of Thessaloniki (Tsoumbaris 1990), b)nutrition data provided by the Agricultural Bank of Greece (1986) and c)nutrition data according to international bibliography (WHO 1972, WHO 1981, WHO 1986).

MATERIALS AND METHODS

Detailed results on metal concentrations of some common foodstuff are presented on the previous paper under the same title, quantitative analysis.

The distributed questionnaire concerned the daily and weekly consumption of basic common foodstuff by a greek family. One hundred fourteen families answered on the quantities of food they consume, independently of the number of members, financial situation and residence area. The results were also, correlated with data on consumption provided by the Agricultural Bank of Greece and by international bibliography, as mentioned.

RESULTS AND DISCUSSION

On tables 1, 2 and 3, correlation data are presented in

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detail.

Table 1. Mean metal daily intake in correlation with questionnaire data

Food	Quantity in g consumed daily	Pb µg	Cd µg	Ni µg	Mn mg	Zn mg
1.Bread (white)	191	12.3	9.4	7.8	0.2744	1.3169
2.Bread (brown)	32	2.0	1.1	1.5	0.0675	0.3958
3.Pastes	47	7.3	3.0	1.9	0.0695	0.4644
4.Meat	111	18.5	4.3	8.7	0.0265	2.4304
5.Fish	52	9.7	2.5	4.1	0.0228	1.1082
6.Diary products	318	9.1	0.8	19.2	0.0375	4.7518
7.Vegetables (leafy)	95	13.9	7.1	10.5	0.2583	0.7990
8.Bulbs	112	19.5	5.5	9.7	0.1983	0.3988
9.Tomatoes	122	25.6	3.2	9.7	0.0610	0.4198
10.Fruit	279	47.8	6.3	17.1	0.0608	0.1742
11.Fruit juices	59	2.9	0.6	1.4	0.0073	0.0378
12.Wines	55	10.6	0.8	2.0	0.0253	0.0379
Total	1,473	179.3	44.5	93.6	1.1093	12.3527

Table 2. Mean metal daily intake in correlation with Argicultural Bank of Greece data

Food	Quantity in g consumed daily	Pb µg	Cd µg	Ni µg	Mn mg	Zn mg
1.Cereals	333	31.81	16.27	14.22	0.5630	3.2640
2.Meat	164	27.36	6.39	12.81	0.0391	3.5909
3.Fish	35	6.52	1.66	2.78	0.0153	0.7459
4.Diary products	526	15.11	1.29	31.72	0.0621	7.8600
5.Vegetables	425	75.07	21.29	39.21	0.7067	2.1834
6.Fruit	410	70.19	9.23	25.09	0.0894	0.2559
Total	1,896	226.05	56.13	125.8	1.4757	17.9002

Table 3. Mean metal daily intake in correlation with international bibliography

Food	Quantity in g consumed daily	Pb µg	Cd µg	Ni µg	Mn mg	Zn mg
1.Cereals	248	23.48	12.01	10.50	0.4155	2.4092
2.Meat and fish	210	37.08	9.02	16.55	0.0711	4.5368
3.Diary products	450	12.93	1.11	27.14	0.0531	0.0172
4.Vegetables	108	15.77	8.02	11.91	0.2936	0.9083
5.Bulbs	263	45.81	13.02	22.85	0.4656	0.9365
6.Fruit	201	34.41	4.52	12.30	0.0438	0.1255
Total	1,552	174.38	48.06	102.17	1.3542	15.6578

Daily metal intake per 1000 g of food for a human being varies:

a)According to questionnaire, for Pb 121 μg, for Cd 30.21 μg, for Ni 63.54 μg, for Mn 0.75 mg and for Zn 8.38 mg.

b)According to Agricultural Bank data, for Pb 119.2 μg, for Cd 29.60 μg, for Ni 66.39 μg, for Mn 0.78 mg and for Zn 9.44 mg.

c)According to international bibliography data, for Pb (correlation with Survey on Lead in Food 1972) 115 μg, for Cd (correlation with Tsalev 1983, Morris 1970, Duggan 1969) 31.93 μg, for Ni (correlation with Drinking Water and Health 1980) 67.88 μg, for Mn (correlation with Wolf 1979, Guthris 1977) 0.90 mg and for Zn (correlation with Robinson 1973, Halsted 1974, Price 1972, Filer 1971) 10.40 mg.

Variations presented for Mn and Zn are probably attributed to variations in ratio of cereals and diary products.

So, it can be said that :

-For Pb the maximum daily intake could be 200 μg, for Cd 50 μg, for Ni 110 μg, for Mn 1.4 mg and for Zn 15 mg.

From these calculations, it seems that some foodstuffs are richer in metals than others. The contribution of several kinds of food in metal daily intake does not pace with metal contents in food, as the quantities of consumed food differ between people.
These conclusions seem to reconfirm the general rule of diet that human beings should consume part of all foodstuff, so that metal consumption will not exceed limits for toxic and be regular for essential metals.

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