PLASMA AND ERYTHROCYTE LEVELS OF TRACE ELEMENTS IN HEALTHY ELDERLY

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SUMMARY

The purpose of the investigation was an assessment of Mg, Zn and Cu in plasma and erythrocytes of healthy elderly. The examined subjects were: 20 old over 80 years and a control group of 32 healthy individuals under 60 years. The levels of trace elements were measured with atomic absorption spectrophotometry (AAS - 3030 B Perkin Elmer spectrophotometer). The data showed normal plasma and erythrocyte concentrations of Mg in healthy elderly. Plasma Cu level indicated an elevation, while intraerythrocytic Cu showed the opposite tendency of significant decreasing in the group over 80 years (80-89 years) in comparison to controls ($11,35 \pm 5,30 \mu\text{mol/l}$ vs $16,75 \pm 5,60 \mu\text{mol/l}$). Plasma Zn was in normal limits with a slight tendency of decreasing, while RBC Zn was significantly lower in both elderly groups in comparison to controls: in 80-89 years pts - $158,14 \pm 43,79 \mu\text{mol/l}$ and in 90-102 years pts - $150,00 \pm 23,85 \mu\text{mol/l}$ vs $230,70 \pm 51,39 \mu\text{mol/l}$ in the controls. Our data showed that the estimation of intraerythrocytic levels of Cu, Zn and Mg gives us a more important information for their actual status and indicates a deficiency of Cu and Zn in old subjects. We recommend food enrichment with Zn even in healthy elderly individuals.

Abbreviations: copper (Cu), erythrocytes (RBC), magnesium (Mg), zinc (Zn) KEY

Keywords: copper, elderly, erythrocytes (RBC), plasma, magnesium, zinc

INTRODUCTION

The role of trace elements in the process of aging is not completely revealed. One of the components of the antioxidant system includes zinc (Zn) and copper (Cu) as ingredients of the enzyme superoxide dismutase (SOD) and this proposes participation of these elements in aging. Man's immune system, the action of some hormones and over 200 enzymes are Zn-dependent. The insufficient Cu also reflects mainly on the cells and causes predominantly hematological disturbances connected with the reduced activity of Cu-containing enzymes (1,2).

Magnesium (Mg) is an important intracellular ion, which activates a large number of enzymes, acts in the regulation of energy metabolism and in supporting K/Na membrane gradient. The development and progression of atherosclerosis, hypertension, heart and psychological disturbances and osteoporosis in Mg - deficiency opens the question of

the possible role of this trace - element in the aging process for discussion (3).

More significant information can be obtained for the active status of these elements in examination their red blood cell (RBC) concentrations rather than their levels in plasma. Possibly this is due to the fact that they take part in the enzyme processes on molecular and cellular level. Sometimes, if we ignore their important role and examine their plasma concentration only, we should conclude facts that are controversial to their active intracellular status.

AIM OF THE STUDY

The aim of the study is to examine the concentrations of Mg, Cu and Zn in plasma and erythrocytes in healthy elderly individuals over 80 years and their changes with aging.

SUBJECTS AND METHOD

We examined the concentration of Mg, Cu and Zn in plasma and RBC in 20 elderly individuals (n=20, 7 men and 13 women), age 80 - 102 years (tabl.1), living in a nursing home without data for renal diseases, hypertension, diabetes mellitus and hypercholesterolemia. The results were

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compared to plasma of a control group of clinically healthy

Tabl. 1. Demographic data of our studies

	Age (years)		Number of patients
	Range	X $\pm$ SD	
Group B	80-89	85.7 $\pm$ 2.4	10
Group C	90-102	92.0 $\pm$ 3.4	10

subjects, age 20-60 years (4).

Mg, Cu and Zn in both, plasma and RBC were measured with atomic absorption spectrophotometer AAS - 3030 B Perkin Elmer (5,6). Variation analysis ($\bar{x} \pm \text{SD}$) was applied for statistical data processing. The results were assessed with t-coefficient of Student - Fischer with statistical significant value $p < 0.05$.

RESULTS

Fig. 1. RBC-Zn concentrations are compared between two groups elderly patients (B and C) and control group young patients (A). Values are given as mean $\pm$ standard deviation. Significant differences were assumed if $p < 0.05$. * $P < 0.05$ - B,C:A

Fig. 2. RBC-Mg concentrations are compared between two groups elderly patients (B and C) and control group young patients (A). Values are given as mean $\pm$ standard deviation. Significant differences were assumed if $p < 0.05$. P - NSe

MAGNESIUM - We didn't find statistically significant differences in plasma Mg, either between the two groups of elderly individuals: 80-89 years (0,830 $\pm$ 0,281 mmol/l) and 90-102 years (0,777 $\pm$ 0,154 mmol/l) or in the control group 20-60 years (0,737 $\pm$ 0,37 mmol/l) (fig. 1).

RBC Mg didn't show significant changes with aging, resp. control group 20-60 years (1,575 $\pm$ 0,43 mmol/l); 80-89 years (1,818 $\pm$ 0,266 mmol/l); 90-102 years (1,580 $\pm$ 0,228 mmol/l) (fig.2).

COPPER - Plasma Cu increased with the age. The change was significant for the age group >90 years in comparison to controls <60 years, resp. 19.44 $\pm$ 3,31 $\mu\text{mol/l}$ and 15,30 $\pm$ 3,12 $\mu\text{mol/l}$ (fig.3).

fig. 3. Plasma-Cu concentrations are compared between two groups elderly patients (B and C) and control group young patients (A). Values are given as mean $\pm$ standard deviation. Significant differences were assumed if $p < 0.05$. * $P < 0.05$ C:A

RBC Cu showed a tendency towards decreasing with aging. The difference was significant for the age group 80-89 years in comparison to controls, resp. 11,35 $\pm$ 5,30 $\mu\text{mol/l}$ vs 16,75 $\pm$ 5.60 $\mu\text{mol/l}$ (fig.4),

Fig. 4. RBC-Cu concentrations are compared between two groups elderly patients (B and C) and control group young patients (A). Values are given as mean $\pm$ standard deviation. Significant differences were assumed if $p < 0.05$. * $P < 0.05$ - B:A

ZINC - Plasma Zn in both group elderly was decreased compared to the controls, but the difference was not statistically significant (fig.5).

RBC Zn was significant decreased in elderly individuals >80 years: 80-89 years ($158.14 \pm 43.79 \mu\text{mol/l}$); 90-102 years ($150.00 \pm 23.85 \mu\text{mol/l}$) in comparison to controls ($230.70 \pm 51.39 \mu\text{mol/l}$). There was not a significant difference in RBC between the two groups of elderly 80-89 and 90-102 years (fig.6).

Fig. 5. Plasma-Zn concentrations are compared between two groups elderly patients (B and C) and control group young patients (A). Values are given as mean $\pm$ standard deviation. Significant differences were assumed if $p < 0.05$. P - NS

Fig. 6. RBC-Zn concentrations are compared between two groups elderly patients (B and C) and control group young patients (A). Values are given as mean $\pm$ standard deviation. Significant differences were assumed if $p < 0.05$. * $P < 0.05$ - B,C:A

DISCUSSION

The examination of Cu, Zn and Mg plasma concentrations in healthy elderly individuals gives the opportunity for assessment if the aging has an influence on the homeostasis of the electrolytes and trace elements themselves (7). The studies in the literature are numerous and basically connected to the establishment of their plasma levels. There are few reports on the intracellular and especially intraerythrocyte concentrations of trace elements and Mg (7,8,9). It's supposed that the needs of protective agents (vitamins, minerals) against the degenerative processes in elderly are higher.

Del Corso et al (7) have determined blood concentrations of Cu, Zn and Mg. Their results suggest that the healthy free-living elderly have had an adequate mineral intake and

don't need nutrient supplements. They may be useful in the elderly with chronic diseases.

Actually, Wakamoto et al. (12) have found higher serum concentrations of trace elements in >85 years, especially of phosphorus and Zn.

Our studied healthy elderly subjects over 80 years have normal plasma and RBC 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.

The elderly are a risk group for Zn-deficiency. The risk for hypozincemia increases with aging (10). Prasad et al (1) has established a low intake of Zn with food in elderly. In our studied subjects plasma Zn is in normal range but trends to decrease, while RBC Zn level in elderly is lower than subjects in control group and it points possibly the proper active status of this trace element.

Opposite to Zn, plasma Cu in elderly over 75 years is increased and correlates with the age (2). In case of insufficient feeding there is a great decreasing of plasma Cu (11). In our healthy elderly the tendency of increasing RBC Cu with aging is underlined. On the other hand, the study of RBC Cu demonstrates the opposite trend - decreasing with age.

CONCLUSION

In conclusion, the study of plasma Cu, Zn and Mg in healthy elderly gives the possibility of assessment if aging influences electrolytes' and trace elements' homeostasis. Their misbalance in the organism can't be disguised early because the minimal plasma concentration of trace elements. If we have in mind their intensive action in the cellular processes, the examination of their RBC level allows a correct clinical evaluation of their metabolic status.

In the studied healthy elderly over 80 years we established normal plasma and RBC Mg. The plasma concentration of Zn was in the normal range but trended towards 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).

In our study the elderly individuals are clinically healthy subjects. They haven't any data for disease or medication, which would provoke deficiency. It's possible that the established results are due to aging itself or to disbalanced feeding. For this reason, we accept that even in healthy elderly over 80 years it's necessary to enrich the food with Zn.

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