Assessment of Some Trace Elements in Very Old Individuals in Varna Region, Bulgaria

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Introduction

Trace elements take an important role in the process of aging but it's not completely clear. Magnesium is an important intracellular ion, ingredient of a large number of enzymes and acts in the regulation of energy metabolism and supports K/Na membrane gradient. Zn and Cu as ingredients of the antioxidant system and the enzyme superoxide dismutase (SOD) probably take active part in aging. Zn-dependent are man's immune system, some hormones and over 200 enzymes. Cu takes part in the cell processes and hematological disturbances (1,2). Atherosclerosis, hypertension, heart diseases and osteoporosis also involve trace elements and they become frequent with aging (4). Because of their active role in the enzymes on molecular and cellular level, their red blood cell (RBC) concentrations are more important to be assessed rather than their plasma levels. If we examine the plasma concentration only we should obtain controversial data to their active intracellular status, especially for Cu and Zn in metabolic diseases like diabetes (10). It's more important if the micronutrient disturbances and trace elements efficiency to be revealed earlier, when no clinical symptoms are found. If we reveal them later, even minimal metabolic changes may cause involvement of basic homeostatic processes and it's difficult to be regulated (3, 4).

Aim of The Study

An assessment of the concentrations of Mg, Cu and Zn in plasma and erythrocytes in healthy very old individuals over 80 years to reveal whether aging interferes their mineral status.

Methods and Patients

We examined the concentration of Mg, Cu and Zn in plasma and RBC in 43 very old individuals (n = 43, 20 men and 23 women), age 80 - 102 years (tabl.1), living in a nursing home without data for renal diseases, hypertension, diabetes mellitus, hypercholesterolemia, iron-deficiency anaemia. They were subdivided into 2 aged-groups: B group (80-89 years), n=25 and C group (90-102 years), n=18. The results were compared to controls (A group) - 39 clinically healthy subjects, age 40-65 years.

We used the following methods in the study:

1) Spectrophotometry with atomic absorption spectrophotometer AAS - 3030 B Perkin Elmer;

2) Statistic analyses: variation analysis (x ± SD) for statistical data processing and t-coefficient of Student - Fischer with statistical significant value p<0.05.

Table 1. Demographic data of our studied groups:

Groups of patients	Age (years) Range X±SD	Number of patients	M:F
Group A (Controls)	40-65 54.3 ±2.1	39	14/25
Group B	80-89 85.7±2.4	25	12/13
Group C	90-102 92.0±3.4	18	6/12

Table 2. Plasma and RBC levels of Mg, Cu and Zn:

Group of patients	Mg levels (mmol/l)		Cu levels (μmol/l)		Zn levels (μmol/l)	
	Plasma	RBC	Plasma	RBC	Plasma	RBC
Group A	0.758 ± 0.387	1.856 ± 0.560	14.98 ± 3.67	16.76 ± 5.66	14.05 ± 2.75	231.47 ± 52.36
Group B	0.836 ± 0.385	1.984 ± 0.264	17.71 ± 3.95	10.93 ± 5.38*	12.34 ± 3.23	161.24 ± 45.75*
Group C	0.779 ± 0.259	1.566 ± 0.224	19.48 ± 2.94*	11.95 ± 6.86	12.62 ± 3.21	152.41 ± 23.68*
Signficance (P-coeff.)	NS	NS	*P<0.01 - C:A	*P<0.05 - B:A	NS	*P<0.001 -B,C:A

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Results

No statistically significant differences in plasma Mg was found between the three groups of old individuals: the control A group, n=39 (0,758 ± 0,387 mmol/l), B group, n=25 (0,836±0,385 mmol/l) and C group, n=18 (0,779±0,259 mmol/l), p-NS (tabl.2). The intraerythrocytic concentrations of Mg didn't show significant changes with aging, resp. control A (1,856±0,56mmol/l); B group (1,984 ± 0,264 mmol/l) and C group (1,566±0,224 mmol/l), p - NS (tabl.2).

Plasma levels of Cu increased with the age. The change was significant for the third group (C group) > 90 years in comparison to controls < 65 years (A group), resp. 19,48 ± 2,94µmol/l and 14,98 ± 3,67µmol/l, p<0.01 (tabl.2). RBC Cu showed an opposite tendency in comparison to plasma Cu levels - decreasing with aging. The difference was significant for the B group (age 80-89 years) in comparison to controls (A group), resp.10,93 ± 5,38 µmol/l vs 16,74 ± 5,66 µmol/l, p<0.05 (tabl.2).

Plasma Zn in the two groups old individuals were decreased compared to the controls, but the difference was not statistically significant, p- NS (tabl.2). RBC Zn was significant decreased in elderly individuals > 80 years: B group (80 - 89 years) - (161,24 ± 45,75µmol/l) and C group (90- 102 years) - (152,41 ± 23,68µmol/l) in comparison to controls, A group (231,47 ± 52,36µmol/l), p <0.001. There was not a significant difference in RBC between the two elderly groups (tabl.2).

Discussion

The plasma concentrations of Mg, Cu and Zn in very old healthy subjects propose the opportunity for precise assessment of the influence of aging on the electrolytes' homeostasis (8). It's supposed that the needs of protective agents (vitamins, minerals) against the degenerative processes in very old healthy individuals are higher and especially in patients with hypercholesterolemia and atherosclerosis, hypertension, diabetes mellitus and renal diseases. The numerous studies in the literature are based on the assessment of their plasma levels only. Some authors have established that there is a slight but important difference between plasma and intracellular concentrations of trace elements and it becomes greater with aging of the man. There are few reports only on the intracellular and especially intraerythrocytic concentrations of trace elements and Mg (8, 9, 10).

Del Corso et al (8) have determined both plasma and erythrocyte levels of 3 trace elements. The results have shown higher plasma levels of Cu and Mg in the elderly group, but their RBC concentrations were low. The levels of Zn and RBC Mg did not differ between the groups of free-living and hospitalised old individuals. No correlation was found between the age and single elements. The authors make the conclusion that healthy free-living elderly have had an adequate mineral intake and don't need nutrient supplements. According to this study, assessment of trace elements may be useful in the old patients with chronic diseases, comorbidities, and polypharmacy to prevent further age dysfunctions.

Another study has found higher serum concentrations of trace elements in the age over 85 years, especially of Zn and phosphorus (13)

We have established that our studied healthy very old subjects over 80 years have normal plasma and RBC levels of Mg, i.e. they have not Mg-deficiency. They haven't taken medicines that cause hypo- and hyper-Mg and have no data for Mg resorption disturbances and probably these two reasons explain our results.

It's known from the literature that the elderly individuals are a risk group for Zn-deficiency. The risk for hypozincemia increases with aging. According to Savarino's study Zn plays an important role in maintaining the metabolic homeostasis in elderly and Zn levels could be used for a model in studying the physiology of the successful aging, because they show precisely the mineral status in healthy subjects over 80 years. He recommends also a prospective and follow-up evaluation of Zn for a correct monitoring of the micronutrient deficiencies and it could represent an early sign of some disease (11). Prasad et al (1) has established a low food intake of Zn in elderly. Our study show that the plasma Zn is normal with a tendency of decreasing, while RBC Zn level in elderly is lower than the control group and it we think that it's possibly the proper active status of this trace element.

In Madric's study in individuals over 75 years the plasma levels of Zn has an opposite tendency to Cu, i.e. plasma Cu is increased and correlates with the age (2). In case of insufficient feeding there is a great decreasing of plasma Cu (12). In our study the data show that RBC Cu is increased with age. Opposite to it RBC Cu is decreasing in very old subjects.

Conclusions

The assessment in both - plasma and intraerythrocytic levels of some trace elements in healthy very old individuals gives an answer of the question if aging interferes with micronutrient status. The data of our study show an influence of aging on electrolytes' and trace elements' homeostasis. The unbalance can't be revealed earlier, because the minimal plasma levels of trace elements have late clinical signs. The fact that they have a strong and intensive action in the cellular processes allow the evaluation of their RBC level s to give us a correct clinical estimation of their real metabolic status.

We have established normal plasma and RBC Mg in healthy very old over 80 years. The plasma concentration of Zn was in the normal range with a tendency of decreasing. RBC Zn in elderly over 80 years was significantly decreased in comparison to the control group and showed Zn-deficiency in these subjects. Plasma Cu increased with aging (significantly over 90 years), while RBC Cu showed a tendency of decreasing (significantly at the age 80-89 years).

Our studied very old individuals are clinically healthy subjects. They haven't data for any disease or medication,

which would provoke a deficiency. We consider that it's possible the established results to be due to aging itself or to unbalanced feeding. For this reason, we accept that it's necessary to enrich the food with Zn even in healthy very old subjects over 80 years.

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