SPREADING OF IODINE AND FLUORINE IN THE OBJECTS OF THE ENVIRONMENT IN DIFFERENT BIOGEOCHEMICAL ZONES OF TRANSCARPATHIA.

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One of the etiologic and pathogenic factors of many diseases is the ecologically conditioned deficiency of iodine and fluorine in the environment. Iodine deficiency is realized through hypothalamus-hypophysial thyroid system, but the direct influence of iodine and fluorine on the exchange of substances and a number of physiologic processes can not be excluded. Heterogeneity of geographical, climatic, biogeochemical, social and national factors that influence the state of iodine - fluorine exchange leads to differentiating approach as to the development of preventive measures and creating regional programs.

Wide spreading of the diseases caused by insufficiency of iodine in the environment was noted at the 39 th World Assembly of Health Protection, 400 million people only in Asia suffering from it at present as well as people in the other parts of the world (Zheneva, 1997).

The expert committee from World Organization of Health Protection considers fluorine to be one of 14 elements necessary for life. But there are no exact experimental findings confiming its biological role, it being impossible to extract fluorine from the ration of experimental animals. Alongside with this leading role of fluorides in the process of bones and teeth development, in the growth of animals, increasing their fertility, blood stimulation formation has been established. Fluorine deficiency is responsible for parodont impairment, teeth carries and other pathologic changes in the bone tissues.

On the other hand the excess of fluorine in the environment results in endemic fluorose being observed in many parts of the world. Endemic (or industrial) fluorose is responsible for the intensified bone and teeth brittleness and general exhaustion in the result of fluorine-calcium exchange impairment.

Iodine as a part of thyroid gland hormone content participates in the process of energetic exchange of proteins, fats and carbohydrates, in the processes of growth and development of the organism, in cell division and differentiation and in many other biochemical and physiological processes. Iodine insufficiency results in exhaustion and development of an infant, endemic goitre, mixcedema, autoimmune thyroidite, etc.

It should be noted that natural essential iodine deficiency as a rule is accompanied by fluorine insufficiency. In addition to it the World Map of iodine insufficiency and endemic goitre coicides with rare exceptions with speading of iodine insufficiency and teeth carries.

The above mentioned findings are the evidence as to the role of iodine-fluorine tandem in the processes of organism vital activity.

Transcarpathian region of Ukraine is a unique region for iodine-fluorine deficiency study as a constantly acting ecological factor in the environment of people and animal settling surrounding.

In view of this we aimed to study the content of iodine and fluorine in water, food products and forage in the biogeochemical zones of Transcarpathia, it being significant for the development of purposeful and effective methods of prevention as well as for the development of the strategy of endemic diseases treating caused by these clements deficiency.

Th territory of Transcsrpathia as to the content of iodine and fluorine in its soil and water can be divided into 3 biochemical zones – highland, foothill and lowland. The investigations of iodine and fluorine in the region were carried out in 1950 – 1960. It should be noted that ineffective iodine-fluorine prophylaxis, the change of natural antropogenic, social and economic factors and the file-conditions resulted in the change of chemical content of soil, water and plants as well as sharp increase in the rate of different diseases spreading due to iodine-fluorine deficiency. This is one more evidence of our research topicality.

According to the findings received by a number of authors, Transcarpathian region especially its mountainous and foot-hill regions are regarded to the areas with iodine deficiency in the objects of the environment. In spite of the fact that goiter as a mass disease has been stamped out, the ecologically conditioned iodine insufficiency still remains to be a coustantly acting factors.

Iodine has been estimated by cerium-arsenium method, while fluorine has been determined by fluorine-selected electrode. All the results were evaluated by variational statistics of Fisher and Student. The changes at $p < 0,5$ were considered to be reliable . The deficiency of iodine in soil, water, food stuffs and forage in mountainous and food-hill regions comparing with lowlands has been found out in of the process of our investigation.

It was established that the everage contend of iodine in soil of the region is 19 – 20 mkg/gr, the lowest on being in mountainous and foothill regions. In lowlands iodine content in soil is somewhat higher, but still lower than in other regions of Ukraine.

The lowest level of iodine concentration was found in the open water bodies of mountainous regions and averaged 1, 40 ± 0,10 mkg/l , somewhat higher in foot-hill regions - 1, 87 ± 0,19 mkg/l, it been relatively high in the water bodies of lowlands where its level averaged 4, 47 ± 0,65 mkg/l.

Iodine content in wells was lower than in open water bodies and averaged 1,00 ± 0,08 mkg/l., 1,4 ± 0,15 mkg/l., and 4,8 ± 0,64 mkg/l. respectively ($p<0,5$). We consider it to be connected with penetration of iodine into open water bodies with precipitation and washing it away from soil by water.

Table 1.

Iodine content in water of three zones of Transcarpathian region

(M ± m, mkg/l)

Lowland		Foothills of Carpathians		Carpathian Highland	
Regions of Uzhgorod, Mukachevo, Beregovo, Vinogradovo		Regions of Irshava, Perechin, Khust, Tyachiv (southern part)		Regions of Veliky Berezny, Rakhiv, Mizhgirya, Svalava (southern part)	
Rivers, lakes	wells	Rivers, lakes	wells	Rivers, lakes	wells
4,47 ± 0,65	4,08 ± 0,64	4,87 ± 0,19	1,48 ± 0,15	1,40 ± 0,1	1,00 ± 0,08

Note: The value of P was calculated in relation to data for lowland.

According to the analysis at iodine content in open sources disrtict of water from different regions, we must concede that it was higher in Uzhgorod region and some what lower in Mukachevo, Beregovo and Vinogradovo districts. Its content in waters at Carpathian foothills was approximately the same and only in Khust region it was higher. However it was lower than in lowland waters. The waters in Svalava and Veliky Berezny (the mountains districts) were most poor in iodine content.

Similar picture was observed during analysis of iodine content in water-wells, with exception of zone of mountains, where in Rakhiv region the iodine content reached its maximum in surface waters. At the same time in iodine content in waters from wells was relatively low.

The iodine content analysis in food and fodder shows its strong deficiency in Carpathian Highland in comparison with lowland regions (Table 2).

Table 2.

Iodine content in food and fodder of two biogeochemical zones of Transcarpathian region (M ± m, mkg/%)

Food, forage	n	lowland	n	Carpathian Highland	P
Milk	12	3,59 ± 0,09	12	1,98 ± 0,17	<0,05
French beans	12	3,55 ± 0,14	12	2,52 ± 0,11	<0,05
Cabbage	14	8,65 ± 0,81	14	5,10 ± 1,09	<0,05
Potatoes	10	6,80 ± 0,78	10	4,47 ± 0,66	<0,05
Table beet	10	6,25 ± 0,34	10	4,57 ± 0,66	<0,05
Maize	10	4,72 ± 0,94	10	3,80 ± 0,72	>0,05
Wheat straw	10	3,77 ± 0,57	12	3,00 ± 0,38	<0,05
Hay from sowed grasses	10	2,80 ± 0,11	13	2,06 ± 0,10	>0,05
Meadow hay	10	5,87 ± 0,37	10	4,12 ± 0,50	<0,05

Note: The value of P was calculated in relation to data for lowland.

We should state, that low level of iodine in food and forage least to its deficiency in human and animals bodies. This causes deficiency in thyroid gland hormones, substantially decreases the quality of animal products and has negative effect on human health.

The calculations show , that inhabitants of lowland regions consume as a mean 121,3 mkg of iodine in their daily diet and people from highland intake only 84,9 mkg of iodine per day. This, of course, is directly connected with the iodine content in drinking water and food. These doses are significantly lower than those recommended by World Health Organization (150 – 200 mkg/day).

The fluorine content in soil of this three zones of Subcarpathia consists of 18, 7 ± 0,16 mg%. However the range of fluorine content varies greatly in each of zones. For example, the fluorine concentration into soils of lowland was estimated as 4,0 - 33 mg% and in soil of Carpathian foothills and Highland as 10,0 - 27,0 and 10 - 27 mg%, respectively . These facts suggest that constant monitoring of fluorine content in soils is very important for particular localities. The data of fluorine content in drinking water of Transcarpathia are presented in table 3.

Table 3.

The fluorine content in drinking water of Transcarpathia in different biogeochemical zones (by Gorzov & Potapchuk, 1998)

Biogeochemical zone	**Amounts of samples**	**Fluoride contendt mg/l**	
		Rivers	**Water-wells**
Lowland	1284	0,62 ± 0,0005	0,049 ± 0,0004
Foothills of Carpathians	1364	0,078 ± 0,0006 p> 0,05	0,053 ± 0,0004 p< 0,05
Highland	1328	0,069 ± 0,0006 p> 0,05	0,057 ± 0,0005 p< 0,05

Note: The value of P was calculated in relation to data for lowland.

The main sources of drinking water are deep-water-wells. This water contains 0, 09 ± 0,01 mg/l (0 – 50 mg/l). The water of open surface lakes and springs is even more poor in fluorine content with an everage 0,08 mg/l (0 – 15 mg/l).

In all studied sources of drinking water supply in lowland and Highland. For example, the level fluorine 0,2 – 0,5 mg/l was observed in 45 % of water sources. This amount is 2,5 times less than concentrations recomended by WHO (0,7 – 0,1 mg/l).

The fluorine content in Transcarpathian cereals was leveled as 0,17 – 0,30 mg/% of row weight. Its level in Fabaceace crops was close to the amounts in cereals. The vegetables contain less of this element, than cereals. Its level in patatoes was estimated as 0, 088 ± 0,01 mg/%. Tomatoes, cabage, beetroot, coutain 0,09 – 0,13 mg% of fluorine. Its level in meat and milk was low also 0,025 ± 0,004 mg% (0,009 - 0,054 mg%) and 0,088 ± 0,009 mg% (0,023 - 0,234 mg/l), respectively. At the same time there was no difference in fluorine level in main food products between three biogeochemical zones.

We estimated that pupils obtain with water and food about 0.323 – 0.336 mg of fluorine per day. The physiological need for fluorine in 7 – 16 years – old children is 1,8 mg. per day.

The analysis of rural inhabitants' diet in different zones of the Subcarpathia estimated an everage level of fluorine intake as 0,52 mg /day, particularly, in lowland zone 0,54 mg/day, in zone of Carpathian foothills – 0,573 mg/day and in Carpathian Highland – 0,466 mg/day.

Our investigations proved the fluorine deficiency in local waters and food products in Subcarpathia.

All things together, our studies support the data of literature about iodine and fluorine deficiency in Subcarpathia. The most strong shortage of this elements was observed in Carpathian Highland. We should take to account the correlation of fluorine deficiency with low iodine content during the implementation of profilactic measures. All measures aimed to prevent iodine –fluorine deficiency in humans and animals shoutd be more carefully controlled for their effectiveness in humans and animals. We recommend the permanent monitoring of iodine and fluorine content in drinking water, food products, particularly in table salt and forage.

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