Oral Health And Prevention Of Dental Caries In Preschool Children Living In Conditions Of Biogeochemical Fluorine Deficiency

S.S. Murtazaev[1], N.Sh. Akhrorkhujaev[2], L. P. Kiselnikova[3],

J.A. Dinikulov[4], M. M. Astanakulova[5]

1 MD, Associate Professor, Head of the Department of Pediatric Therapeutic Dentistry, Tashkent State Dental Institute, Tashkent,Uzbekistan

2 External PhD student of the Department of Pediatric Therapeutic Dentistry,

Tashkent State Dental Institute, Tashkent, Uzbekistan

3 MD, Professor, Head of the Department, Chief Freelance Specialist of the Moscow Department of Health on Pediatric Dentistry, Moscow, Russia

4 Assistant of the Department of Pediatric Therapeutic Dentistry,

Tashkent State Dental Institute, Tashkent, Uzbekistan

5 Assistant of the Department of Theoretical Therapeutic Dentistry,

Tashkent State Dental Institute, Tashkent, Uzbekistan

ABSTRACT

Research objective: to study the oral health and to work out preventive measures for preschool children living in conditionsof biogeochemical fluoride deficiency.

Material and methods. The research included 280 children aged 4 to 6 years attending preschool educational institutions in the Kashkadarya and Surkhandarya regions. During the examination, the generally accepted sequence was followed: external examination, assessment of the teeth location, dentition, assessment of oral hygiene, study of the dental tissues. Besides, we determined and analyzed the quality of OHI, the PMA index, as well as applied methods for detection of concentration of fluoride in the oral cavity and the method of the detection of calcium and phosphorus in the oral fluid.

Results and discussion. During the research the studies on the fluoride content in drinking water sources were carried out. It was established that the intensity index in the core group was 2 times higher than in the control group (P <0.001). Besides, the study showed that before the beginning of preventive measures, the concentration of hydrogen ions in the oral fluid of infants was 6.21 + 0.045, i.e. pH of the oral fluid had a shift towards the acidic side. A year after taking tablets with sodium fluoride, the concentration of hydrogen ions changed and made 7.07 + 0.029, and pH became neutral (p <0.001). Initial indicators of calcium in the oral fluid of children born and living in conditions of biogeochemical fluoride deficiency concluded 1.21±0.063 mmol/L, phosphorus - 1.86±0.043 mmol/L. The inclusion of "Fluorine balance" tablets in the menu of schoolchildren in a month led to a significant increase in the calcium content in the oral fluid to 1.47±0.056 mmol/L (p <0.01). After 2 months after the study initiation in the group to schoolchildren *consuming sodium fluoride, we noted a significant increase of phosphorus content 2.14±0.052 mmol/L (p <0,001).*

Conclusion. The intensity of dental caries in children of the core group was 2 times (p <0.001) higher than that in the control group. 6 months after the inclusion of fluoride tablets in the menu of children, the fluoride content in the mixed saliva was 0.113±0.0046 mmol/L, i.e. the level of fluoride in the oral fluid of preschoolers of the core group was significantly (p<0.001) higher than the same indicator (0.019±0.0001 mmol/L) in the initial data of the core group before thepreventive measures. Besides, inclusion of fluorinated iodized salt in the menu of preschool children in 6 months contributed to a significant increase in calcium content from 1.21±0.063 to 1.46±0.057 mmol/L (p<0.01) and phosphorus in the oral fluid from 1.86±0.043 to 2.14±0.052 mmol/L (p<0.001).

Key words: dental caries, biogeochemical fluoride deficiency, preventive measures, oral fluid.

INTRODUCTION

Dental caries is one of the most common diseases, the prevention of which is paid much attention in the literature [1, 2, 3, 4].

Prophylaxis of dental caries includes a whole range of measures aimed at its prevention. A necessary condition in the complex of these measures is a rational individual oral hygiene, including the use of special therapeutic and preventive agents [1]. Correctly organized high-quality oral hygiene can significantly reduce the incidence of dental caries [2, 9].

In the pathogenesis of dental caries, oral fluid is of particular importance. Numerous studies proved the dependence of the state of organs and tissues of the oral cavity on the composition and properties of the oral fluid [4, 5, 8, 10, 13, 15]. Oral fluid carries out a number of functions, and a very important one is maintaining homeostasis and the associated process of mineralization of tooth enamel. The researches by E.V. Borovsky and V.K. Leontiev [3] established that most of the mineral ions get into the enamel from the oral fluid. In the oral cavity, the process of mineralization occurs when the teeth are washed with saliva. The remineralization of the surface enamel is due to the influenceof calcium and phosphorus of the oral fluid. Oversaturation ofsaliva with Ca and HPO_4 for teeth is the main mechanism for maintaining the constancy of their tissues composition. When the pH reduces to 6.00-6.26, saliva becomes unsaturated with calcium ions and hydroxyphosphate, which leads to the increase of enamel solubility [3].

In Uzbekistan, there is a lack of in-depth researches on the oral health and study of the properties of the oral fluid in children, especially of the southern regions of the republic.Currently, fluorine compounds are recognized as the most studied and effective means of dental caries prevention [7, 12, 16, 19, 20].

Fluorides prevent the development of caries. When ingested in optimal concentrations, fluorine increases the activity of alkaline and acid phosphatases of bone tissue, isocitrate dehydrogenase and liver adenylate cyclase, and has a stimulating effect on bone tissue synthesis, hematopoiesis, and immunity [21, 22]. The mechanism of fluorides effect on mineral metabolism in the dental tissues depends on the method of introducing fluoride into the body. Drinking of pure water with a fluoride concentration less than 0.5 mg/l results in the development ofdental caries. The optimal concentration of fluorine in water for a human is considered to be from 0.7 to 1.2 mg/l, and the threshold concentration for toxicity is 1.5 mg/l. Rugg-Gunn A.J and Murray J.J. [23] analyzed the results of 95 projects on water fluoridation in 20 countries in the period from 1945 to 1972. The reduction of caries in permanent teeth during that period ranged from 29 to 85%, on average 55.6%.

In recent years, many researchessaid about the effective use of fluoride tablets for caries prevention [11, 14, 17]. Pharmacological options for fluoride supplements can be precisely and individually dosed. This fluoride prophylaxis option is independent of food and municipal technology. Sodium fluoride tablets can be prescribed in regions where water fluoridation is not possible. In the Republic of Uzbekistan, there is a problem of the increasing prevalence and intensity of dental caries.One of the factors creating this problem is the low fluoride content in the water.

E. Newbrum [18] recommends prescribing fluoride tablets in regions where water contains less than 0.7 ppmF. The calculation of the fluoride dose should be based not only on the child's age,but also on the individual risk of developing caries [19], as well as on the accurate analysis of the daily introduction of fluoride from all sources [20]. The total dose should not exceed 1 mg F/day (WHO, 1995).

In our country, the prevention of dental caries using fluoridated tablets has not been carried out yet.

Considering all of above mentioned and, especially, the unfavorable oral health of children, the low content of fluoride in the drinking water of the Republic of Uzbekistan, we may conclude that this contingent of children requires a scientifically based approach to the implementation of preventive measures and the selection of means for the dental cariesprophelaxis.

RESEARCH OBJECTIVE

Research objective is to study the oral health and to work outpreventive measures for preschool children living in conditions of biogeochemical fluoride deficiency.

MATERIAL AND METHODS

The object of the study was 280 children aged 4 to 6 years attending preschool educational institutions in the Kashkadarya and Surkhandarya regions. There were 53 boys (58.88%), and 37 girls (41.11%) of the total number of children examined.

Preschool children from various districts of theKashkadarya region (240 children, 129 boys and 111 girls were included in the core group.Children (40 children, 23 boys and 17 girls) living in the mountain areas of the Boysun district of the Surkhandarya region were involved inthe control group.This region, according to ecologists, is the most ecologically favorable southern region of the republic.

During the examination period, all children were practically healthy and were not registered with related specialists. The examination of children was carried out using a standard set of dental instruments under natural light. All data were recorded in a special questionnaire card, with the help of preschool educators. In addition, parents were also questioned to obtain complete information about the child.

During the examination, the generally accepted sequence was followed: external examination, assessment of the teethlocation, dentition, assessment of oral hygiene, study of the dental tissues.

Hygienic history included: when, how many times a day, what and how the child brushed his teeth. As a result of the conducted examinations of children, it was established that all children needed special individual training in hygienic skills and regular quality control of hygienic oral care.

The intensity of caries was determined by the average value ofDecay Missing Filled (DMF) + Decay Missing (DM) indexes of the teeth (T.F. Vinogradova, 1988). This indicator reflects the degree of affection of teeth and cavities in one child. For this purpose, the determination of quantitative values of DMFwas applied, where C is the number of carious (untreated) teeth, F is the number of treated (filled) teeth, and E is the number of extracted teeth or teeth roots to be removed. The sum (C+F + E) of all affected and lost teeth characterizes the intensity of the carious process in a particular person. For deciduous teeth, the DM indicator is calculated - the number of carious and filled teeth in the temporary bite. Extracted or lost teeth as a result of physiological change in the temporary bite are not taken into consideration. For a mixed bite in children, two indexes are calculated:DM for temporary and DMF for permanent teeth. The total intensity of dental caries lesions is calculated by summing the DM + DMF indexes.

The prevalence of dental caries is the ratio of the number of persons with at least one of the signs of dental caries (carious, filled or extracted teeth) to the total number of examined persons, expressed in percentages.

To determine the prevalence, the number of persons with revealed dental caries (except for focal demineralization) is divided by the total number examined in this group, and the result is multiplied by 100.

In order to assess the prevalence of dental caries in the group of examined patients or to compare the value of this indicator in different regions, the WHO evaluation criteria for children are used.

Prevalence of Caries (%)	
Low	0-30
Average	31-80
High	81-100

To assess the hygienic state of the oral cavity, the hygiene index was determined by the method of Yu.A. Fedorov and V.V. Volodkina (1972).

As a test for hygienic cleaning of teeth, the staining of the labial surface of the six lower front teeth with iodine-potassium solution was used (potassium iodide - 2 g; crystalline iodine - 1 g; distilled water - 40 ml).

The quantitative assessment was carried out according to a five-point system:

- staining of the entire surface of the tooth crown - 5 points;
- staining of 3/4 of the tooth crown surface - 4 points;
- staining of 1/2 of the tooth crown surface - 3 points;
- staining of 1/4 of the tooth crown surface - 2 points;

- lack of staining of the surface of the tooth crown - 1 point.

By dividing the score by the number of examinedteeth, an indicator of oral hygiene was obtained (hygiene index - OHI).

The calculation was made according to the formula:

$$Kav. = \frac{\sum Ki}{n}$$

where, Kav. - is the general oral hygienic index;

Ki - is the hygienic index of cleaning of one tooth;

n -is the number of teeth [usually 6].

The quality of oral hygiene was assessed as follows:

- good OHI - 1.1 - 1.5 points;
- satisfactory OHI - 1, 6 - 2.0 points
- unsatisfactory OHI - 2.1 - 2.5 points;
- bad OHI - 2.6 - 3.4 points;
- very OHI IG - 3.5 - 5.0 points.

With regular and proper oral care, the hygiene index is within 1.1–1.6 points; OHI value of 2.6 or more points indicates the lack of regular dental care. This index by Y.A. Fedorov and V.V. Volodkina is quite simple and available for application in any conditions, even when conducting mass dental examinations of the population. It can also serve fordetermination the quality of dental cleaning in hygiene education. Its calculation is carried out quickly, with sufficient information content to draw conclusions on the quality of dental care.

To assess the severity of gingivitis (and subsequently to register the dynamics of the process), the **papillary-marginal-alveolar index (PMA) was used**. Various modifications of this index have been proposed, but in practice the PMA index is more often used in the modification of Parma (1960).

The PMA index is assessed according to the following codes and criteria:

0 –absence of inflammation;

1 - inflammation of only papilla gingivalis(R);

2 - inflammation of the marginal gums (M);

3 - inflammation of the alveolar gums (A).

The PMA index is calculated by the formula:

$$PMA = \frac{sumofscores}{Zxnumberofteeth} x\ 100\%$$

The number of teeth (while maintaining the integrity of the dentition) is taken into account depending on age:

6 - 11 years old - 24 teeth,

12 - 14 years old - 28 teeth,

15 years and older - 30 teeth.

Note: if there are missing teeth, then it is divided by the number of teeth present in the oral cavity.

Normally, the PMA index is 0. The higher the digital value of the index, the higher the intensity of gingivitis.

Evaluation criteria for the PMA index:

30% or less - mild gingivitis;

31-60% - moderate severity;

61% and more - severe.

Method of determining the concentration of fluoride in the oral fluid

The total concentration of fluorides in water and in the oral fluid was determined by the potentiometric method (GOST 4386-89). For this purpose, an electrode system was used, consisting of a fluoride-selective electrode and an auxiliary silver-chloride electrode. Drinking water intake was carried out in the main districts of the Kashkadarya, Surkhandarya and Tashkent regions. To determine the content of fluorides in water and saliva, 2-4 ml of the sample was used. Saliva was taken 60 minutes after having a meal with "Fluorine balance" tablets added to it. The samples were treated with a citrate-ethanol buffer solution in the ratio sample: buffer = 2:1, and the fluoride concentration was measured with an EV-74 ion meter. The lower limit of detection for fluoride using a fluorine-selective electrode was 1 x 10 mmol/L, which corresponded to 0.02 mg fluorine per liter. The survey was carried out at 25° C. All laboratory glassware and containers of oral fluid were frozen under laboratory conditions at - 20° C. Determination of the fluoride level in the oral fluid was carried out in 138 preschool children born and living in conditions of biogeochemical fluoride deficiency (content in drinking water 0.02-0.08 mg/l) associated withthe consumption of “Fluorine balance” with fluoride content 0.05 mg.

Method for determining the concentration of calcium and phosphorus in the oral fluid.

The methods for the determination of calcium and phosphorus in the oral fluid are similar to the methods for the determination of these elements in natural waters. The method for determining calcium is based on the formation of a complex of calcium ion with the anion of ethylenediaminetetraacetic acid (Trilon B), which is stable in a strongly alkaline medium at pH=12-13. The complex of magnesium ions in this medium is destroyed, and magnesium is released in the form of hydroxide. The absence of free calcium ions during the titration with trilon B was detected by the murexideindicator. In the presence of calcium, the solution of murexide (purple) changes color to red.

The oral fluid in a volume of 0.5–1.0 ml was diluted with distilled water to 50 ml, then added 1 ml of 1% solution of hydroxidamine hydrochloride, 2 ml of 2% sodium hydroxide solution, several crystals of murexideand tied with 0.005% solution of Trilon B. The lower detection limit of calcium in the oral fluid in 0.5 ml of saliva used for analysis made 8.0 mg/l.

The determination of phosphorus was based on the reaction of fluorophosphates with ammonium molybdate in an acidic medium. The resulting yellow heteropoly acid under the action of reducing agents (ascorbic acid, tin chloride) turned into an intensely stained blue compound. To destroy proteins, 0.1 ml of saliva was treated with 2.4 ml of 7% trichloroacetic acid solution, then the solution was centrifuged. For the analysis an aliquot of the centrifugate (0.1–2.0 ml) was used. The intensity of the staining was measured using an FEC-56 photoelectric color heater. The calculation was carried out according to the calibration schedule.

The lower limit of phosphorus in the oral fluid was 1.0 mg/l.

Statistical processing of quantitative data

Statistical research methods included methods of variation statistics (determination of the arithmetic mean value - M, mean standard error - m, Student's significance criterion – t). The data were processed using the Statistica software package. Taking into account the sample size, the probability of difference p was determined. To assess the significance of differences of compared arithmetic values the Student-Fischer t-criterion was used. $P<0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

According to the regulations of the research worksat the Department of Pediatric Therapeutic Dentistry,the studies on the fluoride content in drinking water sources were carried out. The part of those studies included the determination of the fluorine content in drinking water in the southern and eastern regions of the Republic of Uzbekistan. As can be seen from the Table 1, the results of water samples analysis from the southern and eastern regions of the republic showed the presence of a low content of fluorides in all surveyed sources. Thisfact requires further study on the incidence of caries among the population living in these regions.

Table 1

Results of water samples analysis in the southern and eastern regions of the Republic of Uzbekistan to determine the concentration of fluorine ions

Place of watersampling**(n=12)**	Fluoride content in water mg/l (M+m)	Place of watersampling **(n=12)**	Fluoride content in water mg/l (M+m)
Drinking water in the Kitab district	0.14±0.007	Drinking water in the Bustonlikdistrict	0.260±0.038
Drinking water from drinking fountains	0.060±0.002	Drinking water in the Angrendistrict	0.181±0.014
Drinking water in Karshi	0.060±0.002	Drinking water in the YukoriChirchik district	0.101±0.008
Drinking water in the Muborakdistrict	0.05±0.002	Drinking water in the Buka district	0.114±0.005
Drinking water in the Guzor district	0.050±0.0016	Drinking water in the Bekabad district	0.411±0.01
Drinking water in theDekhkonoboddistrict	0.08±0.003	Drinking water in the Parkent district	0.233±0.02
Drinking water in the Koson district	0.050±0.0012	Drinking water in Nurafshan	0.273±0.007
Drinking water in the Akkurgan district	0.227±0.004	Drinking water in the Piskent district	0.175±0.01
Drinking water in the Chinaz district	0.167±0.007	Drinkingwater in Akhangaran	0.157±0.009

As a result of the present study, we have compiled comparative tables on the state of dental health of children living in the southern regions of the Republic of Uzbekistan (the Kashkadarya and Surkhadarya regions) (Table 2). The prevalence of caries is not significantly different in both areas. However, the intensity index in the core group was 2 times higher than in the control group (P <0.001). The comparative characteristics show that the hygienic state according to the Fedorov-Volodkina index, of the oral cavity of children and the PMA index values were also higher in relation to the control group.

Table 2

Oral health of preschool children in the Kashkadarya and Surkhandarya regions

Index	Control group (n=40)	Core group (n = 240)	R
DMF + DM (DM)	2.4+0.3	4 , 84 ± 0 , 19	< 0.001
PMA	15.04+1.01	19 , 08 ± 0.67	<0.001
GI	1.75+0.1	2, 29 ± 0.05	<0.001
Prevalence of dental caries	85%	89.6%	

Table 3

Physiochemical properties of mixed saliva of preschool children in theKashkadarya and Surkhandarya regions

Group	Control (n=20)	Core (n=138)	R
Calcium (Ca) mmol/L	1.875±0.12	1.21±0.063	<0.001
Fluorine (F) mmol/L	0 31±0.0014	0.019±0.0001	<0.001
Phosphorus (P) mmol/L	2.94±0.12	1,86±0.043	<0.001
pH	6.5±0.13	6,21±0 , 045	<0.05

Most studies convincingly prove the dependence of the state of the organs and tissues of the oral cavity on the composition and properties of the oral fluid. Considering that children of the core group have higher rates of prevalence and intensity of dental caries, the following parameters of the oral fluid were studied: pH value, calcium, phosphorus, fluoride content in saliva.

The pH factor is the main natural regulator of the homeostasis of the enamel mineral components: the lower it is, the faster the process of demineralization is carried out. We revealed differences in the concentration of hydrogen ions in the oral fluid of children in the control and core groups. The average pH of oral fluid inchildren of those groups made 6.5±0.13 and 6.21±0.045 respectively ($p < 0.05$, Table 3).

Mixed saliva index is an important diagnostic criterion in maintaining the oral health. The mineralizing ability of saliva is dependent on the content of phosphorus, calcium, and fluoride ions in it. The study of the physical and chemical properties of the oral fluid showed the following results:

Differences in the content of inorganic phosphorus in the oral fluid of preschool children in the control and core groups were revealed: 2.94±0.12 mmol/Land 1.86±0.043 mmol/L, respectively ($p < 0.001$, Table 3).

The calcium content in the oral fluid of preschool children in the core group was slightly lower than in children of the control group (on average -1.875±0.12 mmol/Land 1.21±0.063 mmol/L, respectively) ($p < 0.001$, Table 3).

The concentration of fluoride ions in the oral fluid of children in the coregroup was 0.019±0.0001 mmol/L, while in the control group this figure was 0.031±0.0014 mmol/L. Differences are statistically significant ($p < 0.001$, Table 3).

Thus, the analysis of data on the trace element composition of the oral fluid showed its decrease in all studied parameters in children living in the Kashkadarya region.

Informationon the content of calcium fluoride and phosphorus in the oral fluid of schoolchildren at the stage of sodium fluoride tablets consumption associated with biogeochemical fluoride deficiency causerather considerable interest. Fluorides effectively prevent the development of dental caries. It was provedthat the endogenous use of fluorides during the formation and mineralization of teeth contributes to the saturation of the enamel with hydroxyfluorideapatites, leading toan increase of dental cariesresistance. To prevent the development of caries in deciduous teeth, WHO recommends prescribing sodium fluoride tablets to children at the age of 6 months.

Children of thepreventive group wereappointed “Fluorine balance”tablets, containing 0.55 mg of fluoride, 1 tablet daily. During the year, the clinical effectiveness of preventive measures was assessed in terms of increasing the prevalence and intensity of dental caries. The effect of preventive measures on the properties of the oral fluid was assessed by changes in the dynamics of pH values, content of calcium, phosphorus and fluorine in saliva.

Data on the dynamics of the dental caries prevalence in the preschool children under the influence of sodium fluoride tablets prophylaxis are presented in the table 4.

As can be seen from the Table 4, the prevalence of caries of deciduous teethdecreased from 90.57 to 89.58% two months aftertaking fluoride tablets. Under the influence of dental caries prophylaxis with sodium fluoride tablets after 12 months, the prevalence of dental caries reached 88.4%.

We also studied the change in the intensity of dental caries in children of the preventive group under the influence of taking sodium fluoride tablets (Table 4).

Besides, the Table 4 shows that the intensity of dental caries a month after the beginning of prophylaxis according to the DMF+DM indexes 4.96±0.26. After 12 months a decrease in the intensity of cariesto 4.91±0.23 was noted(p <0.001) in relation to the control group. The increase in intensity in the preventive group according to the DMF+DM index was not observed.

Oral hygiene in children of the core group before the preventive measures was evaluated as unsatisfactory, as the proportion of stained surfaces was 2.42±0.32 points. After carrying out preventive measures, we noted a clear tendency to improvement after 2 and 12 months, that made 1.8±0.067 and 1.67±0.062 respectively.The state of cavity hygiene was assessed as satisfactory.

Table 4

Dynamics of changes in the oral health of preschool children of the main group after a complex of preventive measures

Index	Control (n =40)	Before (n=138)	After 2 months (n=138)	After 12 months (n=138)
DMF + DM (DM)	2.4±0.3	4 , 96±0.26 * **	4.94±0.26 ***	4.91±0.23***
PMA	15.04±1.01	19.48±0.89 * **	14.82±0.56 ^^^	13.56±0.18* ^ ^^
GI	1.75±0.1	2.42±0 , 2 2 *	1.8±0.067	1,67±0,06 2
Prevalenc eof dental caries	85%	90.57%	89.85%	88.4%

Note: *- differences relative to the data of the control group are significant (***- P<0.001);
^- differences relative to the data of the group before treatment are significant (^^- P <0.01, ^^^- P<0.001)

It was established that before starting thepreventive measures, the concentration of hydrogen ions in the oral fluid of infants was 6.21 + 0.045, i.e. pH of the oral fluid had a shift towards the acidic side (Table 5). A year after taking tablets with sodium fluoride, the concentration of hydrogen ions changed and made 7.07 + 0.029, and pH became neutral (p <0.001).

Indicators of the fluoride level in the oral fluid of children, depending on the duration of sodium fluoride consumption under conditions of biogeochemical fluoride deficiency, are presented in the Table 5. The initial indicators of the fluoride content in the oral fluid of preschool children of the core group, born and living in conditions of biogeochemical fluoride deficiency, were 0.019±0,0001 mmol/L. Inclusion of sodium fluoride tablets in the diet of children of a preschool educational institution after 2 months led to a significant increase of fluoride in the oral fluid up to 0.12±0.009 mg/l (p <0.001). The level of fluoride in the oral fluid of children of the core group (0.029±0.002 mg/l) was significantly (p <0.001) higher than the same indicator (0.018±0.001 mg/l) determined in the oral fluid of children in the control group.

12 months after the study initiation in the group of children consuming sodium fluoride, the fluoride content was 0.113±0.0046 mmol/L, i.e. the fluoride level in the oral fluid of preschoolers in the core group was significantly (p <0.001) higher than the same indicator (0.019±0.0001 mg/l) in the initial data of the core group before the preventive measures.

Table 5
Dynamics of changes in the physical and chemical properties of mixed saliva of preschool children of the core group after the complex ofpreventive measures

Index	Control (n=20)	Before (n=138)	After 2 months (n=138)	After 12 months (n=138)
Calcium (Ca) mmol/L	1.875±0.12	1.21±0.063***	1.47±0.056 ** ^^	1.46±0.05 7 ** ^^
Fluorine (F) mmol/L	0 31±0.0014	0.019±0.0001***	0, 12±0.009*** ^^^	0,113±0.0046 *** ^^^
Phosphorus (P) mmol/L	2.94±0.12	1.86±0.043***	2.14±0.052 *** ^^^	2.27±0.047*** ^^^
Ph	6.5±0.13	6.21±0.045*	7.11±0.032 *** ^^^	7.07±0.029*** ^^^

Note: *- differences relative to the data of the control group are significant (*- P <0.05, **- P <0.01, ***- P <0.001); ^- differences relative to the group data before treatment are significant (^^- P <0.01, ^^^- P <0.001)

Indicators of calcium and phosphorus level in the oral fluid of schoolchildren, depending on the duration of sodium fluoride consumption in conditions of biogeochemical fluoride deficiency are presented in the Table 5.

Initial indicators of calcium in the oral fluid of children born and living in conditions biogeochemical fluoride deficiency concluded 1.21±0.063 mmol/L, phosphorus - 1.86±0.043 mmol/L. The inclusion of "Fluorine balance" in the menu of schoolchildren after a month resulted in a significant increase in the calcium content of the oral fluid to 1.47±0.056 mmol/L ($p < 0.01$). 2 months after the studyinitiation in the group to schoolchildren consuming sodium fluoride, we noted a significant increase ofphosphorus content 2.14±0.052 mmol/L ($p < 0,001$).

Further consumption of sodium fluoride tablets by the end of the year: the study contributed to the preservation of the previous level of calcium in the oral fluid (1.46±0.057) mmol/L; the results were significant in relation to the control and the initial values of the core group ($p<0.01$). The phosphorus level increased to 2.27±0.047 mmol/L ($p<0.001$). The oversaturation of saliva with hydroxyapatite was due to the high concentration of phosphate, the excess of which in a neutral and slightly acidic medium prevents the entry of calcium and phosphorus ions from the enamel, thereby contributing to the preservation of the physiological situation. In caries-resistant children, the oral fluid contains more calcium and phosphorus. Since it is known that with a calcium deficiency in mixed saliva, the mechanism of acidic dissolution of the enamel comes into effect, associated with an increase in the amount of calcium-deficient apatite in the enamel, which is not able to recover from saliva calcium. Consequently, the increase in the calcium content in the oral fluid of schoolchildren who consumed food with fluoride supplements contributedto the formation of enamel more resistant to the action of acids [3].

Our data are consistent with the results of other researchers [24, 25], according to which endogenous use of fluorides increases calcium and phosphorus level in the oral fluid of children.

CONCLUSIONS

1. The study of drinking water samples in the southern and eastern regions of the Republic of Uzbekistan showed a decrease in fluoride content in all samples.

2. The intensity of dental caries in children of the core group is 2 times ($p < 0.001$) higher than that in the control group.

3. Analysis of the data on the microelement composition of the oral fluid showed its significant decrease in all studied parameters in children of the core group. 6 months after the inclusion of fluoride tablets in the menu of children ofthe preschool educational institution, the fluoride content in the mixed saliva was 0.113±0.0046 mmol/L, i.e. the level of fluoride in the oral fluid of preschoolers of the core group was significantly ($p<0.001$) higher than the same indicator (0.019±0.0001 mmol/L) in the initial data of the core group before preventive measures.

4. Inclusion of fluoride tablets in the menu of preschool children in 6 months contributed toa significant increase in calcium content from 1.21±0.063 to 1.46±0.057 mmol/L ($p<0.01$) and phosphorus in the oral fluid from 1.86±0.043 to 2.14±0.052 mmol/L ($p<0.001$).

REFERENCES

1. A.M. Hegde, S. Joshi, K. Rai, S. Shetty.Evaluation of oral hygiene status, salivary characteristics and dental caries experience in acute lymphoblastic leukemia (ALL) children/J ClinPediatr Dent. 2011 Spring; 35 (3): 319-23.
2. B. Kuter, N. Guler.Caries experience, oral disorders, oral hygiene practices and socio-demographic characteristics of autistic children. /Eur J Paediatr Dent. 2019 Sep; 20 (3): 237-241.
3. E.V.Borovski, V.K.Leontyev. Caries resistance/Stomatologiia (Mosk). 2002; 81 (5): 26-8.
4. C. Dawes, D.T.W. Wong. Role of Saliva and Salivary Diagnostics in the Advancement of Oral Health/J Dent Res. 2019 Feb; 98 (2): 133-141.
5. Carmen Llena-Puy. The rôle of saliva in maintaining oral health and as an aid to diagnosis/Med Oral Patol Oral Cir Bucal. 2006 Aug; 11 (5): E449-55.
6. Christina Stecksén-Blicks , PernillaLifHolgerson , SvanteTwetman. Effect of xylitol and xylitol-fluoride lozenges on approximal caries development in high-caries-risk children// Int J Paediatr Dent 2008 May; 18 (3): 170-7.
7. D.M.O'Mullane , R.J. Baez , S. Jones , M.A. Lennon , P.E. Petersen , A.J.Rugg-Gunn , H.Whelton , G.M.Whitford. Fluoride and Oral Health// Community Dent Health. 2016 Jun; 33 (2): 69-99.
8. Defabianis P, Re F. The role of saliva in maintaining oral health. // Minerva Stomatol. 2003 Jun; 52 (6): 301-8.
9. E.Strömberg, M.L.Hagman-Gustafsson, A.Holmén, I.Wårdh, P.Gabre.Oral status, oral hygiene habits and caries risk factors in home-dwelling elderly dependent on

moderate or substantial supportive care for daily living.// Community Dent Oral Epidemiol. 2012 Jun; 40 (3): 221-9.

10. Flink H. Studies on the prevalence of reduced salivary flow rate in relation to general health and dental caries, and effect of iron supplementation.// Swed Dent J Suppl. 2007; (192): 3-50.

11. H. Meyer-Lueckel , E.Grundmann , A.Stang. Effects of fluoride tablets on caries and fluorosis occurrence among 6- to 9-year olds using fluoridated salt// Community Dent Oral Epidemiol 2010 Aug; 38 (4): 315-23. doi: 10.1111/j.1600-0528.2010.00539.

12. I.Espelid. Caries preventive effect of fluoride in milk, salt and tablets: a literature review// Eur Arch Paediatr Dent 2009 Sep; 10 (3): 149-56. doi: 10.1007/BF03262676

13. Leone C.W, Oppenheim F.G. Physical and chemical aspects of saliva as indicators of risk for dental caries in humans.// J Dent Educ. 2001 Oct; 65 (10): 1054-62.

14. M.R.Giuca , S.Saracino , E. Giannotti , A.Ceccarini. Oral clearance of NaF from chewing gum and tablets in children and adults //Eur J Paediatr Dent 2007 Mar; 8 (1): 19-24.

15. NieuwAmerongen A.V., Ligtenberg A.J., Veerman E.C., Ann N.Y. Implications for diagnostics in the biochemistry and physiology of saliva // Acad Sci. 2007 Mar; 1098: 1-6.

16. Thomas M.Marthaler , Andreas G. Schulte. Monitoring salt fluoridation programs through urinary excretion studies //Schweiz MonatsschrZahnmed 2005; 115 (8): 679-84 .

17. W..S Driscoll , R.Nowjack-Raymer , R.H.Selwitz , Sh. Li , S.B. Heifetz. A comparison of the caries-preventive effects of fluoride mouthrinsing, fluoride tablets, and both procedures combined: final results after eight years // J Public Health Dent Winter 1992; 52 (2): 111-6. doi: 10.1111/j.1752-7325.1992.

18. Newbrum E. Current regulations and recommendations' concerning water fluoridation, fluoride supplement and topical fluoride agents // J. dent. Res. - 1992. Vol. 71, No. 5. - P. 1255-1265.

19. Riordan P.J. Fluoride supplements in caries prevention a literature review and proposal for a new dosage schedule // J. Public. Health. Dent. - 1993. -Vol. 53, no. 3.- P. 174-189 .

20. Toumba K.J., Levy S., Curson M. E.J. The fluoride content of bottled drinking water // J. Dent. Res. - 1993. - Vol. 176. - P. 266-268.

21. Suketa Y., Sato M. Changes in glucose-6-phosphatase activity in liver, and kidney of rat s treated with a single large dose of fluoride // To xicol. Appl. Pharmacol. - 1980. - Vol. 52, No. 3. - P. 386-390.

22. Susheela A.K, Suigh M. Abe nil cyclase activity following fluoride ingestion // Toxicol. Lett. - 1982. - Vol. 10, no. 2-3. P. 209

23. Rugg-Gunn A.J., Murray J. J. Current issues in the use of fluorides in Dentistry // Denial Update. - 1990.- Vol. 17, no. 4.-P. 154-158.

24. Marthaler T.M. Successes and drawbacks in the caries-preventive use of fluorides - Lessons to be learned from history // Oral Health and Preventive Dentistry 2003, v. 1, no.2, p. 129-140.

25. R. Akhmedbeyli. The level of Ca and P content in oral saliva of schoolchildren depending on the length of fluoridated iodized salt intake in conditions of biogeochemical deficiency of fluoride and iodide//Sovremennayastomatologiya 2016 No. 2 p. 68-70.