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# THE PECULIARITIES OF GOITER CHILDREN HAIR ELEMENTAL CONTENT

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SUMMARY: Totally, 304 12–16 years old boys and girls, suffering form goiter (G) and 112 children with normal dimensions of thyroid gland (K), living in 6 territories of Russia (Far East, Siberia, European part) were examined and investigated by ICP-AES and ionometric methods.

It was revealed, that for G patients are typical significantly lower hair Cu, Al and Si (11.5±0.4 vs. 13.4±0.7 mg/kg; 19.9±1.5 vs. 23.8±1.5 and 24.9±2.9 vs. 34.8±2.8 mg/kg, respectively) and higher Pb, Co concentrations (1.71±0.17 vs. 1.59±0.11 mg/kg, 0.18± 0.03 vs. 0.12± 0.07 mg/kg, respectively) as compared to K group.

The hair Ca, Mg, P, K, Na, Fe, Zn, Mn, Cr, Se, Zn, Ni, Sn, As, Ti, V and I concentrations are the similar in both G and K groups. This study suggests the importance of epidemiological investigation of interelemental interactions in genesis of endemic goiter.

## Introduction

Previously we showed, that the children hair elemental content significantly due to biogeochemical picture in different regions of Russia and some specific disturbances of mineral metabolism could influence on the incidence of goiter (Skalny, 2001; Veldanova, Skalny, 2001).

In order to give an ecological-physiological reasoning of the role of different chemical elements in endemic goiter development, comparative estimation of elemental status of children from different parts of Russia was carried out.

## Materials and Methods

Totally, hair of 304 12–16 years old boys and girls, suffering form goiter, and 112 children with normal dimensions of thyroid gland, living in 6 territories of Russia (Far East, Siberia, European part) were examined and investigated by ICP-AES and ionometric methods.

During the examinations the special medical documentation, including questionnaire, were filled and scalp hair (occipital part) samples were collected.

Titanium nitride-coated scissors were employed throughout the campaign to minimize any possible release of contaminations elements. Hair (0,2–0,5 g) thus cut was immediately placed in special bags, which were then accurately sealed and labeled with a group number, the subject name, and the date.

All specimens were stored in dry, cool and ventilated environment until delivery to the laboratory and then kept in desiccators until analysis.

When prepared to ICP-AES analysis, hair samples washed with a mixture of ethyl ether and acetone (3:1 v/v) under continuous stirring for 10 min, then dried at 85°C for 1 hour. After that the samples were treated with a diluted (5%) aqueous solution of EDTA for 1 hour, repeatedly rinsed with double distilled water, and finally dried at 85°C for 12 hour in an oven to determinate the sample dry weight just before the subsequent step is started. Hair digestion has been carried out in a microwave using wet ashing ($HNO_3$ and $H_2O_2$ as 3:1) procedure (Caroli, 1992).

Analytical determination has been carried out using "Thermo Jarrell Ash" ICAP-9000 spectrometer.

When prepared to iodine determination by ion-selective method, hair samples were processed by pure acetone in 10–15 minutes, and then washed thrice by double distilled water. After that hair samples were dried at 60°C in 24 hours. Then of dry defatted hair samples were fused with KOH in carbonglass melters at 450°C in 10 minutes. After the fusion, samples were dissolved in double distilled water on balneum at 130–140°C until complete dissolution. Then 10 ml of HCL was added; the solution was diluted to 100 ml and mixed carefully. Iodine concentration was determined by ion-selective method within range of $10^{-1} – 5\times10^{-7}$ mole/l. The results were calculated by means of a graduation graph.

For the check-up the laboratory data, certified reference material of human hairs obtained from Shanghai Institute of Nuclear Research was analyzed

## Results and Discussion

It was revealed, that significantly ($p<0.05$) lower hair Cu, Al and Si (11.5±0.4 vs. 13.4±0.7 mg/kg; 19.9±1.5 vs. 23.8±1.5 and 24.9±2.9 vs. 34.8±2.8 mg/kg, respectively) and higher Pb, Co hair concentrations (1.71±0.17 vs. 1.59±0.11 mg/kg, 0.18±0.03 vs. 0.12± 0.07 mg/kg, respectively) are typical for patients with goiter as compared to control group (Table 1).

Table 1. Concentration of chemical elements in hair of children, suffered from goiter as compared to control group (mg/kg).

| Element | Goiter | Control |
|---|---|---|
| **Al** | **19.87±1.46** | **23.78±1.53** |
| As | 0.21±0.03 | 0.25±0.03 |
| Ca | 1247.26±177.47 | 1131.61±102.95 |
| Cd | 0.22±0.04 | 0.2±0.04 |
| **Co** | **0.18±0.03** | **0.12±0.01** |
| Cr | 0.79±0.07 | 0.88±0.05 |
| **Cu** | **11.46±0.4** | **13.42±0.69** |
| Fe | 29.53±3.83 | 30.97±2.76 |
| J | 0.46±0.05 | 0.52±0.03 |
| K | 220.32±39.32 | 232±24.71 |
| Mg | 85.46±16.18 | 77.68±9.29 |
| Mn | 1.8±0.28 | 1.67±0.23 |
| Na | 431.14±85.98 | 465.05±37.57 |
| Ni | 0.71±0.09 | 0.91±0.08 |
| P | 145.22±4.62 | 151.53±3.01 |
| **Pb** | **1.71±0.17** | **1.49±0.11** |
| Se | 1.06±0.11 | 1.05±0.06 |
| **Si** | **24.93±2.9** | **34.84±2.8** |
| Sn | 1.34±0.13 | 1.26±0.21 |
| Ti | 0.58±0.11 | 0.54±0.07 |
| V | 0.14±0.02 | 0.15±0.01 |
| Zn | 155.06±8.71 | 161.14±4.22 |

*$p<0.05$.

The hair Ca, Mg, P, K, Na, Fe, Zn, Mn, Cr, Se, Zn, Ni, Sn, As, Ti, V and I concentrations are the similar in both goiter and control groups.

The results demonstrate existence of connection between major and trace elements metabolism in human organism and development of endemic goiter. Epidemiological investigation of interelemental interactions appears to be important in understanding of endemic goiter genesis.

## Conclusions

1. Children with goiter have higher Pb, Co and lower Cu, Al, Si concentration in hair as compared to children with normal dimensions of thyroid gland.
2. The hair Ca, Mg, P, K, Na, Fe, Zn, Mn, Cr, Se, Zn, Ni, Sn, As, Ti, V and I concentrations are the similar in both goiter and control groups.
3. Interelemental interactions play an important role in genesis of endemic goiter and should be taken into account in epidemiological investigations.

## References

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