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CONCENTRATION OF FLUORIDES IN DRINKING WATER AND RELATIONSHIP WITH DENTAL CARIES IN PRESCHOOL CHILDREN IN TASHKENT REGION

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RELEVANCE

The intake of optimal fluoride concentrations into the body is essential among the factors influencing the prevalence and intensity of dental caries, especially in children during the period of tooth formation. Since in the overwhelming majority of regions of Uzbekistan, the content of fluoride in water is less than half of the optimal dose, one of the main methods of caries prevention should be the widespread use of fluoride-containing means [1].

High prevalence and intensity of dental caries in children in different countries and regions, with different environmental conditions, dictate the need for a comprehensive study of risk factors, both socio-hygienic and biomedical [2,3]

The development of caries in childhood is influenced by many factors, both general and local. Among the common factors, there are a genetic predisposition to caries, the influence of environmental factors, including a reduced fluoride content in drinking water, an unbalanced diet, extreme exposure (stress), the presence of general somatic diseases and an aggravated allergic status [4,5]

For the prevention of dental caries, 3 risk factors for caries are of the greatest practical importance: dental plaque and its microorganisms, excess sugar in food, fluorine deficiency in drinking water and food. In a definite way, it is possible to completely prevent the development of dental caries or reduce the intensity of the disease in children and adults by acting on these factors. The extreme effect of prevention is observed with simultaneous action on all 3 factors. In practice, this approach is called "comprehensive prevention". All known methods for the prevention of dental caries are conditionally divided into three groups, respectively, according to the three cariogenic factors to which they are directed. This is the elimination of plaque microorganisms, the reduction of sugars in the diet, the replenishment of fluorine deficiency in the environment surrounding the teeth. Two main types of disease prevention can be distinguished conditionally: endogenous and exogenous. Endogenous prevenion is aimed at strengthening all tissues of the tooth by influencing the entire body from the inside. One of the most important endogenous methods of caries prevention is caries prevention with fluorides. The remineralizing and anti-carious effect of fluorides has been confirmed by numerous randomized clinical trials with the highest level of scientific evidence. This level corresponds to the quality of the evidence base on the effectiveness and safety of systemic methods of fluoride prophylaxis (fluoridation of water, salt, milk, taking fluoride-containing tablets and drops), which at a low cost provide a fairly high anti-caries effect (40-60%). [6,7,8]

MATERIALS AND METHODS

We chose Tashkent region for the study. In order to determine the concentration of fluoride in drinking water in the Tashkent region, drinking water samples were collected from 28 kindergardens located in 5 cities and 9 districts of the region. Water samples were collected in accordance with the requirements of the interstate standard (GOST 31861-2012).

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The fluorine concentration in the collected samples was determined by the potentiometric method. To do this, we used a laboratory ionomer - Ionomer I-160MI. Each sample was tested 8 times and the arithmetic mean was calculated. The selected water was collected in a polyethylene container. If it was impossible to determine the concentration of fluorine on the day of collection, the samples were stored in a refrigerator at t $=6^0$ C for no more than 2 days. The content of fluorine (fluorine ion) in the samples was determined with a fluoride-selective solid-contact electrode ELIS 131 F, designed for potentiometric measurement of the concentration of fluorine ions in a liquid in combination with an ionomer of a laboratory automated type LABORATORY IONOMER I-160MI. The prepared samples were placed on a magnetic stirrer, were immersed in the electrodes solution, and expected the establishment of the equilibrium value of the potential. Each sample was analyzed three times and the concentration of fluorine ions was found from the calibration curve using the electrode potential

The results of the study were processed using statistical processing packages Statistica, version 6.0. Methods of mathematical statistics were used in the study: methods of variation statistics, frequency, dispersion and correlation analyses. The significance of differences in groups was determined using the t-test (Student's t-distribution).

RESULTS AND DISCUSSIONS

The etiological factors of caries are varied, poor oral hygiene, excessive consumption of carbohydrates, which reduces caries resistance in children. However, another group of authors believes that caries resistance after the eruption of milk and permanent teeth and in the first years of life is associated with the concentration of fluoride in the water consumed.

If it contains a number of trace elements-accelerators, the most popular of which is fluorine, the processes of mineralization and remineralization proceed more efficiently: their speed increases, which leads to the formation of less soluble crystals than the original ones, a qualitative change in enamel apatite occurs (magnesium, chlorine and hydroxides are exchanged with fluorides).

Various theories are being formed about the anticaries effect of fluorine, presented by a number of authors, in particular, the theory put forward by Dean and others, fluorine ions enter the lattice of hydroxyapatite $Ca_{10}(PO_4)_6(OH)_2$ with the formation of fluorohydroxyapatite $Ca_{10}(PO_4)_6(OH)F$, which is more acid-resistant (18). The resolutions of WHO emphasize the role of fluoride in caries prevention. The normal level of fluorine in water contributes to a faster intake of calcium into the body. The fluorine reacts with enamel hydroxyapatite crystals, forming more acid-resistant compounds, reducing enamel permeability and strengthening the microcrystalline lattice. It has bactericidal properties and reduces the enzymatic activity of microbes.

The amount of fluorine in water is described as follows:

1. Very low level – up to 0.3 mg/l.
2. Low levels – from 0.3 to 0.7 mg/l.
3. The normative (optimal) level is – from 0.7 to 1.1 mg/l.
4. High, but 8520/F acceptable – from 1.1 to 1.5 mg/L
5. Fixed high level from – from 1.5 to 2 mg/l.
6. High level – from 2 to 6 mg/l,
7. Very high levels – from 6 to 15 mg/l

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Table 1
Drinking water in some districts of the Tashkent region
F-concentration (M±m, mg/l)

№	District/city	F^- (M±m, mg/l)
1	Tashkent district	0,270±0,01
2	Yangiyul district	0,107±0,01
3	Bostonlik	0,26±0,03
4	Parkent	0,234±0,02
5	Angren	0,18±0,01
6	Yukori Chirchik	0,102±0,01
7	Buka	0,115±0,01
8	Nurafshon	0,27±0,01
9	Bekobod	0,412±0,.01
10	Pskent	0,175±0,01
11	Okhangaron	0,158±0,01
12	Chinoz	0,168±0,01
13	Olmalik	0,244±0,01
14	Okkurgon	0,227±0,004

The results of a study of the concentration of fluorine in drinking water in the Tashkent region showed a low level in all surveyed objects, from the lowest levels in the Yukori-Chirchik district (0.102±0.008 mg/l) to the highest level of F concentration in drinking water in the Bekabad district (0.412± 0.01 mg/l), but all these indicators were in the range of the category of low concentration of fluoride in drinking water.

We have carried out a correlation analysis of the intensity of dental caries in preschool children in some districts of the Tashkent region.

Table 2.
The intensity of dental caries in children with caries (n=104) of preschool age (%)

Caries, filling, extracted tooth + caries, filling	Indicators of caries, filling, extracted tooth + caries, filling
Very low degree (0-1.1)	
Low degree (1.2-2.6)	15,38±0,38 (16)
Average degree (2.7-4.4)	25,96±0,50 (27)*
High degree (4.5-6.5)	15,38±0,38 (16)
Very high (6.6<)	43,27±0,64 (45)* •

Note: * - P<0.05 reliability of a relatively low degree of intensity of caries in preschool children from Tashkent region; • - P<0.05 reliability relative to the indicators of the average degree of intensity of caries in preschool children of Tashkent region

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An analysis of the intensity of caries in children of kindergartens in Tashkent region showed that in children there were mainly an average (22.88 ± 0.44 (27) and very high intensity of caries (38.14 ± 0.57 (45)).

Also we analyzed the prevalence of caries in children of kindergartens in Tashkent region, which was assessed according to the following criteria (Table 3)

Table 3
Criterion for the prevalence of dental caries according to WHO

low	0 - 30%,
average	31% - 80%
high	81% - 100%.

Among the 118 examined preschool children, 114 children were found to have carious teeth and the prevalence rate of carious teeth in the Tashkent region was 88.14±0.86%.

According to the accepted criteria for the prevalence of caries according to WHO, the results show a high prevalence of caries (81% - 100%) in preschool children in Tashkent region.

The mineralizing ability of saliva largely depends on the content of fluorine ions in it. In the present study, salivary fluoride concentrations ranging from 0.0013 to 0.022 ppm were found for 118 children, who did not consume fluoride.

Table 4
The concentration of fluorine in the mixed saliva of children of the Tashkent region of preschool age

Tashkent region **(n=118)**	**Saliva values** **F (мг/л)**
General	0,02±0,001

The indicator of fluoride ion in the oral fluid in preschool children, depending on the districts of Tashkent region, did not reveal significant differences, averaging 0.02±0.001.

Table 5
The relationship between the prevalence and intensity of caries in preschool children in the Tashkent region with the content of fluorine in saliva and drinking water

Indicators	**Preschool children**	**Severity criterion**
Prevalence of caries	88,14±0,86	High degree
Intensity of caries	38,14±0,57	Very high degree
Saliva fluoride mg/l	0,02±0,001	Very low level
Fluorine in drinking water, mg/l	0,21±0,02	Very low level

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A comparative analysis of the obtained results showed that preschool children in the Tashkent region have a high degree of intensity (38.14±0.57) and prevalence (88.14±0.86) of caries with a very low concentration of fluoride in saliva (0.02± 0.001) of examined children and low concentration of fluorine in drinking water (0.21±0.02) of surveyed districts of Tashkent region (assessment criteria are shown in Tables 3.2 and 3.3).

In all districts of Tashkent region, the concentration of fluorine in drinking water was low and very low, averaging 0.2 mg/l.

The obtained results show that the lower the concentration of fluorine is in drinking water, the higher the intensity and prevalence of caries in preschool children in the Tashkent region.

We analyzed the relationship between the concentration of fluoride in drinking water in some districts of Tashkent region and the intensity and prevalence of caries in preschool children of these regions (Table 3.6).

Table 6
Dental status of preschool children in regional districts of Tashkent region

Indicators	Tashkent (21)	Akkurgan (37)	Chinaz (45)	Yangiyul (15)
Caries, filling, extracted tooth + caries, filling	6,60±1,33	4,51±0,76	8,56±0,61	5,11±1,0
Prevalence of dental caries (%)	100	70,27	97,78	93,33
Fluoride in saliva	0,02±0,002	0,02±0,001	0,02±0,001	0,02±0,001
Fluoride in drinking water	0,27±0,01	0,227±0,01	0,168±0,01	0,107±0,01

The very high intensity of dental caries, according to the criteria given in Table 3.2, was in Tashkent (6.60±1.33) and Chinaz (8.56±0.61) districts, as well as the prevalence of 100% and 97, 78%, respectively. In Chinaz (0.168±0.01 mg/)l, the concentration of fluorine is lower than in the Tashkent region (0.27±0.01 mg/l). According to the criteria for the level of fluorine given in Table 3.3, the concentration of fluorine in drinking water and in saliva corresponds to a very low level.

Hence, a comparative analysis of the relationship between the intensity and prevalence of caries in children with the concentration of fluoride in drinking water by region showed the same pattern as the indicators in the general group (n=118), that is, the low concentration of fluoride in drinking water and saliva of the examined preschool children correspond to high rates of intensity and prevalence of caries in preschool children of Tashkent region.

CONCLUSIONS

Thus, the results of the studies give basis to suggest the role of low concentrations of fluoride in drinking water in the development of dental caries in children in Tashkent region.

In all districts of Tashkent region, the prevalence of dental caries, in accordance with the low content of fluoride in drinking water, showed very high results, in the Tashkent district 100%, Akkurgan 67.57%, Yangiyul and Chinaz 93.3%.

Nowadays pollution is the greatest threat to water. Pollution refers to all kinds of physical and chemical deviations from the natural composition of water: frequent and prolonged turbidity, temperature rise, rotting organic matter, the presence of hydrogen sulfide and other toxic substances in water. Wastewater is also added to all this: household, food industry, agriculture. Often, wastewater contains oil products, cyanides, salts of heavy metals, chlorine, alkalis, acids. We should not forget about the contamination of water with herbicides and radioactive substances. Today, water everywhere is

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polluted with solid household waste as well. In addition, waste water from the fields enters the untreated reservoirs.

The information accumulated over this period of time made it possible to form a fundamentally new approach to determine the dental status in children, depending on the hygienic assessment of water in Tashkent region. The level of presented indicators can be used as additional criteria for determining hygiene indicators, disease prognosis, and also as a criterion for preventive measures.

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