Elemental analyses of hair of orenburg region's students

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Abstract: *Objective:* Experimental researches resulted in revelation some imbalance in the metal content of hair of different population groups living in foul terrains [Chernyaeva et al., 1997; V.M. Boev, 1998]. One of such terrains is Orenburg region. The region is one of the most ecological unfavourable environmental objects. Earlier mass complex studies about element content in various biological substratums (hair, blood) were carried out on children living in cities and the country of this region and also in the main zones of the region [V.M. Boev et al., 2003]. This work is dedicated to esmation of essential and toxic metal content in an organism of students living in various zones of Orenburg region using multielement hair analysis. *Materials and methods:* In the autumn of 2003 a checkup was carried out including 199 students (33 male and 166 female) at age of 19 to 23 studying at various faculties of Orenburg State University and constantly living in various zones of Orenburg region (from the Central zone – 126 students, from the Eastern one – 53 students, from the Western one – 20 students). The methods of atomic emission spectrometry with inductively bound plasma (IBP – AES) and mass-spectrometry with inductively bound plasma (IBP – MS) upon content of 25 chemical elements applying the standard procedure approved by The Ministry of Health of the Russian Federation [Methodological Instructive Regulations 4.1.1482-03] were used to estimate element status of the students. The specimen of hair produced by Shanghai Institute of Applied Physics of Chinese Academy of Sciences was used as the reference. Derived from the experiment data got compared to reference measures of concentration of some chemical elements in hair for the age group of 18 to 65 [Skalny, 2003]. Iodine content was compared to reference measures by G. Iyengar (1988), mercury content – by V.V. Ivanov (1994). *Results and Discussion:* By comparison the findings with the reference measures it was revealed that all the zones were characterized with normal contents of aluminium, lead, cadmium, mercury and excessive content of mangamum and deficiency of selenium in hair. The Central zone was also characterized with decreased iron and copper content. The Eastern zone was notable for increased copper content and deficiency of cobalt in addition with common regularities. The Western zone is characterized with decreased content of chromium, cobalt and lead in hair.

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Introduction

Studying hair for revelation about the status of microelement turnover in an organism and about toxic effect of some heavy metals gets more and more interest in the last decades [Batsevic, Yasina, 1989; Saet, Revich, 1990; Chernyaeva et al., 1997; Skalny, 2001]. Deficiency of the essential microelements (ME) such as selenium, zinc, iron, iodine, manganese and excess of the toxic ME: mercury, lead, arsenic further the development of serious disorders in a human's health state [Prasad, 1995; Negretti de Bratter,1999].

Experimental researches resulted in revelation some imbalance in the metal content of hair of different population groups living in foul terrains [Chernyaeva et al., 1997; V.M. Boev, 1998]. One of such terrains is Orenburg region. The region is one of the most ecological unfavourable environmental objects. Earlier mass complex studies about element content in various biological substratums (hair, blood) were carried out on children living in cities and the country of this region and also in the main zones of the region [V.M. Boev et al., 2003].

This work is dedicated to esmation of essential and toxic metal content in an organism of students living in various zones of Orenburg region using multielement hair analysis.

Materials and methods

Because of natural and climatic conditions and geochemical features of Orenburg region it is adopted to divide the region into the zones: Central, Eastern and Western [V.M. Boev et al., 2003].

In the autumn of 2003 a checkup was carried out including 199 students (33 male and 166 female) at age of 19 to 23 studying at various faculties of Orenburg State University and constantly living in various zones of Orenburg region (from the Central zone – 126 students, from the Eastern one – 53 students, from the Western one – 20 students).

The methods of atomic emission spectrometry with inductively bound plasma (IBP – AES) and mass-spectrometry with inductively bound plasma (IBP – MS) upon content of 25 chemical elements applying the standard procedure approved by The Ministry of Health of the Russian Federation [Methodological Instructive Regulations 4.1.1482-03] were used to estimate element status of the students. The specimen of hair produced by Shanghai Institute of Applied Physics of Chinese Academy of Sciences was used as the reference.

Derived from the experiment data got compared to reference measures of concentration of some chemical elements in hair for the age group of 18 to 65 [Skalny, 2003]. Iodine content was compared to reference measures by G. Iyengar (1988), mercury content – by V.V. Ivanov (1994).

Results and discussion

In the process of the research on the estimate of essential ME content in students' hair in the zones of Orenburg region it was discovered that in the Central zone the content of iron, copper, manganese was increased and the content of selenium was decreased. In the Eastern zone there were noted excess of copper, manganese and deficiency of cobalt and selenium. In the Western zone increased content of manganese and decreased content of cobalt, chromium, selenium and lead were determined.

The iron content in hair of the students from The Central zone was 1,7 more than those from the Eastern and the Western zones.

The zinc content in hair of student from all three zones of Orenburg region was in boundaries of the reference measure and differences were insignificant.

Copper in hair of the students from the Central and the Eastern zones was on average 1,4 more than that from the Western zone.

The manganese content in hair of those examined from the Western zone was 1,5 more increased than that from the Eastern zone and 1,1 more increased than that from the Western zone.

The cobalt content in hair of the students from the Eastern and Western zones was decreased and the same index of the students from the Central zone was in boundaries of the reference level.

The average chromium content in hair of the students from the Central and Eastern zones was 1,4 more than that from the Western zone.

The selenium content was discovered at deficit in all zones of Orenburg region, especially in the Western and the Central zones.

Orenburg region is endemic in the case of iodine deficiency in environmental objects [Utenina, 1999]. Carried out researches on soil and water proved this statement. The average iodine content in hair was in boundaries of the reference measure, however 62% of the students had deficiency of this element.

There was observed pronounced iodine deficiency in hair of the students from the Eastern and the Western zones compared to the Central zone (in 3,8 and 3,4 times accordingly).

In comparative analysis it was discovered that higher hair content of almost all essential ME excepting manganese and selenium was peculiar to the students from the Central zone. The most pronounced deficiency of ME was discovered in hair of the students from the Western zone.

In the course of the study it was revealed that aluminium, cadmium and mercury were in boundaries of the reference measures in hair of the student from all the main zones of Orenburg region excepting the decreased lead content of the students from the Western zone.

Conclusions

By comparison the findings with the reference measures it was revealed that all the zones were characterized with normal contents of aluminium, lead, cadmium, mercury and excessive content of mangamum and deficiency of selenium in hair.

The Central zone was also characterized with decreased iron and copper content. The Eastern zone was notable for increased copper content and deficiency of cobalt in addition with common regularities. The Western zone is characterized with decreased content of chromium, cobalt and lead in hair.

Our findings conform with the data by V.M. Boev (2003) only in decreased manganese content in hair of children in all the zones of Orenburg region; any other confirmation was not appeared to us. These differences in essential ME content in hair of children and students in zones were perhaps concerned with different age periods of the studied objects and physiological features of a child organism, which has more intensive metabolic processes leading to active absorption of chemical elements in organism.

Annotation.

This work is dedicated to estimation of essential and toxic metal content in an organism of students living in various zones of Orenburg region using multielement hair analysis.

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