ASIAN JOURNAL OF PHARMACEUTICAL
AND BIOLOGICAL RESEARCH

AJPBR

Editorial board

INTERRELATION OF HEALTH AND HAIR ELEMENTAL COMPOSITION IN CHILDREN OF PRIOR SCHOOL AGE IN THE ARAL REGION

Khudainazarova S.R., Danilova E.A., Kuryazova Sh.M.
Tashkent Pediatric Medical Institute, Uzbekistan
Institute of Nuclear Physics of the Academy of Sciences of the Republic of Uzbekistan, Uzbekistan

Relevance. The problem of the deterioration of the health status of the population of the Aral Sea region in our country does not lose its relevance. This trend is especially alarming among the child population - there is a deterioration in indicators of physical development, a high prevalence of morphological and functional abnormalities and chronic diseases of the respiratory, cardiovascular, digestive systems (Akhmedova D.I., Kuryazova Sh.M., 2010).

Taking into account the ecological problem of the Aral Sea region, the increased level of environmental pollution affects the body of the growing generation, which makes it necessary to develop criteria and methods for diagnosing prenosological conditions of the organism on a regional scale in a timely manner.

The elemental status of the human body in the process of life is initially formed inside the womb. The influence of natural and climatic factors and the degree of environmental pollution directly affects macro- and microelements, as a result of which functional deviations are formed first, and then diseases of the internal organs.

The huge role of mineral elements for the body, both biological and physiological processes of the body, in which the elements take part in various metabolic processes, adaptation of the body in pathophysiological conditions.

To designate all pathological processes caused by deficiency, excess or imbalance of trace elements, for the first time A.P. Avtsyn (1991) introduced the concept of microelementoses. Among the numerous reasons for the imbalance of elements in the body, the following can be distinguished: biogeochemical features of the region of residence, anthropogenic environmental impact on humans, the modern food production industry, psycho-emotional stress, irrational use of medicines, etc. [3].

In the context of growing environmental troubles, more and more information appears in scientific publications demonstrating the violation of the content of various chemical elements in the child's body [2, 4, 6].

The study of the effect of elemental status on the physical development of children shows that there are statistically significant differences between the content of elements in biosubstrates in children with normal physical development and those with deviations from the norm, as well as the presence of a correlation between the level of trace elements and height, weight and head volume of children (Skalny A .V., 1999, 2012).

Hair is a biological substrate, reflecting in its composition the processes of deposition, concentration and elimination of chemical elements for a long time, and,

accordingly, characterize the elemental status of the body [3, 5] and are an indicator of the environment.

In Uzbekistan, the relationship between physical development and the elemental status of the body of children and adolescents in terms of hair analysis has not been sufficiently studied. Thus, the studied literary material suggests that an in-depth study of the elemental composition of hair in the Aral Sea region in children and adolescents is necessary.

Purpose of the study. To study the relationship between health and the elemental composition of hair in children of primary school age in the Aral Sea region.

Material and methods. For the study, 240 children from 7-11 years old living in the Khorezm region and 60 children of the control group of the city of Tashkent were selected by the method of continuous random sampling, anthropometric measurements of physical development parameters (length and weight, chest circumference) were carried out. When assessing the length, body weight and circumference of the chest, the recommendations of the WHO Antroplus (2009) were used.

When working with patients, the ethical principles of the Helsinki Declaration of the World Medical Association (World Medical Association Declaration of Helsinki 1964, 2000) are observed. Voluntary consent was obtained from each parent for microelement analysis of hair. The study of the microelement status of the children's body was carried out in the laboratory of ecology and biotechnology of the Institute of Nuclear Physics of the Academy of Sciences of the Republic of Uzbekistan by instrumental neutron activation analysis (INAA) to quantify the content of elements in hair.

Hair was cut from 3-5 places at the back of the head, according to the recommendations of the IAEA (Rezaee Ebrahim Saraee et al., 1978). The samples were washed from surface contamination with bidistilled water and degreased with acetone, and then dried in air. The proposed neutron activation method of analysis makes it possible to determine more than 20 elements in one sample portion with high sensitivity and productivity, while sample preparation is quite simple and does not require sample decomposition [5, 10].

The developed technique for sampling the objects under study, preparing them for analysis, and the neutron activation analysis itself (irradiation, cooling, and measurement modes) have been described previously and demonstrated high reliability and accuracy (Danilova et al., 2008; 2011).

The correctness of the determination of one or another element was checked by comparing the obtained data with the certified values of the IAEA standards Algae IAEA 0393 and Lichen IAEA 336, as well as NIST Standard Reference Material 1572 - CITRUS LEAVES. Statistical data processing was performed using the Microsoft Excel 2010 and Statistica 6.0 software package. When comparing relative frequencies, a two-sided test of statistical significance p was calculated. P<0.05 was taken as the level of statistical significance [11].

Results and discussions. Currently, scientists are concerned about the decrease in the functional indicators of children, adolescents and young people (Milushkina O.Yu., 2013). Modern schoolchildren have a sedentary lifestyle, malnutrition, high study loads and hobbies, and spend a lot of time at computers and phones.

All risk factors associated with reduced functional capabilities of children are predictors of the development of many serious diseases at an older age, such as diseases of the cardiovascular system (arterial hypertension, coronary heart disease, atherosclerosis of cerebral and coronary vessels, etc.), endocrine diseases (diabetes type 2 diabetes, obesity, metabolic syndrome), severe eye damage (high myopia, retinopathy).

According to a comprehensive assessment of the health status of 240 children of primary school age in the Aral Sea region, previously undiagnosed functional disorders of the musculoskeletal, nervous, digestive systems, as well as deviations in physical development, were revealed for the first time. According to the outpatient cards of schoolchildren (No. 025), diseases of the genitourinary system were found in remission.

A study of the physical development of children of primary school age in the Khorezm region was carried out, it was found that WAZ -2-3CO were found in 6.2% of boys and 4.1% of girls, girls. In the control group of schoolchildren in the city of Tashkent, 13.3% of boys had WAZ-2-3CO and 3.3% of girls, respectively, HAZ-2-3CO - 3.3% of boys and 23.3% of girls. Overweight - WAZ + 2 + 3 CO in Tashkent was found in 10% of boys, and obesity - WAZ-> +3 CO in 6.7%.

Accordingly, in girls WAZ-> +3 SD, as well as - HAZ amounted to the same amount of 3.3%, and an increase in weight and height in schoolchildren of the Khorezm region was not observed. According to the standard deviations (SD) proposed by WHO-2009, schoolchildren showed a deficiency in body weight, in height, which showed disharmonious physical development -2– -1SD, 25.2% -WAZ and HAZ- 26.6%, and in girls WAZ – 30,9% and HAZ - 35%.

According to the indicators that were identified among schoolchildren with overweight and an increase in height above + 2– +1 SD for boys - WAZ 2.8% and HAZ 3.5%, overweight girls have much more WAZ-5, 1% and HAZ 2.0%. When examining and studying outpatient cards, the prevalence of functional abnormalities and chronic diseases among younger schoolchildren aged 7-11 was revealed.

Studies of children on diseases: acute respiratory infections - 74%, bronchitis - 18.53%, scoliosis - 43.27%, tonsillitis - 33.65%, hr. enterocolitis - 5.04%, IRR of the vagotonia type - 52.49%, IRR of the eutonia type - 29.19%, IRR of the sympoticotonia type - 10.48%, xp. pyelonephritis - 6.49%, oxalaturia - 14.77%, uric acid crystals - 56.03%.

In Tashkent, acute respiratory infections - 68.08%, bronchitis - 11.79%, scoliosis - 25.94%, tonsillitis - 49.78%, VSD by the type of vagotonia - 59.38%, VSD by the type of Eutonium - 29.64 %, VSD according to the type of sympoticotonia-3.35%, xr. pyelonephritis-1.25%, uraturia-16.61%. The leading place in the structure of

functional deviations and chronic diseases in the Aral Sea region at all stages of education is occupied by disorders of the musculoskeletal system. In the structure of chronic pathology, there is a disease of the urinary system.

The study of the elemental composition of hair in schoolchildren showed that the content of sodium and chlorine in the hair was higher, and some other elements such as cobalt, copper, chromium, potassium, calcium and zinc were below the reference values (Table 1).

Table 1

The content of elements in the hair of schoolchildren aged 7-11 years old living in the Khorezm region (mcg/g).

Element	city of Urgench	Urgench region	Bagatsky area	Reference values
	M±m	M±m	M±m	
Ag	0.061±0.021	0.084±0.051	0.036±0.014	0.1- 0.25
As	0.09±0.025	0.075±0.018	0.15±0.072	0.1-0.3
Au	0.023±0.0061	0.011±0.0025	0.0062±0.0016	0.02-0.05
Br	3.1±1.1	2.7±1.0	1.5±0.25	1-3
Ca	910±250	970±240	960±130	1000-1500
Cl	4800±1900	5000±2500	3100±1000	1000-2000
Co	0.038±0.0052	0.025±0.0028	0.043±0.012	0.05-0.1
Cr	0.19±0.053	0.15±0.037	0.12±0.012	0.35-1.0
Cu	6.8±1.1	9.1±1.3	12±3.9	15-20
Fe	33±3.1	27±2.9	32±4.1	20-30
Hg	0.10±0.015	0.061±0.017	0.090±0.019	0.1-0.3
I	1.1±0.30	0.48±0.19	1.2±0.39	0.8-1.5
K	510±92	540±160	840±350	800-1000
La	0.22±0.078	0.23±0.13	0.069±0.023	0.02-0.04
Mn	0.85±0.12	0.98±0.19	1.2±0.22	0.45-1.0
Na	850±320	1000±530	980±310	250-800
Rb	0.14±0.036	0.30±0.092	0.50±0.22	0.5-1.0
Sb	0.037±0.0067	0.050±0.0093	0.038±0.0059	<0.2
Sc	0.0094±0.0012	0.0058±0.00	0.008±0.001	0.006-0.015

	092	4	
Se	0.39±0.032	0.38±0.029	0.38±0.025	0.35-1.0
U	0.36±0.072	0.23±0.11	0.43±0.099	0.1-0.3
Zn	140±26	130±26	170±38	150-250

According to the data obtained (Table 1.), the content of Na and Cl is increased relative to the reference values in all districts of the region. This situation is possible due to the use of highly mineralized drinking water, according to the data of G.A. Mametkarimov (2016).

In all regions, there is a reduced content of cobalt, copper and chromium compared to the reference values, and in Urgench and the Urgench region, a reduced content of zinc and potassium. Based on the results of statistical processing of data from the Aral Sea region, a correlation was established between acute respiratory infections, functional abnormalities and microelements.

The most significant strong positive correlation was between trace elements copper and chronic enterocolitis (Table 2).

table 2

Correlations between diseases and trace elements

Element	Cl	Na	Cr	Fe	Cu	Br	U	Sc
ORZ	-0,57	-0,51				-0,56		
Chronic tonsillitis			0,53	0,45				0,56
Chronic enterocolitis					0,95		0,58	

Cobalt plays an important role in the body, primarily due to its participation in the structure of vitamin B12. In recent years, there has been increased interest in the interplay of vitamin B12, folic acid, choline metabolism, and cognitive development.

Folate affects the proliferation and differentiation of neuronal stem cells, reduces apoptosis, acts on DNA synthesis, and plays an important role in the biosynthesis of homocysteine and S-adenosine-methionine (ZeiselS.H., 2009; Zhang X.-M., 2009). With a lack of cobalt, various types of anemia, exacerbation of nervous diseases, fatigue and irritability often develop [3]. An imbalance of elements in the hair was also observed in the control group of children in Tashkent (Table No. 3).

Table 3

The content of elements in the hair of schoolchildren aged 7-11 years old living in Tashkent, mcg / g

elem	Bektemir district of Tashkent	Reference values

	M±m	
I	0.5±0.13	0.8-1.5
Cl	3100±1100	1000-2000
Cu	7.4±0.58	15-20
Mn	0.56±0.14	0.45-1.0
Na	680±340	250-800
K	680±390	800-1000
Ca	880±150	1000-1500
U	0.18±0.024	0.1-0.3
Au	0.0035±0.00085	0.02-0.05
Br	2.4±0.57	1-3
La	0.094±0.034	0.02-0.04
As	0.063±0.0058	0.1-0.3
Se	0.34±0.035	0.35-1.0
Hg	0.016±0.0056	0.1-0.3
Cr	0.11±0.0056	0.35-1.0
Ag	0.085±0.055	0.1- 0.25
Rb	0.47±0.25	0.5-1.0
Fe	18±2.8	20-30
Zn	146±16	150-250
Co	0.093±0.016	0.05-0.1
Sb	0.022±0.0045	<0.2

From table 3, it can be seen that in children of the control group, the elements copper, iron, chromium, calcium, iodine are reduced compared to the reference values, and lanthanum and chlorine are increased. Deficiency of Ca, Fe, Co, Cu elements in the hair leads to anemia, to the incidence of the gastrointestinal tract, to secondary immunodeficiency states, and disturbances in physical development. A correlation was established between microelements and physical development in children of the control group, presented in table 4.

Table 4

Correlations between diseases and trace elements

Element	Cl	Na	Cr	Zn	I	K	Fe	La
Chronic tonsillitis	0,56	0,62			0,51	0,52	0,54	0,51
Weight				0,60				
growth			0,53	0,63				
Chest circumference				0,58				

A number of significant positive correlations were found between zinc and height, body weight and chest circumference, as well as between chromium and height. Against the background of the influence of environmental factors in the region, the course of many functional abnormalities and chronic diseases is asymptomatic and latent, as evidenced by the imbalance of elements in the hair.

Thus, a relationship has been established between the level of the content of elements and the morphofunctional state of children.

Taking into account the ecological situation in the Aral Sea region, it should be recognized that the impact of the quality of drinking water and food ration on the development of violations of the microelement status of the younger generation is extremely important for health not only in the Aral Sea region, but also for the entire population of the country.

Conclusions. Our studies have shown that the influence of environmental factors on the health of children is accompanied by the development of an imbalance of macro- and microelements in the body of children, which entails a violation in physical development, a decrease in immunity, and the development of chronic diseases. At the same time, the evaluation of the results of analyzes requires taking into account gender and age characteristics, and regional values, thus an in-depth extended study of all age groups is necessary. In the future, it is important to carry out preventive measures aimed at normalizing the elemental status in children, which may in the shortest possible time lead to an increase in functional reserves and the restoration of reduced functional indicators.

References.

1. Avtsyn A.P. Human microelementoses / A.P. Avtsyn, A.A. Zhavoronkov, L.S. Strochkova. - M.: Medicine, 1991. - 496 p.

2. Akhmedova D.I., Kuryazova Sh.M. Features of the health of preschool children in the Aral Sea region - Khorezm region // "Clinical Immunology, Immunogenetics, Interdisciplinary Problems" is dedicated to the 25th anniversary of the Institute of Immunology ANRUz. Scientific and practical conference - Tashkent. 2010.-p.62-64.

3. Bioelemental status of the population of Belarus: ecological, physiological and pathological aspects; ed. ON THE. Gres, A.V. Rocky. - Minsk: Harvest, 2011. - 352 p.

4. Babenko G.A., Reshetkina A.P. The use of trace elements in medicine. Kiev, 1971. - 311s.

5. Danilova E.A., Kist A.A., Osinskaya N.S., Khusniddinova S.Kh. Application of neutron activation analysis to assess the elemental status of the human body. Medical physics. 2008; 3:73–77.

6. Isaeva R.B., Choi S.V., Mergenova G.A. Assessment of the physical development of children living in the Aral Sea region // Pediatrics: from the 19th to the 21st century. – Materials of the conference. - St. Petersburg, 2005. - P. 80.

7. Karimov U.A. On the physical development of organized preschool children in the Tashkent region / U.A. Karimov, N.A. Zakirova, D.S. Aripova // Vestn. general practitioner. - Samarkand, 2001. - No. 3. - C. 51-52.

8. Malenchenko A.F. Elemental composition of the hair of the inhabitants of Belarus / A.F. Malenchenko [et al.] // Problems of health and ecology. - 2009. - No. 1. - P. 126–130.

9. Mambetkarimov G.A., Zhiemuratova G.K., Utemuratova K.S. The role of the water factor of the Aral Sea region in the formation of children's health // Bulletin of Science and Practice -2016. -№6.-S.85-89

10. Khudainazarova S.R., Kuryazova Sh.M., Alyaviya M.N. Assessment of the state of health in children of primary school age in the Aral Sea region // Eurasian Bulletin of Pediatrics. — 2021; 1(8):23-26