

The determination of Se, Cu and Zn in blood serum of Estonian people

1 Viitak A, 1 Levandi T, 1 Neps T, 2 Pruus K, 3 Lanno R, 4 Kantola M
 1 Department of Chemistry, Faculty of Science, Tallinn University of Technology, Estonia
 2 Pharma Nord ApS, Denmark
 3 Merelahe Family Doctor's Centre, Estonia
 4 Finnish Forrest Research Institute, Finland



Introduction

Trace elements are directly involved in human metabolism and there is growing interest in the role of certain elements in physiological process. Biochemical functions of bioelements: Se - is an essential trace element at a low levels of intake and products toxic symptoms when ingested at ten times higher than those required for the adequate nutrition. A lot of diseases have been linked with the low selenium status. Cu – about 96% of copper in plasma is bound to ceruloplasmin, the rest to albumin, or in the co-factor of the enzymes cytochrom C and monotomino oxidase. Zn – 10-20% of the total Zn in blood present in blood plasma. Zn is taking part in the regulation of the levels of free radicals as antioxidant.

Material and methods

In collaboration with Pharma Nord ApS one hundred people (healthy people and patients with several pathologies) was investigated (during in October of 2007) from Merelahe Family Doctor's Centre. For the determination of Se in serum were analyzed using ETAAS method (SpectraAA 220Z (Varian, Mulgrave, Australia) with Zeeman-effect background correction and for Cu and Zn flame AAS method (SpectraAA - 220FS Varian, Mulgrave, Australia) was used. A reference material seronorm LOT MIO181 was used. The determination of Cu and Zn content in serum: 0.5ml serum was diluted to 5ml with milliQ water and for Se – 0.2ml serum to 1ml with diluent (0.1% w/v Triton X-100+1.0% v/v HNO₃), matrix modifier mixture Pd1.5mg/l+Mg 1.0mg/l).

Statistics

We investigated the relationship between bioelements and correlation analysis was carried out. For principal component analysis (PCA) treatment of the data matrix (91 patients as objects and 3 metals as properties) it was auto scaled to reduce influence of large magnitude in different metals concentration. Auto scaled data matrix was subjected to PCA procedure.

Results

We compared our data with early investigated results in Estonia (1985-1995). In general, bioelements concentrations were for Se (26 - 179 µg/), for Zn (0.35-1.08mg/l) and for Cu (0.60 – 1.81 mg/l).

Table 1: Concentrations of Se in serum of Estonians in 1992-2001, µg/l. * measured in University of Kuopio

	Tarto		Tallinn	Rakvere			Haapsalu	Narva	Other places In Estonia
Object	Young male students	Young female students	Women	Men	Women	Pregnant women	Women	Women	Men
Years of sampling	1993-1994	1994-1994	1992-1997	1997	1997	1992-1997	2000-2001	2000-2001	1991
N	10	50	11	20	14	57	44	82	116
Age (years)									
Mean	19.5	19					45.8	52	21.9
Range	18-33	19-23		20-69	20-69		26-56	28-69	16-31
Se concentration (µg/l)									
Mean	77	83	48.2	64.7	66	63	64	81	59.3
Range	69-98	57-111	38-58	48-83	57-87	31-104	42-104	40.5-131	26-116

Table 2: Concentration of Se in serum of Estonians in 2006, µg/l.

	Men	Women	Smokers	Nonsmokers	Ex-smokers	Estonians	Russians
Mean	60,56	65,79	59,63	68,22	62,79	70,41	56,60
Max	108,20	179,00	108,00	179,00	105,20	179,00	91,90
Min	25,80	25,80	31,20	30,00	31,20	31,30	25,80
stdev	19,787	24,699	19,293	24,865	19,676	25,058	17,317
n	24	70	15	52	20	57	35

Table 3: Concentration of Cu in serum of Estonians in 2006, mg/l.

	Men	Women	Smokers	Nonsmokers	Ex-smokers	Estonians	Russians
Mean	1,03	1,21	1,06	1,14	1,16	1,17	1,07
Max	1,40	2,30	1,40	2,00	2,30	2,30	1,50
Min	0,60	0,60	0,60	0,60	0,70	0,60	0,60
stdev	0,225	0,330	0,247	0,324	0,372	0,347	0,242
n	24	70	15	52	20	57	35

Table 4: Concentration of Zn in serum of Estonians in 2006, mg/l

	Men	Women	Smokers	Nonsmokers	Ex-smokers	Estonians	Russians
Mean	0,63	0,60	0,58	0,65	0,59	0,64	0,59
Max	1,08	1,08	0,88	1,08	0,91	1,08	1,02
Min	0,36	0,12	0,33	0,12	0,40	0,31	0,12
stdev	0,200	0,192	0,148	0,220	0,153	0,208	0,166
n	24	70	15	52	20	57	35

Chart 1: PCA analyse

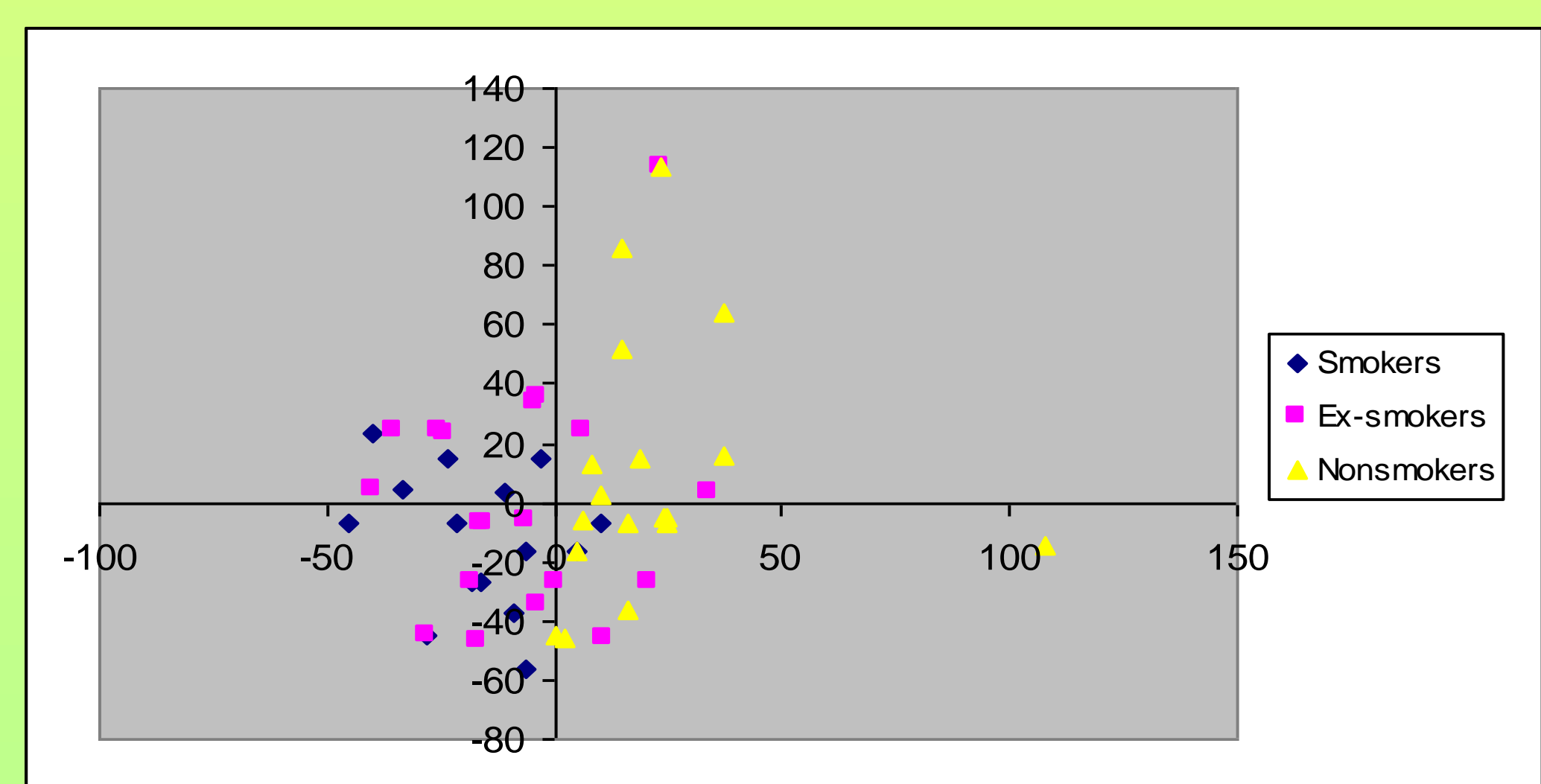
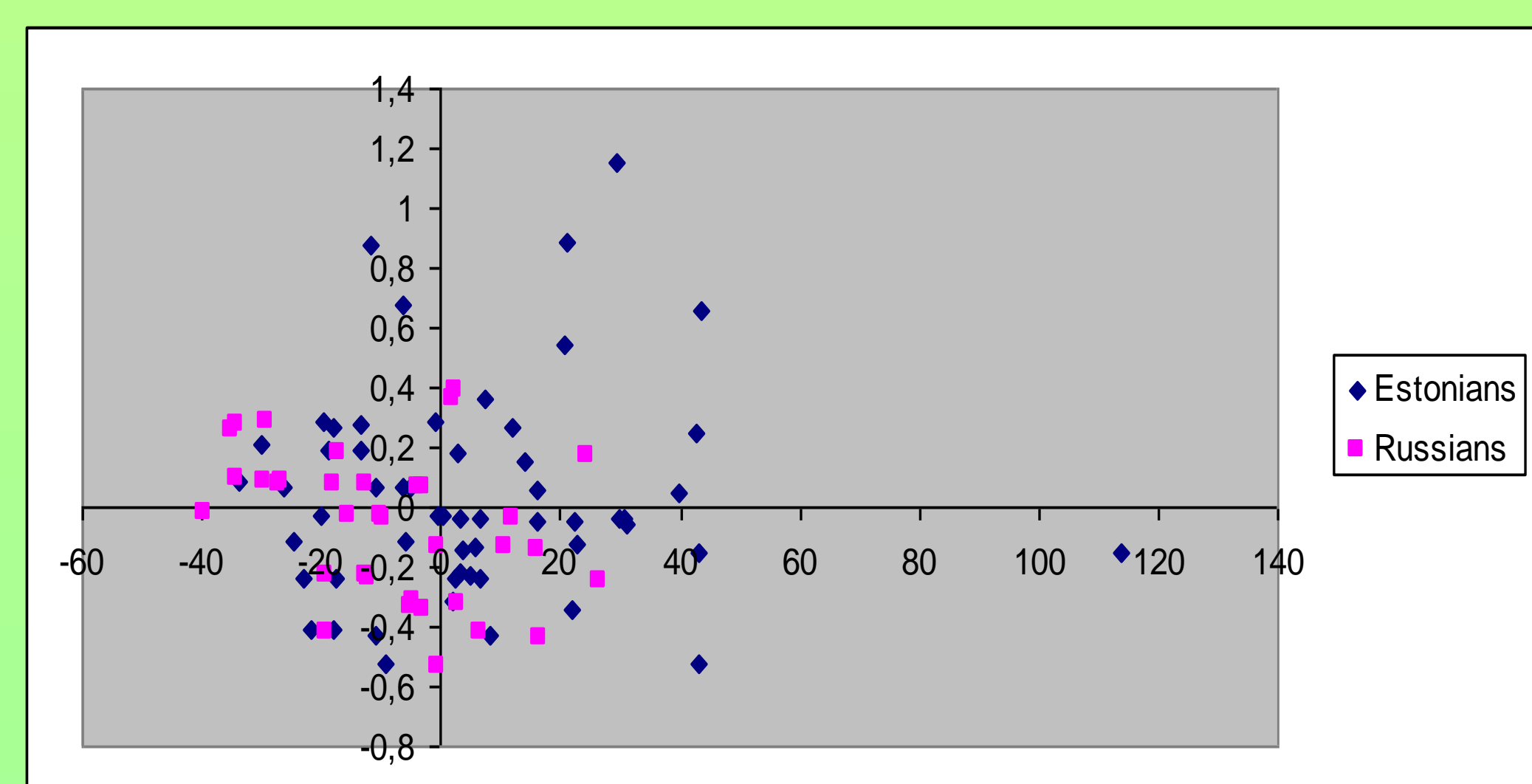


Chart 2: PCA analyse



Conclusion

Investigations have shown that the level of Se in serum is invariable compared to earlier results. It is evident from the data that there exist a certain slight clustering of data in between different groups, which can be attributed to Se concentration.