

**MINISTRY OF HEALTH OF THE REPUBLIC OF UZBEKISTAN  
TASHKENT STATE MEDICAL UNIVERSITY**

**ZOKIRKHONOVA SHAKHZODA AZATOVNA**

**PREVENTION OF DENTAL CARIES IN PRESCHOOL CHILDREN  
(MONOGRAPH)**

**TASHKENT – 2025**

**MINISTRY OF HEALTH OF THE REPUBLIC OF UZBEKISTAN  
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This monograph is devoted to the prevention of dental caries in preschool-aged children. It covers the prevalence of dental caries among children, the characteristics of risk factors contributing to the development of dental caries, and the most important aspects of its prevention. Based on their own research, the authors have scientifically substantiated the chemical composition and hygienic and toxicological properties of fluoride-enriched bottled water for the prevention of dental caries. This represents an important scientific achievement with national economic, medical, and social significance.

This monograph is intended for dentists, students of the Dental faculties, as well as employees of childcare facilities, sanitary and epidemiological surveillance agencies, and the general public.

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### **List of Abbreviations**

WHO — World Health Organization  
HI – Hygienic Index  
HET – Hygienic Education and Training  
PEI – Preschool Educational Institution  
CSDP – Children's Stomatological Dental Clinic  
DMFT – Decayed, Missing, and Filled Teeth Index of Permanent Teeth  
CHI – Compulsory Health Insurance  
MDD – Major Dental Diseases  
RCPSD – Regional Center for Prevention of Dental Diseases  
USA – United States of America  
TMA – Tashkent Medical Academy  
CIL – Caries Intensity Level  
DCL – Dental Care Level  
DAI – WHO Dental Aesthetic Index  
CPI – WHO Community Periodontal Index  
ACB – Acid-Base Balance  
BFW – Bottled Fluoride Water  
SSR – Saliva Secretion Rate

## **Introduction**

Dental caries is one of the most common diseases of mankind. It affects almost the entire adult and child population of the Earth. The low level of oral hygiene, as well as the high prevalence and intensity of dental caries, make the problem of preventing dental diseases one of the most urgent problems [15, 28]. According to the authors, according to A.S. Yuldashkhanova et al., 2005, the epidemiology of caries and periodontal diseases indicates their high prevalence, including up to 80-82% in preschool children. The most important local risk factors are changes in the microflora of dental plaque, the properties and composition of oral fluid, and the presence of carbohydrate food residues [13]. According to the authors, an important role in the resistance of teeth to caries is played by: defective enamel structure; violation of its chemical composition and genetically determined properties of the tooth structure.

The development and course of caries are largely determined by the relationship between the processes of demineralization and remineralization of the surface layer of enamel. Incomplete mineralization of hard tissues of permanent teeth in early childhood increases the risk of caries. In older children, caries can develop: due to excessive consumption of carbohydrates; poor oral hygiene; insufficient intake of minerals and trace elements, vitamins, etc. [27, 48, 79]. It has been found that due to their deficiency in the body, caries of primary teeth appears from early childhood and develops steadily, resulting in an increase in the number of severe complications. The search for effective methods of preventing dental caries and periodontal diseases is the main direction of modern scientific research in dentistry. The main link in solving the problem is the primary prevention of dental caries, the main goal of which is to reduce the prevalence and intensity of caries and improve the health of the population. Primary prevention of caries in primary teeth includes several basic methods. It is known that a balanced diet plays a positive role in the prevention of dental caries [36, 79].

First of all, this concerns complete protein, calcium and other minerals, trace elements, especially zinc and copper, as well as vitamins D, A, ascorbic acid and group B. However, the modern diet of children has an imbalance of essential nutrients, as well as vitamins and minerals, such as calcium and phosphorus [6, 13]. Calcium remains the main component of all programs for the prevention of disorders in the structural and functional state of bone tissue. The most important role of calcium in bone formation does not diminish the importance of phosphorus, magnesium, zinc, vitamins D, A and other trace elements that affect collagen synthesis (ascorbic acid, manganese, copper) and the normal development of the bone skeleton. ensuring energy processes in cells bone tissue (B vitamins) [41]. A

mandatory component of any preventive program, the basis of which is hygienic training and education of the population. The education and upbringing system should involve not only children, but also parents, educators and medical staff of preschool educational institutions [15, 21]. Taking into account the literature data on the insufficient supply of the child's body with vitamins and mineral salts with food, as well as specific data on the possibility of correcting their deficiency with the help of appropriate complexes for the prevention and treatment of dental caries, this served as the basis for formulating the goals and objectives of the study.

Around the world, a large number of scientific and applied studies are being conducted aimed at identifying the etiological and social risk factors of the disease, improving and searching for various highly effective methods of preventing dental caries in preschool children. Research is aimed at ways to eliminate the negative consequences of the disease, as well as at developing and modernizing exo- and endogenous methods of preventing childhood caries. Most of the applied studies are devoted to school-age and adolescent children, which does not give an idea of the state of this problem in preschool children. In this regard, it is necessary to establish and improve the use and improvement of exogenous and endogenous fluoride preventive measures, the prevention of risk factors for caries, the creation of systems for eliminating severe complications in preschool children, as well as the organization of work on improving the quality of prevention. of the population, including children's lives, has significant scientific and practical significance.

Over the past 15-20 years, extensive scientific research has been conducted in the CIS countries on exogenous and endogenous methods of using fluorides to prevent caries with varying degrees of tooth resistance [8, 42]. To achieve a positive long-term therapeutic effect of fluoride in the prevention of caries in children, an integrated approach is required that takes into account all risk factors of the disease [50, 66]. According to the data provided by the authors, the introduction of fluorides for the prevention of caries in children by endogenous methods, in particular, fluoridation of water, milk, salt and food products, has led to a reduction in caries by up to 40 percent. or more. It was concluded that the cheapest, most convenient and economical of the listed methods is water fluoridation [22].

In Uzbekistan, during the years of independence of our republic, more attention began to be paid to the problem of preventing dental caries in children with fluoride. A large amount of work has been carried out on the risk factors of dental caries, which determine the following: resistance and sensitivity of teeth to caries; use of anti-caries vitamins and preparations containing fluoride; study of saliva, as well as the properties of saliva in control and prevention groups of the population [16, 20, 33], etc. The main part of the conducted studies is devoted to solving the problems

of caries in the adult population, as well as in adolescents, which does not give an idea of the assessment of the disease in preschool children. The spread of dental caries among preschool children in the republic has been poorly studied. There is no data on the characteristics of oral fluid parameters, such as: salivary flow rate; saliva viscosity, pH environment, calcium and phosphorus content in mixed saliva, as well as the hygienic indicators of preschool children before and after the use of systemic methods of fluoride prophylaxis with bottled fluoridated water (FS). In current practice, there is no group model of the fluoride prevention system in preschool children, which is the main and important problem of pediatric dentistry.

## **Chapter 1. LITERATURE REVIEW**

Dental caries, especially in young children, today causes the development of acute and chronic odontogenic inflammatory processes. A sociological analysis of the study of the problems of the etiology and pathogenesis of caries has revealed its mass prevalence and intensity, which poses a threat to the population, especially in childhood. Currently, it is important to study and analyze the epidemiology of the main dental diseases, including dental caries, since the study of the features of its development allows planning adequate dental care that meets the real needs of the population [4, 33, 40, 43, 50].

The problem of early childhood caries remains one of the most important problems in pediatric dentistry due to its prevalence and intensity in many countries of the world. In early childhood, it is an extremely active form of the disease, leading to the destruction of primary teeth in children from the first years of life. Already at the age of three, children have an average of 3-4 teeth damaged, and as a result, the number of severe complications increases. Temporary teeth of children with acute and complex caries provoke the development of acute and chronic odontogenic inflammatory processes in them. The problem of dental caries, despite the success achieved in reducing its prevalence and intensity worldwide, continues to occupy a leading position among other dental diseases [2, 15, 18, 26]. According to the modern theory of the etiology and pathogenesis of caries, the disease is multifactorial. A complex of hereditary, congenital and acquired factors, as well as malnutrition, low fluoride content in drinking water, the presence of general somatic diseases, the influence of adverse environmental factors, etc. play an important role in its formation and development [23, 30, 42, 47].

### **1.1. Current data on the etiology and pathogenesis of dental caries in preschool children**

The occurrence and development of dental caries depends on a number of pathogenetic factors, such as: the level of oral hygiene, the condition and properties of tooth enamel, the state of mixed saliva, the microflora of the mouth, etc. [22, 49, 50, 68]. When considering the etiology of dental caries, attention is paid to the diversity of types and forms of various risk factors, the interaction of which determines the formation of a demineralization center. Among them, the most important are: the types and number of microorganisms found in the oral cavity; the nature and nutrition of patients; changes in the functional state of the body; the amount of fluoride entering the body; environmental influences, etc. Among the risk factors affecting the incidence of dental caries are socio-hygienic and medical-biological, which are distinguished by their significance [37, 39].

Comprehensive examination of children, taking into account the influence of unfavorable factors in a particular region, helps to prevent dental diseases and better organize dental care for the pediatric population [5, 45, 88].

Dental caries mainly develops in children on the primary teeth of the upper jaw and on the chewing surfaces of molars. However, due to the significant sensitivity of primary teeth, early childhood caries occurs very quickly and can affect the entire dentition in a short time [20, 31]. Targeted use of the remineralizing effect to increase the resistance of dental tissues to decay has been found to be one of the most promising methods for preventing childhood caries during the period of maturation of dental tissues and enamel.

Dental caries can occur and develop intensively in children with various concomitant diseases: colds, infectious-allergic diseases, long-term diseases of the gastrointestinal tract, diabetes mellitus, hepatitis, enterocolitis, metabolic disorders, etc. [11, 27]. It has been established that the resistance of teeth to caries is also associated with general immunity and pre-existing diseases. Caries develops more actively in people with a weakened immune system. Caries occurs 1.5-2 times more often in children with exudative diathesis and rickets. The composition of saliva plays an important role in this. It has also been found that children with allergies have high dentoalveolar anomalies and systemic hypoplasia of tooth enamel. Various lesions of the oral mucosa and inflammatory changes in periodontal tissues have been observed [1].

Important risk factors for childhood caries: - nature and nutrition; - microflora of the oral cavity; - dental plaque and plaque; - carbohydrate sticky food residues in the mouth; - quantity and quality of saliva; - violation of the composition and properties of oral fluid; - general condition of the body; - resistance of tooth tissues due to the complete structure and chemical composition of the hard tissues of the tooth [14].

Among the risk factors affecting the prevalence of dental caries, socio-hygienic and medical-biological factors are of great importance [99]. The occurrence of childhood caries also manifests itself as a result of the interaction of risk factors, such as: a) the "quality" of hard dental tissues [40]; b) salivary properties [17, 28, 39]; c) body condition [48]; d) nutritional factors [26, 28], etc. A comprehensive examination of children, taking into account the influence of unfavorable factors in a particular region, helps to prevent caries and better organize dental care for the child.

The etiological role in the development of dental caries, including childhood caries, is played by cariogenic microorganisms, primarily *Str. mutans*. The realization of the cariogenic properties of bacteria occurs gradually. Even before the

eruption of primary teeth, as a rule, the child's oral cavity is colonized by *Str. mutans*. Qualitative and quantitative indicators of bacterial colonization increase after teething due to plaque contamination. Up to 70% of the volume of mature dental plaque consists of microorganisms. Under the influence of the enzymatic activity of plaque bacteria, carbohydrates (glucose, sucrose) are converted into organic acids, in particular lactic and acetic acids [24].

Long-term local exposure to organic acids contributes to the demineralization of tooth enamel, the increase in micro-voids between the crystals of enamel prisms, and the penetration of microorganisms into enamel defects. These processes contribute to the formation of a carious defect. In the process of plaque formation and subsequent demineralization of tooth enamel, mainly acid-forming streptococci (*Streptococcus mutans*, *Str. sanguis*, *Str. mitis*, *Str. salivarius*), which are characterized by anaerobic fermentation, and lactobacilli (lactobacilli) are involved. The most important enzymatic processes in the oral fluid associated with the fermentation of carbohydrates are determined by the quantitative and qualitative composition of the oral microflora [18, 34], i.e. The most important enzymatic processes in the oral cavity are associated with the fermentation of carbohydrates. They are determined by the quantitative and qualitative composition of the oral microflora, which are involved in the development of dental caries.

According to many other researchers, the occurrence and activity of dental caries disease are the result of the interaction of many risk factors: a) the "quality" of hard tooth tissues [7, 71]; b) salivary properties [14, 41, 46]; c) body condition [42, 44]; d) environmental factors [25], etc.

In recent years, certain progress has been made in studying the etiology and pathogenesis of dental caries in both adults and children [43]. Among the many etiological factors in the pathogenesis of the carious process, the leading one is the lack of fluoride in the remineralization of teeth [10, 11, 12]. Therefore, the use of fluoride-containing preparations is currently recognized as an effective and inexpensive option for preventing dental caries. According to domestic and foreign authors, the effectiveness of fluoride preventive methods ranges from 25 to 80%. [30, 37].

Currently, there are many theories devoted to the etiology of caries in early and preschool children, taking into account the state of homeostasis and changes in the immune status, as well as the causes of dental caries [23, 39]. In this regard, the composition and quality of the oral cavity oral fluid, as well as salivary secretion (remineralization potential of saliva, buffering properties, nonspecific and specific salivary protective factors) play an important role [15, 18]. It is known that the main liquid that carries out ion exchange reactions between different zones, tissues and

organs in the oral cavity is mixed saliva (oral fluid), and changes in its properties largely determine the cariogenic state. Various mechanisms of acid-base regulation associated with the composition and properties of mixed saliva prevent the development of acidolysis or alkalization under the influence of food and oral microflora [2, 8].

Literature data indicate that the prevalence and intensity of dental caries are also characterized by the rate of salivation, and these indicators are higher in children. According to the International System, the unit of productivity of the salivary glands for a certain period of time is characterized by the salivation rate, which as such is defined in l / h or ml / h [Bolshakov CB, 2003; Gavrilova OA 2004; 163]. According to this system, three types of salivation are distinguished: with hyposalivation, fluctuations in the value of the indicator are within the range from 0.03 to 0.30 ml / min, for normal secretion - from 0.31 to 0.60 ml / min, and with hypersecretion - from 0.61 to 2.40 ml / min. It has been established that in the oral cavity at a salivation rate below 0.30 ml / min, a favorable environment for the development of dental caries is created [Shadrina L.I. A., Potemkina N.M., Bezsheiko V.K., 2002; Yuldashkhanova A.S., Daminova Sh.B., Sultanova G.S. 2002; Leontiev V.K. 2001; 2007].

The literature has convincingly demonstrated the dependence of caries development on the properties and composition of oral fluid, which contains minerals necessary for enamel maturation. A relationship has been established between the viscosity of oral fluid and the susceptibility of teeth to caries, as well as between enamel mineralization and its permeability. An analysis of literary sources shows that the determination of the clinical course of caries, as well as the assessment of the prospects of caries preventive measures on the mineralizing property of saliva, taking into account the pathogenetic features of this disease, has been studied in sufficient detail [Anisimova I.V. et al. 2005; Leontyev V.K. 2002; Yuldashkhanova A.S., Sultanova G.S., 2002; Sadovsky V.V. 2005]. It has been established that in the development of dental caries, taking into account the mineralizing properties of saliva, the leading role is played by the concentration of calcium and phosphorus ions in saliva, as well as the pH and buffering activity of saliva. A direct relationship was found between the concentration of Ca, F, P and Mg in oral fluid and the carious process.

Dental caries can occur and develop intensively in children suffering from various concomitant diseases: colds, infectious-allergic diseases, long-term diseases of the gastrointestinal tract, diabetes mellitus, hepatitis, enterocolitis, metabolic disorders, etc. [19, 22, 32].

According to WHO, a sharp increase in the incidence of caries is observed in areas with intensive urbanization of countries and states, especially among the population of developing countries [WHO-89; WHO-95; WHO-2003]. There is considerable literary data that in economically developed countries of the world there is also a high prevalence of caries [Ohlund I., 2007; Rusanova T.A. et al., 2009]. In the CIS countries, there is also a trend towards a higher prevalence and intensity of childhood caries, with a higher severity of the disease [29].

Epidemiological studies conducted in many CIS countries show that childhood caries still remains one of the most common diseases. The average prevalence of caries in primary teeth among 6-year-old children is 84.0% with an average intensity of 4.83. The literature provides extensive information on the prevalence and intensity of caries in Volgograd, Voronezh, Khabarovsk, Krasnoyarsk, Barnaul, Kazan, Nizhny Novgorod, Omsk [Trukhacheva, II., 2003; Bakhturina G.I., 2004; Antonova A.A., 2006; Atanasova A.S., Maslak E.E., Stavskaya S.V., 2007; Shiriyak T.Yu., 2011], as well as in the republics of Dagestan, Sakha (Sakha) and others [Filippov. S. V., Mikhailova R. I., 2005; Budaychiev M. G., Abakarov S. I., Askhabova L. M., 2011]. In particular, studies have established that the prevalence of childhood caries in Omsk at the age of 3 is 77.3%, and at the age of 4 and 5 years, respectively, is 84 - 87%. In Volgograd, 12.2% of 1-year-old children had dental caries, 57.7% at 3 years old, and 85.4% at 6 years old. According to their data, the prevalence of dental caries increases by 4.7 times from 1 to 3 years old, and by 1.5 times from 3 to 6 years old. The authors, considering the dynamics of caries lesions of baby teeth, established the most favorable age for preventive measures. According to their conclusion, the most appropriate age for carrying out preventive measures is the first and second years of a child's life.

In the Republic of Belarus, caries is diagnosed in more than 90.0% of the country's residents, including children. The literature presents an original work devoted to the comparative study and analysis of the prevalence and intensity of dental caries in Ukraine, Russia and Belarus for 20 years from 1990 to 2010. It was found that there is an increase in the incidence at 2 years of age, a tendency to increase at 3 years of age, a decrease in the prevalence and intensity of dental caries in 4-year-old children, and consistently high rates of dental caries in children 5-6 years of age. The highest rates of caries prevalence in primary teeth in 2-year-old children are shown: in Russia - 37%, in Ukraine - 23.5%, in Belarus - 39.3%, with an intensity of damage of 1.7; 0.6 and 1.1, respectively. According to their data, the prevalence and intensity of caries in 3-year-old children in Russia remained at the same high level on average over a 20-year period (about 60% prevalence and 3.7 intensity). In Ukraine, for the same period, there were similar indicators, and they

averaged about 50% prevalence and 3.0 intensity of caries. The highest prevalence rates of dental caries in 5.6-year-old children were: 73.0% in Russia, 82.5% in Ukraine and 96.7% in Belarus [Terekhova T.N., Melnikova E.I., 2014; Leus P.A. Terekhova T.N., 2015].

According to WHO data, In Kazakhstan, the prevalence of caries is 63.7%, and the caries intensity is 1.87. In Almaty, the incidence and prevalence of dental caries in children is low. In particular, the prevalence of dental caries in children is from 80.0 to 82.0%, and the intensity is from 2.2 to 2.6. As a result of the implementation of dental disease prevention programs in Almaty for 5 years, the disease has been reduced by 8-10%. In Kyrgyzstan, the prevalence of caries in children is 72%, and the average intensity of dental caries is 1.75, and the prevalence of caries in primary teeth in 6-year-old children is 89.4%, and the intensity is 5.2. The overall prevalence of caries in children in the republic was 77.7% with an intensity of 1.64 [Yuldashev I.M., 2006].

According to the WHO classification, the Republic of Uzbekistan also belongs to the region with high prevalence of dental caries. Epidemiological studies conducted in recent years have established that the high prevalence of dental caries in the republic, especially among children, is associated with a number of social and hygienic reasons. It was found that the prevalence of caries among children living in urban areas in the republic is 87.76%, the intensity is 3.96%, and among children living in rural areas it is 80.91%. of 3.3 [20, 32].

### **1.1.2. Healthy nutrition for dental caries in preschool children**

Nutrition or diet has a significant impact on the formation and development of teeth, and subsequently their susceptibility to caries and sensitivity. One of the leading factors in the development of caries risk in young children is: lack of proteins, mineral salts, fluorine, vitamins, various microelements in the body, lack of raw vegetables and fruits in the daily diet, etc. Therefore, proper and rational nutrition of children plays an important role in the prevention of dental caries [Spiricheva T.V., 2007; Morozov V., 2007; Shaikhova G.I. , 2011 ].

Modern data on the needs of children's bodies for food products are summarized in the doctrine of balanced nutrition [100; pp. 284-285, 104; pp. 63-66]. A balanced diet provides for an optimal quantitative ratio of basic food products and biologically active substances - proteins, fats, carbohydrates, vitamins, minerals. Rational nutrition, along with other factors, plays an important role in the formation of resistance of teeth to caries. In this regard, the most significant risk factors for childhood caries are an excess of easily digestible carbohydrates in the diet, a deficiency of vitamins, macro- and microelements, and a predominance of soft

foods. Particularly important and one of the leading factors in the development of caries risk is the nutrition factor in childhood. Some eating habits are also unfavorable factors - the use of carbohydrates between meals, drinking sour and carbohydrate-containing beverages. It is during this period that the enamel of the teeth in the oral cavity “ripens” and their tissues are saturated with calcium and other macro- and microelements [11, 26].

One of the factors contributing to the development of caries in young children is a lack of proteins, mineral salts, fluorine, vitamins, various microelements in the body, excessive consumption of carbohydrates, lack of vegetables, fruits and vegetable raw materials, etc. Therefore, proper and balanced nutrition plays a very important role in the prevention of dental caries [41, 46]. The daily diet should include foods containing the required amount of the most important nutrients - proteins, carbohydrates and fats. In addition, the diet should be rich in minerals and vitamins. Solid foods, such as fresh fruits and vegetables, will help maintain dental health. In the process of their use, the surface of the tooth enamel is effectively cleaned of plaque and deposits. In addition, the listed products also serve to improve the health of the gums. The solution to the problem of proper organization of nutrition for children is not only of medical but also of great social importance, because is a determining factor in all subsequent development of children [Kuchma V. R., Gorelova, Zh. Yu., 2006; Gorelova Zh. Yu., 2006; Ivanova G. V., 2007; Tutelyan V. A., 2008].

**Nutrition or diet** have a significant impact on the formation and development of teeth in both children and adults, and their subsequent predisposition or susceptibility to caries [Sakharova E.B., 1987; Kuryakina N.V., Chernov I.P., 1995; Kuryakina N.V., 2007; Kondentsova V.M., Vrzhesinskaya O.A., 2008]. In recent years, the nature of nutrition of the population, including children, in our republic has changed. The structure of nutrition has changed, the consumption of foods high in fat, especially animal origin, and easily digestible carbohydrates has increased. According to research conducted by the Ministry of Health of the Republic of Uzbekistan (2010), the main risk factors for a number of non-communicable diseases in Uzbekistan are recognized as excessive consumption of fats of both vegetable and animal origin, sugar, salt; insufficient consumption of the most biologically valuable food products: meat, fish and dairy products, fresh vegetables, herbs and fruits. Nowadays, people often choose products based solely on one criterion: tasty or not tasty. And tastes are often spoiled since childhood by excessive consumption of sweets, fast food and other unhealthy things. The child population prefers food products such as "chips" that have no nutritional value. The fast food

system and the use of semi-finished products in nutrition have become increasingly widespread [ Tutelyan V.A., 2005; 2008; Kuchma V.R., Gorelova, Zh.Yu., 2006].

**In childhood**, healthy lifestyle skills are formed, an integral part of which is rational nutrition. In each period of childhood, nutrition has its own characteristics and requires close attention. Rational nutrition, which meets the physiological needs of a growing organism, increases his immunity, ensures the health and harmonious development of the child, helps prevent various diseases, including dental diseases, and creates conditions for the body to adapt to adverse environmental factors.

**One of** the main risk factors for caries development is protein deficiency. Protein foods play a caries-protective role, since proteins affect the quality of saliva. Studying the effect of protein content in the diet on the composition of bones and teeth, even if the diet contains a constant amount of phosphorus and calcium, it was found that the decrease in protein in it leads to a significant increase in caries. A cariogenic diet entails a violation of protein metabolism, and therefore, the formation of a full-fledged structure of tooth enamel. The amount of protein in diets with a moderate content of calcium and phosphorus had a positive effect on the frequency of caries. When eating cheese, beans, eggs, milk, nuts, the mineralizing potential of saliva increases, which creates opportunities to compensate for the negative effect of sugars on oral fluid. Protein deficiency during tooth development leads to a decrease in their size and weight, disruption of the enamel structure. The amount of protein in the diet is directly related to the mineral composition of teeth and jaws. With low protein content in food, calcium accumulation and apatite formation are unsatisfactory [ Bakhturina G.I., 2003; Amin MS, Harrison RL, Benton TS, 2004; Shcheplyagina L.A., Moiseeva T.Yu., Marchenko T.K. et al., 2005; Vrzhesinskaya O.A., Kodentsova V.M., 2007; Spiricheva T.V., 2007; Okushko V.R., 2011].

The cariogenic effect of sugars is considered from different points of view. Eating food containing simple carbohydrates promotes the growth of microorganisms on the surface of teeth. These microorganisms react with sugars (carbohydrates in the oral cavity) and break them down into organic acids (lactic, pyruvic, etc.). They also decalcify teeth, promote the destruction of their enamel and cause caries [ Redinova T.D., Subbotina A.V., 2000; Gorbunova I.L., 2005; Kobiasova I.V., 2006; Leontyev V.K., Pakhomov N.G., 2006; Suntsov V.G., Popova E.V., Mokhova O.P.; Suntsov V.G., Popova E.V., Mokhova O.P., 2009]. Excess carbohydrates in the diet, especially in the period before teething, leads to increased susceptibility of teeth to caries. Increased carbohydrate content in food and insufficient protein content turns a person's diet into a cariogenic one [ Askerko T.G., 2007; Akhmetzyanova G.R., [2009].

**Carbohydrates** present in fresh fruits and vegetables and in starchy foods are not a significant cause of tooth decay. The main culprits of dental caries are sugars that are added during industrial production, preparation or before consumption of food products. Sugary substances are primarily found in confectionery, soft drinks, cakes, cookies, etc., which are often consumed between meals as light snacks and drinks. It should be noted that frequent consumption or snacking on sweets between main meals harms children's tooth enamel. The cariogenic effect of sugar consumed in large quantities can be due to shifts in the body's metabolic processes due to carbohydrate overload, as mentioned above. The negative effect of sucrose on the condition of hard dental tissues is most intense when sweet foods are consumed between meals. To prevent caries, a "culture of carbohydrate consumption" has been proposed. It includes three main rules: do not eat sweets at night; do not eat sweets as a last course; do not eat sweets between meals. If these rules are violated, you should rinse your mouth or brush your teeth

**In the prevention of** dental caries, both in children and adults, mineral substances play an important role in regulating rational nutrition. They make up the majority of nutrients entering the body. Early age is the most effective period for the impact of diet on the child's body and dental tissue. The following factors play a key role in the development and prevention of dental caries in children: lack of fluoride in water and food: the content of mineral salts in optimal proportions in the teeth as well as in the oral fluid [3, 49, 50]. Therefore, along with the composition of the diet in terms of proteins and vitamins, it is necessary that it be complete in terms of mineral content.

**In a normal** diet, metal ions and organic substances are balanced in such a way that excess of one or another substance is excreted from the body undigested. A significant portion of such elements as potassium, sodium, chlorine, and phosphates remains in the body, providing optimal pH, osmotic pressure, and intercellular membrane potentials. Extracellular and intracellular microelements such as sodium, potassium, and magnesium provide balance in relation to each other. [ Bakhturina G.I., 2003; Latyshev O.Yu., 2005; Tsvetnaya I.N., 2005; Shcheplyagina L.A., Moiseeva T.Yu., Marchenko T.K., 2005; Gmoshinsky I.V., Mazo V.K., 2006; Shilina N.M., Pozdnyakov A.L., 2007]. It should be noted that nutritional disorders, expressed by their deficiency in the oral cavity, can have a significant impact on the development of dental diseases. Calcium remains the main component of all programs for the prevention of disorders of the structural and functional state of bone tissue. This is due to its essential role in the development of the skeleton and its mineralization. A person's calcium supply directly depends on its intake with food. The highest rate of calcium incorporation into the skeleton is observed during

periods of intensive child growth, i.e. from 1 to 3 years, from 5 to 6 and from 11 to 15 years [Elizarova V.M., Petrovich Yu.A., 2002; ; Shcheplyagina L.A., Moiseeva T.Yu., 2003; Shcheplyagina L.A., Moiseeva T.Yu., Marchenko T.K. et al., 2005; Mikhalyuk N.S., 2005]. Biochemical changes in phosphorus-calcium metabolism in hard tissues of teeth and skeletal bones in animals, which occur in the pre-carious period, are contained in the cariogenic diet. These changes are not simply quantitative, but represent a complex of qualitative changes related to the factors of occurrence and development of dental caries [Borovsky E.V., Pozyukova E.V., 1985; Marchenkova O.N., 2005].

Calcium plays an important role in bone formation and is essential for the normal development of the skeletal system, while other micronutrients such as phosphorus, magnesium, zinc, copper, manganese, etc. are also important for collagen synthesis. Collagen also provides energy processes in bone tissue cells [Ladnova G.G., Istomin A.V., Nikolaev A.V., 2001; Perevoshchikova N.K., Basmanova E.D., 2006; Vrzhesinskaya O.A., Kodentsova V.M., 2007]. Therefore, oral tissues are very sensitive to the lack of certain micro and macro components of food.

**Vitamins** play an important role in the normal development of teeth. Growing deficiency of vitamins, macro- and microelements, disrupting metabolism, aggravates the course of any disease. For successful treatment, it is necessary to correct the patient's vitamin deficiency by including multivitamins or biologically active additives in complex therapy. Rational organization of medical and preventive care for preschoolers, especially the high prevalence and intensity of dental caries in them, is of great importance for achieving a modern level of dental health [79, 103]. According to the results of the study, it was found that insufficient intake of vitamin A in rat teeth leads to a decrease in dentin thickness. Long-term vitamin A deficiency leads to yellow pigmentation and enamel hypoplasia of the teeth, increasing the susceptibility of teeth to caries due to the imperfection of hard tissues [42, 46].

Vitamins D, K, and P belong to the group of vitamins that play a major role in the development of dental and periodontal diseases [Pakhomov G.N., 1982]. A significant deficiency of vitamin D leads to primary damage to calcium metabolism during the formation of teeth and bones. Experiments on dogs, rats, guinea pigs, and sheep indicate that vitamin D deficiency causes an increase in the volume of the organic matrix of dentin due to impaired mineralization, a delay in the development of dentin, and an increase in the amount of interglobular dentin. Vitamin D deficiency also leads to impaired enamel formation and hypoplastic changes in it. In rats and dogs, changes in the alveolar process occur in the form of osteoporosis with the replacement of bone tissue with osteoid tissue. In addition, vitamin D deficiency

causes the formation of pits on the enamel of teeth, and these areas are highly susceptible to caries. [Baturin A.K., 1998; Gorelova Zh.Yu., 2006]. With a lack of phosphorus and a normal amount of vitamin D and calcium in the diet, a slowdown in jaw growth and teething is observed.

**Water-soluble vitamins** B1, B2, B12, folic acid, vitamin PP (nicotinic acid) and vitamin C also play an extremely important role in the metabolism of oral tissues. With a lack of vitamin C, there is a disruption in the formation of collagen - the main substance of mucopolysaccharides and intercellular cementing substrate in mesenchymal tissues. At the same time, slow bone formation and osteoporosis are noted. Vitamin C deficiency also leads to increased capillary permeability, susceptibility to traumatic bleeding, hyporeactivity of contractile elements of blood vessels and slow blood flow. Hypovitaminosis can worsen the reaction of the gums to local irritation, increase swelling and bleeding of the gums. Probably, vitamin C deficiency is the cause of periodontal diseases, which are so common at all ages. It has been established that with a vitamin C deficiency, pathological pockets do not form. As a result of an acute deficiency of vitamin C, the reaction of the periodontium changes to such an extent that the destructive process ends with tooth loss [Mikhalyuk N.S., 2005; Kosheleva O.V., Baturin A.K., Shagnyuk L.N., 2006; Goncharenko A.S., 2006; Kuchma V.R., Gorelova Zh.Yu. 2006].

**There are works in the literature** that provide facts characterizing the relationship between bad habits, general health, including dental health, and the nutrition of a child from birth to adolescence. It has been shown that improper and unbalanced nutrition leads to dysbacteriosis, obesity and other diseases. Bad habits - smoking, alcohol, drugs - lead to the risk of occurrence and development of severe, integrated with dental, somatic diseases. [Latyshev O.Yu., 2005].

The correct organization of nutrition for children brought up in preschool institutions **is of great importance. The coverage of** preschool children by public education is about 45%, and in some cities and large industrial centers it reaches 80-90%. Children stay in preschool institutions for 10-12 hours, and some - around the clock, and the health of children and their morbidity rate largely depend on the correct organization of nutrition in these institutions [48]. It is appropriate to note that the period of transition of children from preschool educational institution to primary school education is a critical period for them, since during this period, children move from constant care in the family and in the preschool educational institution to a certain independence inherent in the school regime. Numerous studies have shown that many children have already formed irrational stereotypes of food choice by the time they start school. Therefore, of the total number of factors that have a negative impact on the health of children and adolescents, one factor is

violation of nutritional rules during the transition period. Taking into account the above, we can conclude that teaching preschool and school-age children, as well as their parents, the principles and skills of healthy eating will help children develop properly physically and mentally, as well as prevent dental diseases, including dental caries.

The Republic of Uzbekistan, according to the WHO classification, also belongs to the region with high prevalence of caries. The greatest increase in caries intensity is observed in childhood and adolescence. Quite a few works have been devoted to the study of the prevalence of dental caries in our republic [16, 19, 20, 31, 32]. According to research conducted to date, dental diseases in our republic are at a high level and pose a significant threat to the health of young people. The prevalence of caries among children living in urban areas in the republic is 87.76 percent, with an intensity level of 3.96 percent, while the prevalence of caries among children living in rural areas is 80.91 percent, with an intensity level of 3.3 percent.

In conclusion, judging by the current state of literature on the origin and prevalence of dental caries in children aged 3-6 years, the prevention of dental diseases such as dental caries is a major focus of modern scientific research in dentistry. In the etiology and pathogenesis of caries, the main factors are caries susceptibility of the tooth surface, cariogenic bacteria, fermentable carbohydrates and time. In addition, when considering the mechanisms of the occurrence of dental caries, attention is drawn to the variety of various etiological factors. Their interaction causes the occurrence of a focus of tooth demineralization.

In general, in recent years, certain progress has been made in studying the etiology and pathogenesis of dental caries in children. However, the etiology of caries has not yet been fully elucidated. The modern etiology of caries can be characterized as follows: caries is a pathological process that occurs after teething and is characterized by demineralization of tooth tissues due to the activity of microbes. Enamel contains hydroxyapatite crystals that are destroyed due to the occurrence of an acidic environment in the mouth, which appears as a result of the release of organic acids by bacteria. Then, penetrating into the underlying layers, microbes begin to destroy them as well. At the same time, many aspects of physiological and biochemical disorders that occur in the oral cavity during caries prevention have not yet been sufficiently studied. Therefore, it is necessary to continue research on the development and implementation of fundamentally new and effective methods for the prevention and treatment of major dental diseases.

**1.2. Types of dental caries prevention in preschool children, fluoride prophylaxis .**

Solving the problem of reducing the prevalence and intensity of dental caries, especially in children, is primarily important and can be solved with the help of preventive measures. The key link in solving the problem raised is the primary prevention of dental caries, the main goal of which is to reduce the prevalence and intensity of caries. Early prevention of dental caries in the preschool period is one of the urgent tasks of modern dentistry, since a significant part of children suffer from its complications, starting from a very early age [40. Denga O. V., Gavrilenko M. A., Ivanov V. S. , 2007; Petrikas A. Zh., Zakharova E. L., 2014; Shiryak T. Yu., 2011]. The problem of early stages of dental caries (focal demineralization) in the last decade has been solved by using special remineralizing drugs. In the early years, remineralizing agents included preparations containing ions of micro- and macroelements of fluorine, calcium, and phosphorus. Currently, new preparations similar in composition and properties are being sought.

There are a large number of publications in domestic and foreign literature on the use of various methods and means of preventing dental caries in children, as well as on the development of general and local measures to prevent it. Accordingly, the ways of preventing this disease should be built, of which there are currently three: primary; secondary and tertiary prevention of caries [Kuzmina D.A. Novikova V.P., Moroz B.T. et al., 2010]. Primary prevention of caries in children should be started in the neonatal period [Antonova A.A., 2006; Arutyunov S.D., Sverdlova M.G., Kuzmichevskaya M.V., 2007; Elizarova V.M., 2014]. During this period of life, there is a massive microbial contamination of the child's oral cavity during: - kisses from parents and relatives, - when parents (grandmother, nanny) lick a pacifier that has fallen out of the child's mouth. All this leads to the fact that a huge amount of pathogenic microflora gets into the child's oral cavity, including those that cause the development of childhood caries. Therefore, caries can occur in a child at a very early age, when all the baby teeth have not yet formed.

Numerous works by scientists from foreign countries are devoted to early diagnostics, prevention and rational treatment of early childhood caries [Kuzmina E. M., 2001; 2005; 2006; Elizarova V. M., Petrovich Yu. A., 2002; Lutskaya I. K., 2002; Avraamova O. G., Muravyova S. S., 2005; Suntsov V. G., Leontyev V. K., Distel V. A., 2005; Maksimovsky Yu. M. et al., 2009]. According to their conclusions , any procedures that stop demineralization or lead to remineralization should be considered as measures to prevent caries. It is known that dental caries develops as a result of imbalance in the "tooth enamel - saliva" system under the influence of various unfavorable factors. It has been established that one of the factors that disrupts this system of oral balance is over-acidification of saliva when eating carbohydrate-rich foods. A decrease in the pH of the oral fluid leads to a decrease in its mineralizing

potential [Kasimov B.Kh., Gulyamov S.S., 2013; Ippolitov Yu.A. Plotnikova Ya.A., 2016].

An analysis of literary sources shows that in recent years new methods of primary prevention of dental caries have been constantly improved and introduced [ Ulitovsky S.B., 2001; 2004]. It has been established that most of these measures, aimed at eliminating the etiological factors causing dental caries, are related to methods of primary prevention that help reduce the growth of dental caries.

The priority preventive direction of enamel mineralization in dentistry will help reduce the growth of dental caries [ Kobiyasova I.V., 2006; Kuzminskaya O.Yu., Rutkovskaya L.V., 2016]. It has been shown that such macroelements as calcium, phosphorus, fluorine, etc. play an important role in the prevention of dental caries. Their preventive and therapeutic effects are determined by the inclusion of enamel apatites in the crystal lattice, as well as a decrease in bacterial acidity and the formation of buffer systems.

In countries of the world and the CIS, these have been implemented many studies on the etiology and pathogenesis of caries and its prevention have significantly reduced the intensity of caries in children [Rusanova T.A. et al., 2009;]. However, it remains an important and pressing problem The issue of prevention of dental caries in children remains , since the high incidence of caries in children poses a real threat to the health of the younger generation [Daminova Sh. B., Yuldoshkhonova A. S., Khudanov B. O., 2011]. The solution to the issues of prevention of childhood caries is impossible without studying and creating preventive anti-caries programs that allow coping with the disease in preschool children.

At the present stage, modern and progressive research methods are being developed for the prevention of childhood caries, such as: - digital radiography; - low-intensity laser radiation; - photodynamic therapy; - fluorescence; - electrical conductivity; - low-frequency ultrasound ; - electrophoresis, as well as biochemical express tests and others [ Khudanov B.O., Daminova Sh.B., Yuldoshkhanova A.S., 2012; Shaimieva N.I., 2014]. To predict the development of caries in children, computer programs for the analysis of risk factors are compiled. Their use in practice led to: improving the biological properties of oral fluid and their analysis; high-quality cleaning of hard dental tissues; ensuring the sterility of the carious cavity; improving the adhesive capacity of the filling material, etc. It is hoped that the introduction of modern research methods into the practice of preventing caries will contribute to improving the quality of preventive studies and measures.

In general, the experience of individual countries of the world and the CIS convincingly shows that as a result of the introduction of effective prevention programs into practice, a significant reduction in the intensity of caries in children

is observed. Nevertheless, scientific and practical work is currently ongoing in four areas: improving oral hygiene, organizing a balanced diet, sealing fissures, and using fluoride preparations for the prevention and treatment of dental caries.

It is an undeniable fact that the cariogenic situation in the oral cavity develops more actively and is clinically manifested faster with poor oral hygiene, due to abundant plaque and tartar. Improper oral care contributes to the appearance of soft plaque, which prevents the necessary macro- and microelements from entering the tooth enamel, thereby disrupting the process of enamel maturation [Kunin A.A., Belenova I.A., Kravchuk P.S., Kasim V., 2005; Kravchuk P.S., 2007]. Timely and effective removal of plaque reduces the risk of the cariogenic properties of bacteria and organic acids.

In the organization of preventive measures for all dental diseases, including dental caries, is the hygienic education and training of the population, especially children [Garifullina A.Zh., 2006; Kuchma V.R., 2004]. At first glance, proper care of oral hygiene is simple and accessible. But the process of organizing and conducting hygienic education and training among preschool children is complex. According to most researchers, it is advisable to start hygienic education and training with children attending preschool educational institutions: first the younger (3-4 years old), then the middle (4-5 years old) and then the older (5-6 years old) groups. However, it should be noted that individual oral hygiene in preschool children should be carried out, first of all, by their parents [Gulyamov S.S., 2008]. It is important to accustom a child to oral hygiene from an early age. By their example, parents should show the child in a playful way how to brush their teeth. Moreover, the child must do everything himself, even if ineptly, but in the future he will develop a new habit of brushing his teeth twice a day [Terekhova T.N., Borutta A., Wagner M., 2011].

The most effective and feasible strategy for combating caries in young children is the introduction of healthy oral hygiene habits and the promotion of home dental care methods. A number of authors have convincingly shown that proper oral care reduces the intensity of the growth of the caries process [Barabanova L. I., 2007; Bakhmatskaya I., 2007; Adilova Sh. T., 2009; Terekhova T. N., Shakovets N. V., 2013]. It is known that the surface of tooth enamel is covered with a film called "pellicle" (film - lat.). While bacteria that make up the normal flora of the oral cavity are glued to this film, a bacterial mass called plaque is formed. Through glycolysis, plaque bacteria, especially *Streptococcus mutans* and lactobacilli convert sugars consumed in food into weak organic acids [55; -416 p., 179; p. 504-508]. The acids produced by these bacteria diffuse through plaque and into the tooth, washing out calcium and phosphorus from the enamel and subsequently causing the destruction

of tooth structures and forming dental caries. According to them, the most significant risk factors for the development of caries include a violation of the composition and properties of mixed saliva, as well as the growth of the development of oral microflora [Kasimov B.Kh., Gulyamov S.S., 2013].

The use of personal hygiene helps to improve the condition of the oral cavity and reduce the incidence of caries in children [ Popruzhenko T. V., Terekhova T. N., 2008; Tabolina E. S., 2009 ]. Consequently, oral hygiene is aimed at maintaining a good level of health and is one of the sections of personal hygiene of a person, including children. At the same time, the literature quite convincingly shows the dependence of the development of caries on the properties and composition of oral fluid, which contains minerals necessary for the maturation of tooth enamel.

Systematic hygienic education of preschool children and their parents promotes awareness of their health as an enduring value, the formation of skills and habits of a healthy lifestyle. However, the analysis of a number of studies has shown that parents do not pay due attention to hygienic care of the oral cavity of their child. Therefore, not only parents, but also educators and medical workers of preschool educational institutions should be involved in the system of hygienic education and training of children [ Bakhturina G.I., 2004; Maslak E.E., Rozhdestvenskaya N.V., Lavrov A.A., 2005; Garifullina A.Zh., 2006; Ataniyazova R.A., 2012].

Thus, unfavorable factors affecting the state of oral hygiene in children are: failure to comply with the rules, insufficient use of additional items and means of individual oral hygiene, lack of chewing load, lack of controlled individual oral hygiene, as well as insufficient knowledge of hygienic education and upbringing of preschool children. At present, issues of hygienic education and upbringing among preschoolers are still poorly developed. The level of knowledge of oral hygiene in preschool children and parents is assessed as unsatisfactory. To prevent and reduce the incidence of caries in children, it is necessary to carry out complex dental measures, taking into account the psychological and pedagogical characteristics of preschool children. This will undoubtedly lead to an improvement in the hygienic state of the oral cavity of children, as well as a decrease in the growth of caries.

Among the most widespread and popular means of preventing dental caries in children, the priority role undoubtedly belongs to the use of various fluoride-containing preparations. Caries preventive effect of fluoride is based solely on increasing the rate of enamel remineralization due to an increase in the concentration of fluoride in saliva. Fluorides can affect adhesion to the tooth surface, and also inhibit the growth of various types of plaque bacteria. The use of fluorides for the prevention of dental diseases still causes lively debate. Fluoride can have both beneficial and harmful effects on people. It is generally recognized that low

concentrations of fluoride preparations with short-term contact with tooth enamel help to strengthen the crystal lattice of the tooth. The average reduction in dental caries when using fluoride preparations for the purpose of preventing caries is 30-50%. Of the currently used means, fluoride preparations are the main ones in the prevention of dental caries.

The anti-caries effect of fluoride is associated with three mechanisms of action. Firstly, fluorides interact with one of the main mineral components of dental tissues - hydroxyapatite - to form a very stable compound - hydroxyfluorapatite . As a result, the permeability of enamel decreases and its resistance increases. Secondly, fluoride has a depressing effect on the growth of oral microflora due to the inhibitory effect on carbohydrate metabolism enzymes. As a result, the intensity of carbohydrate breakdown and acid production decreases . Thirdly, fluorides affect the metabolism of the protein phase of enamel, participating in the formation of teeth and, consequently, their resistance to caries.

Both organic and inorganic fluoride compounds are used to prevent dental caries. The most commonly used are: sodium fluoride, potassium fluoride, tin fluoride, titanium fluoride, and aminofluoride . Their purpose depends on the fluoride content in drinking water and food products (tea), social and climatic factors. The concentration of fluoride for local use (in the oral cavity) should not exceed 1-2% (based on the fluoride ion).

Many etiologic factors participate in the pathogenesis of the carious process (see Chapter 1). From the literature review it follows that the theoretical basis for caries preventive measures is the timely provision of conditions for the qualitative and quantitative process of enamel mineralization in childhood. Therefore, the leading problem in caries prevention in children is the event aimed at stimulating the processes of mineralization and maturation of tooth enamel by implementing the appointment of the main components of enamel - calcium, phosphorus, fluorides, as well as substances that ensure their metabolism. The leading one is the deficiency of fluoride ions in the body. Therefore, fluorine-containing substances are recognized as the most effective and affordable option for the prevention of dental caries . Exo- and endogenous methods of fluoride prevention of caries are most widespread in the world [Shaimieva N.I. et al., 2005; WHO-89 ; Yuldashkhanova A.S. et al. , 2006; Kiselnikova L.P. , 2006 ]. This is the only method that has allowed us to achieve a real reduction in the incidence of caries. According to domestic and foreign authors, the effectiveness of these methods is from 25 to 50%. It should be noted that fluorine plays a significant role in the processes of mineralization and development of teeth, the formation of dentin and tooth enamel, as well as bone formation. Optimal intake

of fluorine into the body ensures increased resistance of the outer layer of tooth enamel to caries and the action of pathological factors.

Many researchers believe that the introduction of fluoride, using endogenous methods of preventing caries, such as fluoridation of drinking water, milk, table salt, etc., has a beneficial effect on the body. Fluoride content in water and food, as well as proper nutrition, are an active means of preventing caries [Kuzmina D.A., Novikova V.P., Moroz B.T. et al., 2010]. In accordance with this, diets with the addition of fluoride or its complete exclusion are recommended.

The effect of fluorine on the occurrence of pathological changes in teeth was discovered unexpectedly, when a connection was established between the increased fluoride content in water and the presence of dental and bone fluorosis. By introducing fluoride preparations into drinking water and, conversely, defluoridating water to prevent fluorosis, the possibility of preventing dental caries was proven [Knappvost A. O. , 2004; Kolesova O. V. , 2010 ]. In dental practice, both organic and inorganic fluorine compounds are most often used to prevent caries, such as: sodium fluoride, potassium fluoride, tin fluoride, titanium fluoride, aminofluoride , etc. Fluorine-containing substances are used both for mass prevention of dental caries and for individual prevention.

It is known that primary prevention methods are combined into four groups — endogenous and exogenous, medicinal and non-medicinal [ Kunin A.A., Belenova I.A., Kravchuk P.S., Kasim V. , 2005; Kravchuk P.S. , 2007 ]. Fluoride preparations play an important role in medicinal prevention of caries. World experience and conducted studies have shown that a comprehensive system of fluoride prophylaxis has the following positive features: - introduction of additional fluoride ions into oral fluid promotes restoration of tooth enamel; - reduces permeability of microorganisms into tooth tissue; - slows down the action of microorganisms of soft dental plaque; - prevents processes of mineralization of tooth enamel; has an antibacterial effect; - has a stimulating effect on all derivatives of connective tissue; - stimulates immune reactions, and finally, reduces the incidence of caries to 65%. Considering the above-mentioned positive properties of fluorine in the body, as well as the high prevalence of caries among children, many researchers believe that widespread implementation of caries fluoride prevention programs is necessary . Today, in regions with low fluoride content in drinking water or a lack of fluoride in the body, caries prevention is impossible without the use of fluorides. Therefore, it is so important to use all available methods of fluoride prevention when forming preventive programs among children [Leontyev, V.K. , 2006 ].

Effective fluoride prevention of dental caries is carried out mainly in two ways - the use of fluorides locally and internally, i.e. there are two main ways: a) systemic

- the intake of fluorides into the body with water, salt, milk, in tablets or drops; b) local: the use of solutions, gels, toothpastes, varnishes. Based on the needs of the body, with the correct intake of fluoride-containing drugs, it is possible to easily compensate for the lack of fluoride [ Nurseitova Z.K., Aldasheva M.A. , 2005; Oulis K., Raadal I. , 2008; Terekhova, T.N. , 2016 ]. To systematize the inclusion of fluoride in the body and in the hard tissues of the teeth, the WHO Expert Committee proposes to differentiate the methods of fluoride prevention of dental caries as endogenous and exogenous [WHO-95]. In the endogenous method of caries prevention, fluoride is included in the body by fluoridation of drinking water, table salt, milk, as well as the use of fluoride-containing tablets and drops, etc. The exogenous method of prevention includes: - rinsing the mouth with diluted fluoride solutions; - the use of fluoride-containing toothpastes; - the application of fluoride-containing gels, solutions and varnishes, as well as the combined use of fluorine compounds [ Khamadeeva A.M., Litvinov S.D. , 2005; Avraamova O.G. , 2005 ].

The introduction of a caries prevention program by endogenous application of fluoride, in particular by means of water fluoridation, is the most accessible and cost-effective, compared to other methods of primary prevention of caries [ Yanovsky L.M., Persits M.M., 2003]. Fluoridation of drinking water is carried out in areas where the fluoride content in sources does not exceed 0.7 mg per liter. By installing fluoridation units at water intake stations, the fluoride concentration is brought to optimal values of 0.9-1.2 mg/l. Its effectiveness is most pronounced in childhood and reaches a 25-40% reduction in caries growth.

Currently, about 5% of the world's population (approximately 260 million people) drink fluoridated water [WHO-89; WHO-95; WHO-2003]. WHO recommends fluoridating water in all countries where there is a shortage of fluoride in drinking water. However, fluoridation of drinking water, often considered an effective measure worthy of widespread use, can, together with fluoride in food products, increase the concentration of fluoride ions in saliva to a maximum. This concentration of fluoride is capable, at best, of compensating for the deficiency of OH ions in a very thin layer of plaque on the smooth surface of the tooth. No undesirable effects have been identified, and the safety of fluoridated water can be considered established [ Wright . JC et al. al ., 2001; Yanovsky L.M., Persits M.M., 2003]. It should be noted that the range of physiological concentrations of fluorine in water is very narrow, and makes the problem of hygienic standardization of fluorine in water very acute. It is also necessary to take into account that a high amount of fluorine ( more than 1.5 mg / l) can lead to fluorosis. This is a specific enamel lesion, manifested in a change in the color of the teeth, in severe forms of fluorosis, the enamel becomes brittle, extensive and deep defects can form -

erosions, which leads to abrasion and gradual destruction of teeth. [WHO., 1989; 1965; Smirnova T.A. 2001; Davydov B.N., Borinsky Yu.N. , 2002; Bazanova O.A., Yanovsky L.M., Persits M.M., 2003; Davydov B.N. and others.2005]. Therefore, in order to implement fluoridation of drinking water with an optimal concentration, it is necessary for dentists to interact with representatives of local administrative bodies, engineers, chemists, nutritionists and other specialists. The disadvantages of the method include the difficulty of creating the necessary conditions for a centralized water supply, which is practically impossible in many populated areas, especially in rural areas.

In programs for the prevention of dental caries in children, one of the alternative systemic methods is the use of fluoridated milk. A necessary condition for its implementation should be a long-term forecast of the availability of sufficient milk in the region. Milk has long been of interest to a number of researchers in the field of dentistry, as it is a high-calorie food product for children, containing lactose, calcium and phosphorus. This composition of the product allows milk to actively participate in the process of remineralization of tooth enamel. It has been proven that taking fluoridated milk for several years does not cause the accumulation of fluoride in the child's body and is safe for his health. Milk fluoridation is carried out in England, Bulgaria, Chile, China, Thailand, Hungary and in many cities of the CIS countries, such as Russia, Belarus, Ukraine and other countries. In Russia, the milk fluoridation project has been carried out since 1994 in 3 cities - Voronezh, Maykop, Smolensk; since 1998 - in Volgograd. Sodium fluoride is most often used for milk fluoridation, less often sodium monofluorophosphate can be used . Fluoridated milk can be produced in various forms: liquid (pasteurized, sterilized, high-temperature processed) and powder. When adding a certain amount of fluoride to milk, it is necessary to take into account the age of the child, as well as the intake of fluoride from other foods and drinking water. According to WHO recommendations, for children over 7 years of age, the daily intake of fluoride is 0.87-1.75 mg. For preschool children, the concentration of fluoride in milk, equal to 2.5 mg/l, is optimal, since it provides a daily total intake of 1.0-1.15 mg of fluoride into the body of children per day [ 18; - 116c, 19; -56c]. The positive effect of prevention was demonstrated by the prevalence and intensity of caries, the increase in caries intensity, acid resistance and the rate of remineralization of tooth enamel. In particular, the use of fluoridated milk led to a significant and reliable decrease in the prevalence and intensity of caries in permanent teeth [ Wright . JC et al ., 2001; Yanovsky L.M., Persits M.M., 2003; Stepanova I.A., Avraamova O.G., 2007].

A fairly cheap and comparatively effective method of endogenous fluoride application in mass prevention of dental caries is fluoridation of table salt. This

method is mainly widely used in different areas of the city with different fluoride content in drinking water. It has been established that regular and optimal dose consumption of fluoridated salt promotes an increase in non-specific resistance of the oral cavity in preschool children [Davydov B.N., Borinsky Yu.N., 2002; Davydov B.N. et al., 2005]. Fluoridated salt promotes an increase in the concentration of fluorides in the oral cavity throughout life. In the course of the conducted studies, it was concluded that the intake of fluoridated salt containing 250 mgF /kg is more appropriate for the prevention of dental caries than fluoridated drinking water.

A number of studies conducted in different countries have shown that the use of salt containing fluoride in a concentration of 90-350 mg/kg significantly reduces the intensity of dental caries. The most convincing data on the effectiveness of the method were obtained in Venezuela, Colombia, Sweden , etc. As a rule, the concentration of fluoride in salt recommended today is 250 mg/kg . . [ Wright . JC et al . , 2001; Whelton HP , Ketley C. E., McSweeney F., O'Mullan DM, 2004; Zupko CM, 2004; Davydov B. N. et al., 2005; Nurseitova Z. K., Aldasheva M. A., 2005; Montero M., Rojas-Sanchez F., Socorro M., 2007; Ysyeva A. O., 2008; Serebrennikova V. G., 2008]. In the world, experience in the use of salt fluoridation is also available in a number of countries - Switzerland (more than 40 years), France, Costa Rica, Jamaica, Germany. For this purpose, fluorides are added to highly purified salt by stirring to the required concentration per 1 kg of salt. Comparative studies of water and salt fluoridation methods have been conducted in terms of their effectiveness, safety, and cost. According to their data, despite the effectiveness of each method, they cannot be implemented everywhere due to technical, financial, political, and other problems. The disadvantages of using fluoridated salt include the difficulty of distributing the salt, the use of very complex technology, difficulties in the method of selecting an individual dosage, and mandatory monitoring [ Terekhova TN, 2000; Trukhacheva, II. I., 2003].

For mass prevention of dental caries in children in conditions where it is not possible to fluoridate drinking water or individual food products (milk, salt), fluoride can be introduced into the body of children in the form of tablets, based on the daily optimal intake of 1.2-1.6 mg.

NaF ) is currently widely used as a fluoride-containing tablet , as it dissociates fairly easily into active fluoride ions and is well fixed in plaque and the oral mucosa. One of the most important advantages of taking sodium fluoride tablets orally in the process of preventing dental caries is the "flexibility" of this method. It allows you to introduce fluoride exactly at those periods when it is most necessary, and you can also accurately set the dose of the microelement taking into account the age

characteristics of the body. The anti-caries effect of using sodium fluoride tablets depends primarily on the age at which it is taken, as well as the regularity and duration of their use. The dose of sodium fluoride should be as follows: 0.25 mg - up to 2 years; 0.5 mg - from 2 to 4 and 1 mg - from 5 years. Taking the tablets is organized by preschool teachers or health workers. In preschool educational institutions, sodium fluoride tablets are taken daily immediately after breakfast. On weekends and holidays, each child is given the required number of tablets. The disadvantage of this method of caries prevention is the difficulty of monitoring regular tablet intake in unorganized groups, and it is more expensive than other methods of introducing fluoride into children's bodies.

A more attractive method of caries prevention is the so-called local fluoridation with simple fluoride and amine fluoride. Treatment of enamel with these salts, which are part of varnishes or gels, leads to a chemical reaction with the enamel and the formation of relatively large -crystalline calcium fluoride, which freely covers the surface of the tooth enamel [ Yuldashkhanova A.S. et al., 2006; Sadovsky V.V., 2005; Fattal R.K., Ammaev M.G., 2014]. Throughout the experiment, the accumulation of minerals when using liquids with fluoride demonstrated a linear dependence on time, and even over four weeks there were signs of the possibility of further absorption of minerals.

One of the forms of introducing fluoride into the surface layer of enamel in order to further increase its resistance is the use of fluoride-containing toothpastes for brushing teeth. It is known that they are currently the most important source of fluoride supply to the population [Makeeva I.M., 2014; Kupets T.V., Mirnaya E.A., 2016]. Their widespread use in many regions and populations is explained by their availability and variety of products. Unfortunately, it is often in such regions that fluoridation of water or salt is impossible, so for most of the world, the development of affordable and effective fluoridated toothpastes is an important task. At the same time, new formulas of toothpastes with increased anticaries properties should be critically assessed in terms of their additional therapeutic and prophylactic properties [21; 77-80., 51; pp. 60-63].

The relevance of studying the role and importance of fluoride-containing toothpastes in oral hygiene and dental caries prevention is currently beyond doubt, since their caries-preventive effectiveness has been proven by numerous studies. It has been established that their use (for oral care), by increasing the resistance of tooth enamel, as well as reducing its permeability and solubility, leads to a sharp decrease in caries intensity (from 15 to 35%) [ Kunin A.A., Belenova I.A., Kravchuk P.S., Kasim V. , 2005; Kravchuk P.S. , 2007 ]. The mechanism of the preventive action of fluoride-containing toothpastes is associated, first of all, with the caries-

inhibiting activity of fluorine. Research by various authors shows that fluoride included in toothpastes freely enters the saliva when brushing teeth and is then absorbed by tooth enamel [ Popruzhenko T.V., Terekhova T.N., 2008].

For mass prevention of dental caries in children in conditions where it is not possible to fluoridate drinking water or individual food products (milk, salt), fluoride can be introduced into the body of children in the form of tablets, based on the daily optimal intake of 1.2-1.6 mg.

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Thus, the analysis of numerous information presented in the literature indicates that fluorine deficiency in the body of children leads to delayed eruption and specific tooth decay, the appearance of brittle bones, teeth, etc. The most active and effective preventive effect of fluoride-containing preparations is manifested during the period of maturation of tooth enamel, i.e. in childhood. In adulthood, the anti-caries effectiveness of preparations is significantly reduced. Therefore, in order to prevent the development of dental caries, fluoride prophylaxis is advisable to carry out in childhood.

The overwhelming majority of the population of the Republic of Uzbekistan lives in conditions where there is a noticeable or significant fluorine deficiency. In order to prevent dental caries on a large scale, it is necessary to artificially enrich the body with fluorine, the most realistic, widespread and effective means of which is fluoridation of drinking water. As studies of recent years show, the high incidence of dental diseases in the Republic of Uzbekistan poses a real threat to the health of the younger generation. According to the authors A.S. Yuldashkhanova et al. (2005),

in the territory of the Republic, among preschool children living in the city, the prevalence of caries was 87.76%, with an intensity of 3.96, and among preschoolers living in rural areas, the prevalence of caries was 80.91% with an intensity of 3.3. In tap water in Tashkent, the concentration of fluorine is only 0.36 mg / dm<sup>3</sup> (a very low concentration of fluorine in water).

Further deepening of research, involving systems of age dynamics of development of the child's body, psychological reactions of children, features of persuasion and assimilation can significantly increase the effectiveness of the entire system of preventive measures.

## **Chapter 2**

### **EPIDEMIOLOGY OF DENTAL CARIES IN PRESCHOOL CHILDREN OF TASHKENT CITY AND TASHKENT REGION ATTENDING PRESCHOOL EDUCATIONAL INSTITUTIONS**

#### **2.1. Prevalence and intensity of teeth caries lesions in preschool children**

Despite numerous methods of prevention, treatment, as well as ongoing scientific and practical work in this area, dental caries, especially in preschool children, remains one of the most common diseases [Borovsky, E. V., Leontyev V. K. 2001; Yuldashkhanova A. S., Sultanova G. S. 2002. Kiselnikova L. P., Kirillova E. V., 2011; Kamilov E. Kh. 2012. Suntsov, 2001; Kuryakina N. V. 2001; Voloshina, 2006;]. It is known that temporary teeth are of great importance in the

life of a growing child. Caries of temporary teeth, destroying them, steadily progresses from early childhood and is a problem all over the world [Suntsov, 2001; Voloshina, 2006 Ahmed NA 2007; Ayo-Yusuf O.A., 2007; Ohlund I. 2007; Sagheri 2007]. The course of caries in baby teeth has its own characteristics, the main one being the rapid development of the pathological process, which quickly reaches dentin, capturing large areas [ Kuryakina ]. This is due to the thin enamel cover of baby teeth, a smaller volume of dentin, as well as the presence of poorly mineralized dentin zones in it, which in the form of wide stripes reach the borders of the pulp and contribute to the progression of the carious process [ Borovsky, Leontiev 2001 ]. In addition, enamel and dentin structurally contain a higher percentage of organic matter, which also increases the possibility of rapid spread of caries [ Kobiasova I.]. Primary teeth with acute and complicated caries cause the development of acute and chronic odontogenic inflammatory processes [ Shiryak ]. The high incidence of caries in children, starting from an early age, requires constant improvement of prevention and treatment methods [ Korchagina V.V. 2008 3,6,7]. Considering the high incidence of dental caries , the main scientific and practical activities of dentists in our republic in recent years have been aimed at reducing the prevalence and intensity of dental caries [ Adilova Sh.T. 2008; 2009; Yuldashkhanova A.S., Sultanova G.S. 2002; Gulyamov S.S., 2010 Kamilov E.Kh. 2012 ]. To identify the dynamics of caries incidence in primary teeth in preschool children, it is necessary to have data on the prevalence and intensity of caries in specific age groups.

During the work, an epidemiological survey of 935 children aged 3 to 6 years attending preschool institutions in Tashkent and the Tashkent region was conducted. The studies were conducted in preschool institutions in Tashkent and the Tashkent region.

To study and identify the prevalence and intensity of dental caries in preschool children in preschool institutions of the Almazar district of Tashkent, the examination was conducted using disposable dental kits in natural light. A total of 380 children aged 3 to 6 years were analyzed. Information from the medical records of the subjects was studied.

All the examined children were divided into 4 age groups: Group 1 - 3 years old (74 people); Group 2 - 4 years old (138 people); Group 3 - 5 years old (106 people) and Group 4 - 6 years old (62 people). Preschoolers of Mirzo -Ulugbek district of Tashkent city were divided by age into two groups: Group 1 - 5 years old (n = 187); Group 2 - 6 years old (n = 123). In preschool institutions of Kibray and Zangiota districts of Tashkent region, all the examined children were divided by age and amounted to: 52 children at the age of three; 56 children at the age of four; 80

children at the age of five and 55 children at the age of six. The prevalence and intensity of dental caries were studied according to the index "kp + KPU".

The prevalence of dental caries was determined by the ratio of the number of children with at least one of the signs of dental caries (carious - K, filled - P or extracted - U teeth) to the total number of children examined, expressed as a percentage proposed by the WHO expert committee.

The intensity of dental caries in children was determined by the number of teeth affected by caries, as the sum of carious, filled and removed permanent and temporary teeth, due to complicated caries (indices kp and kp+KPU) on a 5-point scale proposed by the WHO expert committee.

At the same time, the prevalence of dental caries among children aged 3-6 years in the Almazar district of Tashkent was 75.1%, with an intensity of 3.8. 24.9% of children were intact in terms of caries.

According to the data obtained, the average prevalence and intensity of dental caries in children generally correspond to that in the republic. The prevalence of dental caries by groups was: group 1 -  $67.7 \pm 2.42$ ; group 2 -  $73.8 \pm 1.75$ ; group 3 -  $77.3 \pm 2.21$  and group 4 -  $81.3 \pm 2.54\%$  (Table 1). From these data it follows that in group 1 children the prevalence is comparatively lower than in other groups, but by the age of 5-6, more than 80% of teeth in these children are affected by caries. This indicates that they have a high prevalence of dental caries.

The analysis of the intensity of caries of primary teeth showed that in the 1st group of examined children the intensity level can be assessed as low ( $kp+KPU - 2.42 \pm 0.35$ ), and in the second and third groups of children the intensity of caries is of average degree and is  $3.75 \pm 0.21$  and  $4.38 \pm 0.29$  (Table 1). From these data it follows that the intensity of dental caries increases with the age of children, and then reaches a high mark. Thus, by the age of 6 it reaches a high degree ( $5.14 \pm 0.41$ ).

Table 1.

Prevalence and intensity of caries in the examined children

The indicators under study	Groups of children examined			
	1 group (n=7 4)	2 group (n=1 38)	Grou p 3 (n=1 06)	4 group (n=6 2)
Prevalence of caries, %	$67.7 \pm 2.42$	$73.8 \pm 1.75$	$77.3 \pm 2.21$	$81.3 \pm 2.54$
Intensity " kp+KPU "	$2.42 \pm 0.35$	$3.75 \pm 0.21$	$4.38 \pm 0.29$	$5.14 \pm 0.41$

Considering the localization of lesions of temporary teeth, it should be noted that in temporary occlusion in children, the teeth of the upper jaw are more affected by caries compared to the teeth of the lower jaw, and in permanent occlusion, the teeth of the upper and lower jaws are affected by caries almost equally. Thus, in the course of the studies, the classification of carious cavities by localization proposed by Black was carried out in the examined children. Localization of carious cavities in children was observed in all classes with the prevailing majority in classes I-III . In particular, it was established: Class I - 63.1 ; Class II - 78.5; Class III - 45.1; Class IV - 15.0 and Class V - 10.5%.

Research was also conducted to study the structure of dental caries lesions depending on the group of teeth. When analyzing the caries lesions of various groups of teeth, it was found that in temporary and permanent bite, molars are significantly affected by caries in all examined children by age groups (Table 2). Premolars and incisors are affected to a lesser extent, and canines are affected much less often. Analysis of caries lesions of various tooth surfaces showed that the approximal surface of temporary teeth in children is most often affected. The chewing surface is in second place in terms of caries lesions. In mixed bite, the teeth of the upper and lower jaws were affected by caries equally.

Table 2.

Structure of dental caries lesions depending on group affiliation, %.

Group of children	Fangs	Incisors	Molars
1 group	2.7	38.8	50.7
2 group	8.3	65.9	75.4
3 group	8.9	68.4	87.3
4 group	9.3	57.8	88.4

Research was also conducted on the distribution of the number of carious and filled teeth and the depth of dental caries by all ages. When studying the index " kp + KPU " by groups, a predominance of almost two times, the number of carious teeth, compared with filled teeth, was revealed. The study of the depth of dental caries showed that in the examined children, superficial and fissure caries were quite rare. This is apparently due to the fact that the carious process in children develops very quickly and the children did not complain, and therefore superficial caries in them turned into medium and then deep.

During the examination of preschool children of Mirzo Ulugbek district, the following indicators of prevalence and intensity of caries of temporary and permanent teeth in the examined preschool children, by age were obtained in the

course of the study. Thus, the prevalence of caries by groups was: group 1 -  $77.3 \pm 2.2$  and group 2 -  $81.3 \pm 2.5\%$ , with the intensities of tooth damage by caries of  $4.38 \pm 0.29$  and  $5.14 \pm 0.41$  according to the  $kp + KPU$  index, respectively. The analysis of the indicators of the intensity of dental caries according to the  $kp$  and  $KPU$  index revealed the statistical significance of their differences ( $p < 0.05$ ). It follows from these data that in the first group of children the prevalence is comparatively lower than in the second group, but by the age of 6, more than 80% of teeth in these children are affected by caries. This indicates that they have a high degree of prevalence and intensity of dental caries. These data generally correspond to the average indicators for the republic.

The prevalence and intensity of caries in primary teeth of children aged 3 to 6 years attending preschool institutions in Kibray and Zangiota districts of Tashkent region were also studied. A total of 243 children were analyzed. In both preschool institutions of the districts, all examined children were divided by age into 4 groups: Group 1 - aged three years (52 children); Group 2 - aged four years (56 children); Group 3 - aged five years (80 children) and Group 4 - aged six years (55 children). The prevalence and intensity of dental caries were comparatively studied according to the index " $kp$ ,  $kp + KPU$ ", as well as the structure of dental caries depending on group affiliation in the specified regions.

The study yielded unequal indices of prevalence and intensity of caries in primary and permanent teeth across regions. Thus, prevalence of caries in preschool children of Kibraysky District was within the range of  $69.52 \pm 0.57 - 78.70 \pm 0.43\%$  with intensity of  $2.33 \pm 0.05$  and  $4.75 \pm 0.05$ . At the same time, intensity of caries in preschool children of Zagiatsinsky District ranged from  $2.45 \pm 0.03$  to  $4.88 \pm 0.05$  with prevalence of  $70.23 \pm 0.15$  to  $80.85 \pm 0.37\%$  (Table 3). The results of the study show that prevalence and intensity of dental caries in children of group 1, having low index values, is comparatively lower in both Kibraysky and Zangiatsinsky Districts than in other groups. Already by the age of 5-6, more than 80% of teeth of these children are affected by caries, with high intensity. Nevertheless, these data, in general, correspond to the average indicators for the republic. The prevalence of dental caries in children of groups 2-4 of both regions is estimated as high. Statistical processing of dental caries incidence rates in the examined children of the regions of the region revealed their statistical difference.

The analysis of the dental caries intensity index in the examined preschool children of the Kibray and Zangiatsinsky districts shows that in the first and second groups of examined children the intensity level can be assessed as low and moderate (from  $2.33 \pm 0.05$  to  $3.62 \pm 0.04$ ), and in the third ( $4.12 \pm 0.03$ ) and fourth groups of

children ( $4.88 \pm 0.05$ ) the caries intensity is high. Comparison of dental caries intensity indices by the index "kp, kp+KPU"

Table 3.

Prevalence and intensity of caries in examined children of Kibray and Zangiata districts

Groups of children	Spread - Negativity, %	Meaning index	Intensity "kp, kp+KPU"	Meaning index
Preschoolers of Kibray district				
1 group (n=15)	69.52 ± 0.57	average	2.33 ± 0.05	moderate
Group 2 (n=16)	74.15 ± 0.65	high	3.62 ± 0.04	moderate
Group 3 (n=30)	73.54 ± 0.70	high	4.13 ± 0.04	high
Group 4 (n=30)	78.70 ± 0.43	high	4.75 ± 0.05	high
Preschoolers of Zangiatsinsky district				
1 group (n=37)	70.23 ± 0.15	average	2.45 ± 0.03	moderate
Group 2 (n=40)	75.44 ± 0.10	high	3.74 ± 0.05	moderate
Group 3 (n=50)	76.82 ± 0.52	high	4.12 ± 0.03	high
Group 4 (n=25)	80.85 ± 0.37	high	4.88 ± 0.05	high

statistical significance of their differences was also revealed. It was established that the degree of intensity of dental caries in both the Kibray and Zangiata districts increases with the age of children and reaches a high level.

The localization and structure of tooth damage were studied. When analyzing caries damage of different groups of teeth, it was found that in primary occlusion, molars are significantly affected by caries in all examined children by age groups. Molars and incisors are affected to a greater extent, and canines are affected much less often. Analysis of caries damage of different surfaces of teeth showed that in primary teeth in children, the approximal surface is most often affected. The chewing surface is in second place in terms of caries damage. In mixed occlusion, the teeth of the upper and lower jaws were affected by caries equally.

In a comparative study of the index "kp, kp+KPU" by dental caries groups in preschool children of the Tashkent region, a predominance of carious teeth was found almost twice as high as filled teeth. A study of the depth of dental caries showed that superficial and fissure caries were quite rare in the examined children. This can be explained by the fact that the carious process in children develops very quickly, contributing to the transition of superficial caries to medium and then deep.

Thus, a comparative study of dental caries in preschool children in two districts of the Tashkent region showed that the prevalence and intensity of dental caries increases with age. It was shown that by 5-6 years, more than 80% of teeth are affected by caries in groups of children, with high intensity. A study of the localization and structure of dental lesions has established that molars and incisors are affected to a greater extent, and canines are affected much less often. Analysis of caries lesions of various tooth surfaces showed that the approximal surface of children's teeth is most often affected. In the course of a comparative epidemiological study, it was established that the observed patterns and changes associated with the prevalence and intensity of dental caries in preschool children are more clearly expressed in the preschool institution of the Zangiata district. It was established that the incidence of dental caries in the examined children, divided into age groups, was assessed as high: a) the highest prevalence of dental caries is noted among 5-6 year old children and in the city is  $80.42 \pm 2.33\%$  with an intensity of  $4.83 \pm 0.03$ , and in the region is  $74.47 \pm 2.50\%$  with an intensity of  $4.47 \pm 0.05$ . b) the lowest prevalence of dental caries is noted among 3-4 year old children and in the city is  $72.13 \pm 2.21\%$  with an intensity of  $3.20 \pm 0.03$ , and in the region is  $72.33 \pm 2.21\%$  with an intensity of  $3.03 \pm 0.03$ . It has been shown that dental caries in children aged 3-6 years occurs regardless of the location of the preschool educational institution and has the following types of localization, depth and structure of the lesion: a) by localization, cavities according to Black's class II predominate; b) molar lesions predominate; c) by the depth of caries lesions, medium caries predominates; d) by the structure of caries lesions, "K" predominates, which determines the high need of children for dental care.

Early detection of carious cavities will reduce the percentage of complications. Regular dental examinations and timely treatment help to develop children's needs for maintaining healthy teeth.

## **2.2. Determination of the hygiene index in preschool children**

Oral hygiene is the most accessible and widespread factor in the comprehensive prevention of dental caries. In civilized countries of the world, it has long become an integral component of culture, both for adults and children [ Ismail A . I ., 2003;

Kiselnikova L.P., Zueva T.E., Kruzhalova O.A., et al., 2007; Denyakina E.K., Sarkisyan G.A., 2008; Terekhova T.N., Shakovets N.V., 2013]. After all, regular proper oral hygiene ensures 85-90% of dental health. The teeth and periodontium of a healthy person can withstand enormous loads, while tooth enamel is a very strong material in structure, but they are quite vulnerable to the daily effects of acids secreted during fermentation by oral bacteria. Therefore, the main criterion for dental health is, first of all, thorough personal hygiene.

It is known that the surface of the tooth enamel is covered with a film called pellicle. At the same time, plaque is a bacterial mass consisting of bacteria that inhabit the oral cavity and adhere to the pellicle. Plaque bacteria, especially *Streptococcus mutans* and lactobacilli convert ingested sugars through glycolysis into weak organic acids [ Wan A.K. , Seow W.K. , For die D . M., et al., 2003; Douglass J. N. , Douglass A. B. , Silk H . J ., 2004; Leontiev V. K., Pakhomov G. N., 2006;]. The acids produced by these bacteria diffuse through plaque and into the tooth, washing out calcium and phosphorus from the enamel and subsequently causing the destruction of tooth structures and forming dental caries. According to the authors, the most significant risk factors for the development of caries include a violation of the composition and properties of mixed saliva, as well as the microflora of the oral cavity [ Douglass J. N. , Douglass A. B. , Silk H . J ., 2004; Arutyunov S. D., Sverdlova M. G., Kuzmichevskaya M. V., 2007; Lvova I. A., 2008].

Currently, various programs on health education and hygiene training are being developed, primarily for children and adolescents. When developing them, the following were taken into account: age dynamics of development of the child's body; psychological reactions of children; features of persuasion and assimilation of the rules of oral hygiene, etc. [ Garifullina A.Zh., 2006; Korchagina V.V., 2007; Maslak E.E., Rodionova A.S., 2008; Kamennova T.N., Maslak E.E., Rodionova A.S., Alatorseva E.V., Vlasova D.S., 2009; Vusataya E.V., Dremalov B.N., Krasnikova O.P. et al. 2011]. They note the enormous importance of proper hygienic education of children from the earliest age , since skills in individual oral hygiene are among those that are best learned in early childhood. Moreover, children, as noted in the works of scientists, copy such skills from adults, in particular from parents. Therefore, according to many scientists, health education talks and lectures should be conducted primarily with the parents of children.

The level of oral hygiene, the presence of correct hygiene skills in children is the main link in the prevention of dental caries. The hygiene index in the examined children was studied in detail . The level of oral hygiene in preschool children was determined using the Fedorov- Volodkina index [ Fedorov Yu.A., Volodkina V.V., 1971 ] . The method is based on determining the areas of the vestibular surface of six

lower frontal teeth covered with plaque. Dental plaque was stained with Schiller-Pisarev solution. The results of tooth staining were assessed in points: 1 - no staining; 2 - staining of 1/4 of the tooth crown surface; 3 - staining of 1/2 of the tooth surface; 4 - staining of 3/4 of the tooth surface; 5 - staining of the entire tooth surface. The hygienic condition of the oral cavity was determined based on the hygiene index value: 1.1-1.5 - good; 1.6-2.0 - satisfactory; 2.1 - 2.5 - unsatisfactory; 2.6-3.4 - poor and 3.5-5.0 - very poor.

Table 4

Hygienic index of the oral cavity of preschool children depending on group affiliation

Group of children	Preschoolers Kibray district		Preschoolers Zangiata district	
	Hygienic index	Meaning index	Hygienic index	Meaning index
3 year olds	2.21 ± 0.07	unsatisfactory	2.30 ± 0.03	unsatisfactory
4 year olds	2.67 ± 0.06	bad	2.72 ± 0.06	bad
5 year olds	3.24 ± 0.04	bad	3.30 ± 0.04	bad
6 year olds	3.33 ± 0.05	bad	3.41 ± 0.04	Very bad

The obtained results indicate that the children examined are poorly familiar with the rules of oral hygiene and do not sufficiently observe the rules of individual oral hygiene. The oral hygiene index in children of the first group was  $3.18 \pm 0.04$  and in the second  $3.39 \pm 0.05$ . These oral indicators can be assessed as "low". It was found that the hygienic index in 3-4 year old children examined in the city is  $2.56 \pm 0.03$ , and in the region  $2.47 \pm 0.04$  and is assessed as an "unsatisfactory index", in 5-6 year old children in the city is  $3.36 \pm 0.03$ , and in the region is  $3.32 \pm 0.05$  and is assessed as a "poor index" of hygiene.

This may be primarily due to the fact that the preschoolers surveyed are poorly acquainted with the rules of oral hygiene and do not sufficiently observe the rules of personal hygiene. In this regard, it should be noted that one of the most important

tasks of hygiene is to cleanse the oral cavity from food debris, detritus, microflora, and on the other hand, to introduce into it agents that have a positive effect on its condition, strengthening its protective properties and functional capabilities [Leontyev V.K., Pakhomov N.G., 2006; Shakovets N.V., Likhorad E.V., 2013, Voevoda E.A., Golubeva I.N., Ostapko E.I., 2014]. Various oral care products are created from the standpoint of these tasks. The level of oral hygiene and the presence of correct hygiene skills in children are the main link in the prevention of dental caries.

### **Chapter 3.**

## **THE RELATIONSHIP AND ROLE OF NUTRITION IN THE PREVENTION OF CARIES IN PRESCHOOL CHILDREN ATTENDING PRESCHOOL EDUCATIONAL INSTITUTIONS**

### **3.1. The role of diet in dental caries**

Caries is one of the most common dental diseases typical for the population of developed countries. It does not pose a significant threat to life, but significantly reduces its quality. High dental morbidity in children in the Republic of Uzbekistan can pose a real threat to the health of the younger generation. According to A.S. Yuldashkhanova et al ., in the territory of the republic among preschool children

living in the city, the prevalence of caries was 87.76 with an intensity of 3.96%, and among preschoolers in rural areas, the prevalence of pathology is slightly lower - 80.91 with an intensity of 3.3%. In Russia, a tendency towards the prevalence and intensity of caries of primary teeth has been established. Thus, the prevalence of caries in Omsk in children was at the age of: 3 years - 77.3 %; 4 years - 84.0% and 5 years - 87.0%. The average intensity rate in the group of three-year-old children was 3.56%, in four-year-olds – 3.8, and by the age of 5 – 4.4%. In children aged 6 in Kyrgyzstan, the prevalence of caries in primary teeth was found to be 89.42 with an intensity of 5.21%. According to WHO data, the incidence of caries in children living in Almaty is low. In Kazakhstan as a whole, the intensity of caries does not exceed 1.87 with a prevalence of 67.3%. This is probably due to the content of the optimal concentration of fluorine in drinking water in Almaty (0.5–1.2 mmol/l), which does not require systemic administration of the microelement into the body.

The solution to the problem of proper organization of children's nutrition has not only medical, but also great social significance, since it is a determining factor in the entire subsequent development of children [Kuchma V. R., Gorelova, Zh. Yu., 2006; Gorelova Zh. Yu., 2006; Ivanova G. V., 2007; Tutelyan V. A., 2008]. In this regard, scientists have developed a modern doctrine of balanced nutrition. Today, the concept of balanced nutrition includes data on nutrients needed by each organism and the relationship between them. Balanced nutrition is a qualitative and quantitative optimal ratio of the most essential nutrients such as fats, proteins, carbohydrates, vitamins and minerals, macro and microelements. [Davenport ES et al., 2004; Tutelyan V. A., 2005; 2008; Kuryakina N. V., 2007; Shaykhova G. I., 2011]. The diet should be rich in minerals and vitamins. Consuming solid foods, such as fresh fruits and vegetables, will also help maintain the integrity and health of teeth. When consumed, the surface of the tooth enamel is effectively cleaned of plaque and deposits. In addition, the listed products also serve to improve the health of the gums.

The literature contains numerous examples where a balanced and rational diet in children, along with other risk factors, plays an important role in the formation of resistance of teeth to caries [Sakharova E.B., 1987; Kuryakina N.V., Morozov V., 2007; Kondentsova V.M., Vrzhesinskaya O.A., 2008; Zokirkhonova Sh.A.]. It should be noted that in recent years the nature of the diet of the child population has changed. The consumption of dairy and fermented milk products has sharply decreased, replacing them with drinks such as Coca-Cola. The consumption of ballast substances (fiber) has decreased, the consumption of sugars and sausages has sharply increased. The child population prefers food products such as "chips", which have no nutritional value [Morozov V., 2007; 2008; Kuchma V.R., Gorelova,

Zh.Yu., 2006]. The fast food system and the use of semi-finished products in nutrition have become increasingly widespread.

Poor and irrational nutrition significantly increases the risk of caries. The nutrition factor is especially important in childhood, during the first 6-18 months after teething. It is during this period that the enamel of the teeth in the oral cavity "maturation" occurs, and their tissues are saturated with calcium. In the modern diet of children, there is a deficiency of nutrients, as well as minerals, such as calcium and phosphorus. Calcium is the main component of many programs for the prevention of changes in the structure and functions of the bone system. This is due to its essential role in the mineralization and development of the skeletal system. The saturation of the human body with calcium directly correlates with its intake with food. The main intake of calcium into the body and skeleton occurs during periods of intensive growth of the child. This is the age from 1 to 3 years, at 5-6 and at 11-15 years [ Davenport ES et al., 2004; Elizarova V.M., Petrovich Yu.A., 2002; [Shcheplyagina L.A., Moiseeva T.Yu., Marchenko T.K. et al., 2005; Mikhalyuk N.S., 2005]. On a cariogenic diet, biological and biochemical changes in the metabolism of phosphorus and calcium in the tissues of bones and teeth in animals occur. These changes are not simply quantitative, but represent a set of qualitative disturbances that are related to the factors causing the development of dental caries. [Borovsky E.V., 2006; Akhmetzyanova G.R., 2009].

One of the main risk factors for caries development is protein deficiency. Protein foods play a caries-protective role, since proteins affect the quality of saliva. When studying the effect of the amount of protein in the diet on the composition and properties of the bone system and teeth, it was found that even with regular intake of phosphorus and calcium in the diet, a decrease in the amount of protein in it can cause a noticeable increase in caries. A diet for caries entails a violation of protein metabolism, and therefore interferes with the formation of a full-fledged structure of tooth enamel. An increased amount of protein in diets with a moderate content of calcium and phosphorus showed a positive effect on the frequency of caries [ Bakhturina G.I., 2003; Amin MS, Harrison RL, Benton TS, 2004; Khomenko L.A., Sidelnikova L.F., Voevoda E.A., 2008; Vrzhesinskaya O.A., Kodentsova V.M., 2007; [Okushko V.R., 2011]. When consuming cheese, beans, eggs, milk, nuts, the mineralizing potential of saliva increases, which creates opportunities to compensate for the negative impact of sugars on oral fluid. Protein deficiency during the period of laying the rudiments and development of teeth leads to a decrease in their size and weight, as well as disruption of the enamel structure. The amount of protein in the diet directly correlates with the mineral composition of teeth and bone systems. With insufficient protein content in the diet, calcium accumulation and apatite

formation slows down [ Shcheplyagina L.A., Moiseeva T.Yu., Marchenko T.K. et al., 2005; Vrzhesinskaya O.A., Kodentsova V.M., 2007; Spiricheva T.V., 2007], which creates favorable conditions for the occurrence and development of caries.

The main areas of research in dentistry continue to be the issues of dental caries prevention. In this issue, the role of nutrition as an integral part of a healthy lifestyle is great. Thus, BA Dye et al . noted the relationship between healthy nutrition and caries prevention in children aged 2-5 years. Being a polyetiological pathology, the probability of caries formation also depends on a number of alimentary factors, which can be conditionally divided into general and local. General factors include sufficient content of fluorine, vitamins D, A and C, calcium, protein in the diet, which ensure normal metabolism in dental tissue. Local regulated factors are mono- and disaccharides, organic acids of microflora and pH of the oral cavity. Caries develops due to demineralization of tooth enamel by acids entering with food or formed as a result of fermentation of carbohydrates by bacteria in the oral cavity. The highest acidogenic potential was found in sucrose, glucose and fructose, the lowest - in lactose. The most cariogenic bacteria include *Streptococcus mutans*. Recently, the nature of children's nutrition has changed in almost all countries of the world: the consumption of whole milk and fermented milk products, fiber has decreased. Children prefer fast food, as well as various useless, but attractive food products - sugar, potato and starch chips, crackers, etc.

The ratio of carbohydrates and proteins is an important component in diets. Carbohydrates attract the attention of scientific researchers as the main factor in the development of dental caries. The most cariogenic sugar is sucrose, while other sugars such as fructose and glucose are not inferior to it in properties. Sucrose is especially often detrimental to teeth against the background of eating sweet products between main meals. [Leontyev V.K., Pakhomov N.G., 2006; Suntsov V.G., Popova E.V., Mokhova O.P., 2009]. At the same time, granulated sugar, in comparison with lump refined sugar, is less cariogenic , since its direct time of contact with teeth is shorter. Traces of sugar soluble in an aqueous solution remain in the oral cavity for 15 minutes, while solid sugar remains in saliva for a long time. Food products such as bread, candies, baked goods with a high butter or margarine content can remain on the surface of the teeth for more than one hour. When studying sugars for the level of enamel demineralization, it turns out that the greatest degree is manifested when teeth are exposed to a 3% sucrose solution ( the microhardness of the enamel decreases by 28.8%), and then 6% glucose - by 22.2% and 10% syrup solution - by 8%.

The most significant risk factors for dental caries are an excess of easily digestible carbohydrates in the diet. Long-term exposure to sweet foods increases

the risk of plaque formation. The cariogenic effect of sugars is considered from various points of view. Eating foods containing simple carbohydrates promotes the growth of microorganisms on the surface of teeth. These microorganisms react with sugars (carbohydrates in the oral cavity) and break them down into organic acids (lactic, pyruvic, etc.). They also decalcify teeth, promote the destruction of their enamel and cause caries [ Redinova T.D., Subbotina A.V., 2000; Gorbunova I.L., 2005; Kobiasova I.V., 2006; Leontyev V.K., Pakhomov N.G., 2006; Suntsov V.G., Popova E.V., Mokhova O.P., 2009].

Carbohydrates present in fresh fruits and vegetables and in starchy foods are not a significant cause of tooth decay. The main culprits of dental caries are sugars that are added during industrial production, preparation or before consumption of foods. Sugary substances are primarily found in confectionery, soft drinks, cakes, cookies, etc., which are often consumed between meals as light snacks and drinks. It should be noted that frequent consumption or snacking on sweets between main meals harms the enamel of children's teeth [Leontyev V.K., 2006; 2007; Leontyev V.K., Pakhomov N.G., 2006]. To prevent caries, the rule "carbohydrate consumption culture" was proposed: do not eat sweets at night; do not eat sweets as the last course; do not eat sweets between meals. If these rules are violated, it is necessary to rinse your mouth or brush your teeth [Borovsky E.V., 2006; Leontyev V.K., Pakhomov N.G., 2006].

Prevention of caries in children should be aimed at creating optimal conditions for the maturation of tooth enamel and increasing its resistance. Mineralizing properties of oral fluid determine the resistance of hard dental tissues to caries after their eruption, ensuring the processes of enamel maturation. The leading role in the implementation of the mineralizing function of saliva belongs to calcium and phosphorus - the main components of the structure-forming elements of tooth enamel. Calcium, along with other macroelements, is very important for the normal functioning of the body. Its deficiency, as well as its excess, negatively affects the functioning of almost all organs and systems of the child's body. Fluorine plays an important role in the processes of laying rudiments, the formation of dentin, tooth enamel and bone formation. Optimal intake of fluoride into the child's body ensures increased resistance of the outer layer of tooth enamel (due to the formation of fluorapatite in it) [ Maslak E.E., Rozhdestvenskaya N.V., Podvalnikova A.S., Ivanova A.I., 2001; Dyonosopulos R et al ., 2003; Truin , GJ, 2005; Giuca MR, Saracino S., Giannotti E., 2007; Terekhova TN, Shakovets NV, 2013]. It has been confirmed that fluorine plays an important role during the period of dental tissue formation. The intake of exogenous and endogenous fluorine into the child's body

provides some resistance to dental caries for years and its role in the prevention of childhood caries is undeniable.

Growing deficiency of vitamins, macro- and microelements, disrupting metabolism, aggravates the course of any disease. For successful treatment, it is necessary to correct the patient's vitamin deficiency by including multivitamins or biologically active additives in complex therapy. Rational organization of medical and preventive care for preschoolers, especially with the high prevalence and intensity of dental caries, is of great importance for achieving a modern level of dental health [Yatskevich E. E., 2000; Touvier M. et al ., 2005; Mikhalyuk N. S., 2005; Askerko T. G., 2007; Urazova R. Z., Akhmetzyanova G. R., Egorova S., 2007]. It has been established that insufficient consumption of vitamin A leads to a decrease in the thickness of dentin in rat incisors. Long-term deficiency of vitamin A during the period of tooth development leads to the appearance of yellow pigmentation and enamel hypoplasia, increased susceptibility of teeth to caries due to imperfections of hard tissues [Ladnova G. G., Istomin A. V., Nikolaev A. V., 2001; Spirichev V. B., 2003; Askerko T. G., 2007; Urazova R. Z., Akhmetzyanova G. R., Egorova S., 2007]. Vitamins D, K, and P belong to the group of vitamins that play a major role in the development of dental and periodontal diseases [Leontyev V.K., Pakhomov N.G., 2006]. A significant deficiency of vitamin D leads to primary damage to calcium metabolism during the formation of teeth and bones. Vitamin D deficiency also leads to disruption of enamel formation and hypoplastic changes in it. In rats and dogs, changes in the alveolar process occur in the form of osteoporosis with replacement of bone tissue by osteoid tissue. In addition, vitamin D deficiency causes the formation of pits on tooth enamel, and these areas are highly susceptible to caries. When vitamin D deficiency is combined with a deficiency of calcium and phosphorus in food, rickets quickly develops in infants. With a deficiency of phosphorus and a normal amount of vitamin D and calcium in the diet, there is a slowdown in jaw growth and tooth eruption, accompanied by incorrect occlusion. Vitamin C also plays an extremely important role in the metabolism of oral tissues. Probably, vitamin C deficiency is the cause of periodontal diseases, which are so common at all ages. It has been established that with vitamin C deficiency, pathological pockets do not form. For them to appear, local irritants are also necessary. With vitamin C hypovitaminosis, pockets are deeper than under other conditions. As a result of acute vitamin C deficiency, periodontal reactions change to such an extent that the destructive process ends with tooth loss [Mikhalyuk N. S., 2005; Kosheleva O. V., Baturin A. K., Shagnyuk L. N., 2006; Goncharenko A. S., 2006]. Proper organization of nutrition in preschool children , as well as timely

diagnostics, prevention and treatment of caries in childhood and adolescence will help maintain their health.

Since the connection between caries and nutrition is now generally recognized, we believe it is important to identify alimentary risk factors that affect the damage of hard dental tissues. No targeted studies in this area, especially in relation to the child population, have been conducted in the Republic of Uzbekistan before.

### **3.2. Comparative study of the actual nutrition of preschool children attending preschool educational institutions**

Recently, the nature of children's nutrition has changed in almost all countries of the world: the consumption of whole milk and fermented milk products, fiber has decreased. Children prefer fast food, as well as various useless, but attractive food products - sugar, potato and starch chips, crackers, etc. [Kuzmina E. M., 2005; 2007]. Taking into account the above, an analysis of the state and risk level of caries was carried out, the structure and quality of children's diets were studied, and a comparative and comprehensive assessment of the actual nutrition of preschool children of preschool educational institutions in the local region of Tashkent was carried out. Targeted studies in this area, especially with respect to the child population, have not been previously conducted in the Republic of Uzbekistan. To identify the relationship between the high prevalence and intensity of caries in the examined children, as well as the nature of nutrition, a comprehensive assessment of their actual nutrition was carried out.

The actual nutrition of preschool children was studied using a questionnaire card. The material was collected in expeditionary conditions twice a year ("winter-spring" and "summer-autumn" periods of the year) with registration in individual sheets of products actually eaten by preschool children over 6 days. The content of essential nutrients and energy was calculated using tables of the chemical composition of food products. The results obtained were compared with the norms of physiological needs for energy and nutrients for various groups of the population of the Republic of Uzbekistan according to SanPiN 0250-08.

The study and analysis of the actual nutrition of children showed that the diet of the studied groups of preschoolers was not optimal and balanced. Thus, the energy value of the diets was below the physiological norm by 20-25%. The analysis of the provision of children with basic products showed that the actual diets of children are generally not balanced in terms of basic nutritional ingredients. According to the questionnaire survey of children and parents, the diets were characterized by the predominance of bakery and confectionery products. Of the meat products, children in preschool educational institutions consumed beef, at home - sometimes lamb; they

practically did not eat fish dishes in the last 5-6 months of observation. Fruits and vegetables, even in summer, were consumed by children in small quantities, including canned ones.

A study of children's provision with basic food products showed that the average daily consumption of meat and meat products, milk and dairy products, eggs and fish, vegetables, berries and fruits, as well as vegetable oil is significantly below the norm (Table 5).

Table 5. Norm and actual consumption of basic products by the surveyed children in the "winter-spring" (numerator) and "summer-autumn" (denominator) periods of the year

Types of food consumed by children	Norm Consumed products per day	Actual consumed products per day	Deviation from normal per day	Deviation from the norm, %
Meat and meat (meat equivalent), g	95.0	$69.2 \pm 0.4$ $70.0 \pm 0.3$	$26.8 \pm 0.2$ $25.0 \pm 0.3$	$-27.3$ $-26.3$
Fish and fish products (in terms of fish), g	20.0	$4.0 \pm 0.2$ $5.0 \pm 0.4^*$	$16.0 \pm 0.3$ $15.0 \pm 0.2$	$-80.0$ $-75.0$
Milk and dairy products (in terms of milk), ml	1268	$700.0 \pm 0.5$ $800 \pm 0.8^{***}$	$568.0 \pm 0.6$ $468.0 \pm 0.7$	$-44.7$ $-36.9$
Egg, pcs.	0.5	$0.1 \pm 0.0$ $0.1 \pm 0.01$	$0.4 \pm 0.0$ $0.4 \pm 0.0$	$-80.0$ $-80.0$
Bread and bakery (in terms of bread), g	165.5	$237.2 \pm 0.7$ $237.1 \pm 0.9$	$71.6 \pm 0.5$ $71.6 \pm 0.6$	$+43.3$ $+43.0$
Potatoes, g	120.0	$60.0 \pm 0.2$ $80.0 \pm 0.4^{**}$ *	$60.0 \pm 0.3$ $40.0 \pm 0.2$	$-50.0$ $33.3$
Vegetables and	191.0	$133.7 \pm 0.7$ $143.2 \pm 0.5^*$ **	$57.3 \pm 0.2$ $47.8 \pm 0.3$	$-30.0$ $-25.0$
Fruits and berries, g	203.0	$81.3 \pm 0.4$ $142.1 \pm 0.7^*$ **	$121.9 \pm 0.4$ $60.9 \pm 0.6$	$-60.0$ $-30.0$
Vegetable oil, g	7.0	$6.0 \pm 0.5$ $4.9 \pm 0.3$	$1.0 \pm 0.2$ $2.1 \pm 0.3$	$-14.3$ $-30.0$

Sugar and confectionery products (in terms of sugar), g	and	60.0	$47.9 \pm 0.4$ $49.1 \pm 0.4^*$	$12.0 \pm 0.3$ $9.9 \pm 0.5$	$-20.0$ $-16.5$
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Note: reliability of the difference in results compared to the norm: \* -  $p < 0.05$ , \*\* -  $p < 0.01$ , \*\*\* -  $p < 0.001$ .

The analysis of diets showed that the deficit in meat and meat products consumption in the examined children was from 25.7 to 27.1% in the "winter-spring" period, and from 20.0 to 26.4% in the "summer-autumn" period. Milk and dairy product consumption in the "winter-spring" period seemed to be below the recommended norms, the deficit was from 39.2 to 45.0%, in the "summer-autumn" period - from 29.8 to 37.0%. Fish was not included in the menu of preschool educational institutions, and at home, children ate it no more than 1-2 times a month. Potato consumption during the year was also below the norm, and the deficit of this product in the "winter-spring" period was from 40 to 50%, in the "summer-autumn" period - 33.4%. Food products and drinks with a high fluoride content (fish, cereals, tea, chicken egg yolk, liver, etc.) were consumed in families in limited quantities (see Table 5). Analysis of the actual data showed that the caloric content of the daily diet of the children examined was 25–30% below the norm.

The diets of the examined individuals were characterized by an insufficient content of total protein: the deficit in their consumption ranged from 33.8 to 34.5% in the "winter-spring" period and from 24.0 to 33.0% in the "summer-autumn" period (Table 6).

Table 6. Average daily content of essential nutrients and energy in diets of preschool children surveyed in various periods of the year

Nutrients	Periods of the year			
	"winter-spring"		"summer-autumn"	
	abs. (M ± m)	%	abs. (M ± m)	%
Proteins, g	$43.9 \pm 0.6$	65.5	$45.9 \pm 0.6$	67.0
animal proteins, g	$18.8 \pm 0.2$	42.7	$21.1 \pm 0.3$	46.5
Fats, g	$39.5 \pm 0.4$	58.9	$43.5 \pm 0.4$	64.9
vegetable fats, g	$5.3 \pm 0.5$	75.7	$5.3 \pm 0.4$	75.7
Carbohydrates, g	$336.5 \pm 0.9$	134.6	$329.5 \pm 0.9$	131.8
Caloric content, kcal	$1927,0 \pm 29,7$	100,0	$1943,7 \pm 35,2$	100

Minerals, mg:	781.0 ± 0.9	69.5	904.5 ± 0.8	75.3
calcium	117.0 ± 0.3	77.5	224.0 ± 0.8	74.6
magnesium	1	79.4	1	84.1
phosphorus	114.5 ± 1.1		235.0 ± 1.3	
iron	8.1 ± 0.5	53.3	8.4 ± 0.2	56.3
Iodine	0	0	0	0
Vitamins:	316.5 ± 0.8	43.8	242.0 ± 0.6	51.7
A (retinol) mcg	0.6 ± 0.0	65.0	0.7 ± 0.0	74.0
B <sub>1</sub> (thiamine), mg	0.8 ± 0.0	65.7	0.8 ± 0.0	65.3
B <sub>2</sub> (riboflavin), mg	6.5 ± 0.4	51.5	8.3 ± 0.4	69.1
PP (niacin), mg	37.0 ± 0.6	78.5	40.0 ± 0.7	80.0
C (ascorbic acid), mg				

Note: % – percentage of deviation from the recommended norm [14].

The main sources of animal protein are meat and dairy products, and vegetable protein is bread and cereals. According to the data, the deficit in the consumption of meat and meat products in the daily diet was compensated by excess consumption of bread products.

It is known that fats help protect against caries, since during a short stay in the oral cavity they play the role of a hydrophobic coating that prevents the formation and growth of dental plaque [9]. In the examined children, the content of fats of plant origin was reduced in the "winter-spring" period by 20%, and in the "summer-autumn" – by 30%.

The carbohydrate content in the actual diet of preschoolers was in the "winter-spring" period 270-336 g, and in the "summer-autumn" period - 200-220 g. Consequently, the subjects consumed carbohydrates during the year by 56.6% above the norm (Tables 5, 6). Excess carbohydrates in the diet, especially in the period before teething, leads to increased susceptibility of teeth to caries. Increased carbohydrate content in food and insufficient protein turns a person's diet into a cariogenic one .

Minerals and vitamins play an important role in the normal development of teeth. When studying the consumption of macro- and microelements by children, it was found that it was below the recommended norms. The results of the studies showed that the calcium content was insufficient, its deficiency in the "winter-spring" period was from 31.5 to 38.9%, in the "summer-autumn" - from 25.0 to 36.9% (Table 6). Nutritional disorders, expressed by calcium deficiency, can have a significant impact on the development of dental and periodontal diseases. However, it is extremely difficult not only to determine the true need of the body for calcium

from food, but also to achieve ideal provision of the body with it.

Low content of vitamins A, B1, B2, PP and C in the diet of the examined children correlated with the low proportion of vegetables, fruits, potatoes and berries. Vitamin A deficiency ranged from 45.0 to 56.2 and from 40.0 to 48.3%; vitamin B1 deficiency ranged from 31.3 to 35.0 and from 19.4 to 26.0% in the "winter-spring" and "summer-autumn" periods, respectively. When determining the content of vitamin B2, it was found that it was below the norm in the "winter-spring" period by 29.0, in the "summer-autumn" - by 28.5%. Studies have shown that vitamin C deficiency in children's bodies in the "winter-spring" period ranges from 16.7 to 21.5%, and in the "summer-autumn" period - from 12.3 to 20.0%. Water-soluble vitamins B1, B2, B12, folic acid, vitamin PP (nicotinic acid) and C play an extremely important role in the metabolism of oral tissues.

The mineral composition of the diet was unbalanced (Table 6). With calcium deficiency, the magnesium level was found to be 1.6 times higher than the recommended norms, probably due to excess cereals. According to the calculation tables, the iron level in the diet of children in preschool educational institutions slightly exceeded the recommended norms, but anemia and pre-emic conditions were detected in every second child (60–80%), indicating insufficient absorption of this element. The iodine content in the children's diet was negligible, despite the use of only iodized salt over the past 7 years.

Most microelements do not have a specific effect on the incidence of dental diseases, the only exception is fluorine. In studies in drinking water of preschool educational institutions and at home, the concentration of fluorine was very low (0.36 mg/dm<sup>3</sup> according to GOST 4386-89).

of microelementosis with vitamin deficiency is especially unfavorable for the child's health. The level of essential vitamins (A, B1, B2, B6, PP, C), determined in the children's nutrition by calculation methods according to tables of the chemical composition of food products, corresponded to age norms. However, during heat treatment, the vitamin content in finished products decreased by 40-90%, determining the vitamin deficiency of the final dishes. Unfortunately, in untreated form, vegetables and fruits were consumed by children in Tashkent insignificantly.

The imbalance and carbohydrate redistribution of the diet of children in preschool educational institutions was evidenced by the violation of the ratio of the main food ingredients - proteins, fats and carbohydrates - 1:0.8:7.8 with the norm being 1:1:4.

The range of products and the structure of nutrition had a fundamental difference on weekdays and weekends. Thus, on weekends, nutrition was characterized by monotony, frequent repetition of the same dishes, during the day

the range of products was limited. Cheese and fish were not used enough in the diet, and dairy products were used in small quantities. The source of animal protein - meat - was eaten by preschoolers at home on weekends in limited quantities. Frequent consumption of sweet drinks, juices, candies, various chips, as well as baked goods and confectionery was noted. Products containing fluorine were practically absent from the diet.

Thus, based on the conducted dental research A high prevalence and intensity of dental caries was revealed among children aged 5–6 years attending preschool educational institutions in the Mirzo- Ulugbek district of Tashkent .

It was found that the diets of children in preschool educational institutions and at home do not satisfy their need for proteins, fats (in particular, of animal origin), vitamins and minerals. The deficit in meat and meat product consumption in the examined children in different periods of the year ranges from 20.0 to 27.1%. Children consume very little milk and dairy products. Drinking and mineral water are not popular. Preference is given to foods and drinks rich in sugar. The carbohydrate content in the actual diet of preschoolers exceeds the norm by 56.6%. The consumption of macro and microelements with food, in particular calcium (its deficit ranges from 25.0 to 38.9%), was clearly insufficient. There were virtually no products containing fluorine in the diet.

A study of the actual nutrition of preschoolers studying in preschool institutions of the Mirzo Ulugbek district of Tashkent and the Tashkent region showed that the diet of preschoolers raised in families and in preschool institutions requires correction and the use of multivitamin complexes containing fluorine.

#### Conclusions:

1. The prevalence and intensity of dental caries among preschool children in preschool educational institutions in a local region of Tashkent city was studied. The incidence of dental caries among the examined children, divided into age groups, was assessed as high.

2. It was revealed that the diet of children in preschool educational institutions and at home does not satisfy their need for proteins, fats, vitamins and minerals. In particular, it was found that in the "winter-spring" and "summer-autumn" seasonal periods of the year, there is a deficit in children's consumption of: meat and meat products from 20.0 to 27.1%; milk and dairy products - from 29.8 to 45.0%; fresh vegetables, fruits and berries - from 25.0 to 40.0%, respectively. The carbohydrate content in the actual diet of preschoolers exceeds the norm by 56.6%.

3. It has been established that deficiencies in proteins, fats, minerals and vitamins, lack of fluoride, and excess carbohydrates in children's diets contribute to increased susceptibility of teeth to caries and its development.

Thus, it has been established that the diets of children in preschool educational institutions and at home do not satisfy their needs for proteins, fats (in particular, of animal origin), vitamins and minerals. Deficiencies of proteins, fats, minerals and vitamins, lack of fluoride, as well as excess carbohydrates in the diet, are known to lead to increased susceptibility of teeth to caries and its development.

## **CHAPTER 4**

### **HYGIENE-TOXICOLOGICAL STUDIES OF BOTTLED WATER WITH FLUORIDE CONTENTS OF 0.7 AND 1.0 MG/L**

#### **4.1. Hygienic assessment of bottled water**

Fluoride plays a major role in caries prevention, the optimal intake of which by enriching (fluoridating) water, salt or milk significantly reduces the incidence of caries. According to available data, the use of fluoridated salt leads to a 50% reduction in caries cases. Fluorides contained in tea also play a positive role: an

increase in the number of cups of tea drunk per day correlates with a decrease in caries incidence.

It is 5-10 g, with 80% of salt coming from commercially prepared products, including bakery products.

Fluorine (F) is found everywhere in the biosphere. It is contained not only in rocks (300-800 mg kg<sup>-1</sup>) and soils (30-320 mg kg<sup>-1</sup>), but also in fresh (0.01-0.8 mg l<sup>-1</sup>) and sea (0.7-1.4 mg l<sup>-1</sup>) waters, in atmospheric air ( $2.6 \cdot 10^{-6} - 4 \cdot 10^{-4}$  mg m<sup>-3</sup>) tissues of plants (0.05-3 mg kg<sup>-1</sup>) and animals (soft tissues 0.05-3 mg kg<sup>-1</sup>, hard 100-800 mg kg<sup>-1</sup> and more) organisms.

It has been shown experimentally that F is vital for normal growth and development of the organism. In rats on a highly purified amino acid diet with controlled isolation of microelements, the addition of F at a dose of 2.5 mg/kg (in the form of KF) caused an acceleration of growth by 30.8% compared to control animals that did not receive fluorine supplements.

Fluorine contained in food products is absorbed 20% less than from water. Even F from liquid products (milk, etc.) is absorbed 5-10% less and more slowly than F from water. When adding a solution of NaF to food, its absorption decreases by 15-20, and sometimes by 30 %.

Water fluoridation is the controlled addition of fluoride to tap water to prevent dental caries. Treated water contains fluoride in an amount sufficient to prevent the development of cavities in teeth. When the fluoride entering the body naturally is insufficient, its deficiency is replenished from fluoridated water. Fluoridated water acts through the surface of the tooth, imparting a low concentration of fluoride to saliva, which reduces the leaching of mineral salts from tooth enamel and increases the saturation of the walls of decay cavities with minerals at the very beginning of their formation. Fluoride has been successfully added to tap water for over 40 years. It has been determined that in order to prevent tooth decay, the safe and recommended concentration of fluoride in drinking water is about one part per million. This is equivalent to one drop of fluoride per bath of water. Recommended optimal concentrations vary from 0.7 to 1.2 mg/l, depending on the climate [Kuzmina E.M., 2001]. In hot countries where people drink a lot of water, a lower concentration is recommended. A person can get from 10 to 85% of the required amount of fluoride from water.

The only alternative method of systemic fluoride prevention of dental caries for the population of our republic, especially for preschool children, can be bottled fluoride-containing water (BFW), since fluoridation of tap drinking water is completely absent in our country, and fluoridation of milk and salt has not yet been established. BFW is environmentally friendly water, since it is created according to

favorable microbiological indicators in accordance with GOST 18963, is subject to strict control over many indicators, the concentration of fluoride in it is strictly dosed, which allows us to virtually eliminate cases of fluorosis. It should be noted that conditioned draft BFW in a container can be used specifically for those categories of the population who need it, in particular children, in children's organized groups. In preschool educational institutions for children, it is advisable and relatively easier to carry out fluoride prevention, since they have an assigned nurse whose responsibilities include organizing and performing preventive work.

To assess the nutritional value of the developed fluorine-enriched bottled water, the following methods were used: organoleptic, physicochemical, microbiological. Organoleptic assessment was determined according to (GOST 3351; 4151; 18190), chemical composition of water according to GOST-26927; 26931-26934, radionuclides MU 5778; 5779. Coli index and coli titer according to GOST-18963. Microbiological indicators according to GOST – 18963. Sanitary and bacteriological analysis of mineral water was carried out after their preliminary degassing according to GOST 18963.

The chemical composition of bottled drinking water was studied in the laboratory of the State Sanitary and Epidemiological Surveillance Center of the Shaykhantakhur District of Tashkent.

Indications for water fluoridation are:

1) natural fluoride content in water supply sources less than 0.03 mg / dm<sup>3</sup> ; 2) significant level of damage in the high-risk group ( preschool and school age) by dental caries. A significant level should be considered as damage by dental caries of permanent teeth in preschoolers at a level of 80% or more and the intensity of caries (KPU index), which is 2.5 or more.

T.M.Martaler (1992) were used as an evaluation criterion for the amount of daily fluoride intake in preschool children . According to these boundaries, the level of fluoride intake in preschool children should be 0.8-1.75 mg per day, which is justified by the high energy expenditure of this age period. Sodium fluoride was used to prepare bottled water .

The table shows the required amount of dry sodium fluoride salt for the preparation of bottled fluoridated water in volumes up to 1000 liters.

Table 7

The amount of dry sodium fluoride salt required for the preparation of bottled fluoridated water in volumes up to 1000 liters

o.	s	Option	Required volume of fluoridated water					
			1	10	10	500l	1000l	Dose
		1	1		0l			

.	Option -1	0.5 mg	5.0 mg	50 mg	2500 mg ( 2,5 г)	500 mg ( 0,5 г)	Low
.	Option - 2	0.7 mg	7.0 mg	70 mg	3500 mg ( 3,5 г)	700 mg ( 0,7 г)	Average
.	Option - 3	1.0 mg	10.0 mg	100 mg	5000 ( 5,0 г)	10,000 mg ( 10,0 г)	Optimum .

Together with technologists, a recipe was selected based on option 2. The developed drinking water, bottled and enriched with fluorine according to organoleptic indicators, meets the requirements of Q zDSt 540, is white, transparent, without foreign odor or taste.



In terms of microbiological parameters, bottled drinking water enriched with fluoride meets the requirements of GOST 18963. One liter of water contains: iron - 0.05 mg / dm<sup>3</sup>; sulfate - 23-24 mg / dm<sup>3</sup>; hydrocarbonate - 107 mg / dm<sup>3</sup>; calcium - 28 mg / dm<sup>3</sup>; sodium - 2-24; potassium < 1; chlorides - 5.0; nitrates - 0.005 below; oxidizability - 0.05. Fluorine content in 1 l.-0.7 mg / dm<sup>3</sup>.

The developed bottled fluoridated water belongs to an alternative water fluoridation system, which is recognized as the most effective measure in preventing dental caries. It should be noted that fluoridation of tap water involves significant economic costs, requires satisfactory condition of water supply systems, as well as strict control over fluoride dosing.

Thus, bottled water enriched with fluorine is environmentally friendly, is subject to strict control over many indicators, the concentration of fluorine in it is strictly dosed, which allows to virtually eliminate cases of fluorosis. It should be noted that conditioned water in a container can be used purposefully in those categories of the population that need it, for example, in children's organized groups.

Conclusion.

A technological instruction for the production of fluoridated water for preschool children has been developed and approved by the Main Directorate of the Sanitary and Epidemiological Center of the Republic of Uzbekistan. (TI 25097940-02:2014).

#### **4.2. TOXICOLOGICAL STUDIES OF BOTTLED WATER WITH FLUORIDE CONTENT CONCENTRATIONS OF 0.7 AND 1.0 MG/L**

Toxicological studies of bottled water containing fluoride at concentrations of 0.7 and 1.0 mg/l were conducted in an animal experiment.

Toxicological studies were conducted in the Interuniversity Research Laboratory (IURL) of the Tashkent Medical Academy. Experimental studies were conducted on 36 outbred white male rats weighing 130-160 g and 36 pregnant females weighing 207- 241 g, kept separately in the vivarium of the Interuniversity Research Laboratory (IURL) of the TMA on a balanced diet in terms of proteins, fats and carbohydrates. All animals received bottled fluoridated water for 90 days. 36 male rats were divided into 3 groups. Animals of group 1 were administered 3.0 ml of 0.0001% (fluorine concentration 1.0 mg/l, equivalent dose 0.12-0.14 mg/kg) fluoridated water per 100 g of body weight 2 times a day daily. The animals of group 2 were administered 3.0 ml of 0.00007% (fluorine concentration 0.7 mg/l, equivalent dose 0.084-0.098 mg/kg) fluoridated water per 100 g of body weight twice daily. Considering that rats weighing 200 g consume an average of 30-35 ml of liquid per day, the animals independently obtained the remaining fluoridated water from a drinking bowl. Group 3 served as a control. 36 female rats were distributed in a similar manner. After 90 days, the 36 female rats were divided into 3 groups after mating . Pregnant females of group 1 continued to be administered 3.0 ml of 0.0001% (equivalent dose 0.12-0.14 mg/kg) fluoridated water per 100 g of body weight twice daily . Animals of the 2nd group were administered 3.0 ml of 0.00007% (equivalent dose 0.084-0.098 mg/kg) fluoridated water per 100 g of body weight twice a day . Considering that rats weighing 200 g consume 30-35 ml of liquid per day, the animals independently obtained the remaining fluoridated water from a drinking bowl. Group 3 served as a control.

Histomorphological examinations of the thyroid gland and femur osteogenesis were performed on the 3rd, 7th, 10th and 14th days of newborn rats. The model for studying the osteogenesis of rat teeth was rejected due to the fact that rats could receive fluoride with their mother's milk. In this case, teeth are exposed to residual amounts of fluoride in milk to varying degrees. Clinical blood tests of rats were performed using standard methods. Biochemical parameters of blood serum were determined by standardized methods: total protein — biuret , albumin — bromocresol , glucose — glucose oxidase , aspartate aminotransferase ( AST ) and alanine aminotransferase ( ALAT ) — standardized Reitman-Frankel methods , alkaline phosphatase — standardized method using nitrophenyl phosphate (reagent kits from CYPRESS Diagnostics , Belgium). Based on the detailed blood test, the content of hemoglobin, erythrocytes, platelets, leukocytes, eosinophils, lymphocytes , monocytes, segmented nuclei, color index and ESR were studied. Testing for possible mutagenic activity of the studied concentrations of fluorine in water was carried out on human lymphocyte cell cultures. For chromosomal analysis, the micromethod of culturing whole blood lymphocytes according to Arakaki was used [ Arakaki DT, Sparkes RS // Cytogenetics . 1963. 2. 57-60].

Quantitative determination of pituitary thyroid-stimulating hormone (TSH) in blood serum was performed by the method of solid-phase enzyme-linked immunosorbent assay (ELISA type AT 858) using a reagent kit for enzyme-linked immunosorbent assay of thyroid-stimulating hormone " Thyroid ELISA-TSH-1", Alkor-Bio (Russia). Morphological studies were performed according to the generally accepted method.

Determination of glucose in blood serum was carried out using commercial Glucose GOD-POD kits (CYPRESS Diagnostics , Belgium).

The study of acute toxicity of bottled water with fluoride concentrations of 0.7 and 1.0 mg/l (equivalent doses of 0.084-0.098 and 0.12-0.14 mg/kg of weight, respectively) was conducted on mature white male rats with an initial body weight of 130-160 g. Three experimental groups were formulated with 6 animals in each. Fluoridated water was administered daily in the morning and evening twice per os at the rate of 3.0 ml per 100 g of body weight. 3-4 hours after the introduction of fluoridated water, the animals were given natural and briquette feed. 20-25 ml of fluoridated water was left in open drinkers. The experimental animals were observed for 90 days. No symptoms of intoxication or death of animals were noted. The experimental animals remained active, neat, willingly ate food, their fur was smooth, shiny, and they responded adequately to external stimuli. Due to the absence of death of the experimental animals and symptoms of intoxication, it was not possible to calculate the average lethal dose (LD50).

Thus, due to the absence of symptoms of intoxication and death of animals in acute experiments, bottled water with a fluoride content of 0.7 and 1.0 mg/l can be classified as class 4 - low-toxic substances in terms of toxicity parameters.

#### **Local cutaneous and skin-resorptive action**

The study of the local effect of bottled water containing fluoride in concentrations of 0.7 and 1.0 mg/l on the skin and mucous membrane of the eyes, as well as the ability to penetrate through intact skin, was conducted on white male rats. Fluoridated water was applied to the skin of experimental animals at a rate of 20 mg/cm<sup>2</sup>. The skin reaction was recorded at the end of a 4-hour exposure, 1 and 16 hours after a single application. It was found that bottled water containing 0.7 and 1.0 mg/l of fluoride does not cause irritation of the skin.

The toxicity of repeated exposure of white rats to skin was studied, receiving 20 cutaneous applications of fluoridated water. It was found that no deaths of animals or clinical signs of intoxication were observed during the entire period of the experiment.

Based on the data obtained, it can be concluded that bottled water containing fluoride in concentrations of 0.7 and 1.0 mg/l does not have an irritating effect on the skin upon repeated exposure.

Thus, the results of the studies allow us to state that bottled water containing fluoride concentrations of 0.7 and 1.0 mg/l does not have local skin and skin-resorptive effects.

#### **Study of the effect of fluoridated bottled water on the mucous membrane of the eye**

into the conjunctival sac of the right eye of the rats once; the left eye served as a control. The effect of water with a fluoride concentration of 0.7 mg/l did not reveal any changes. Under the influence of a fluoride concentration of 1.0 mg/l, lacrimation was noted after 2 minutes. After 3-3.5 minutes, this phenomenon completely disappeared.

#### **Study of cumulative properties**

The cumulative capacity of fluorinated bottled water was studied using the Lim subchronic toxicity method under conditions of repeated intragastric administration to white rats. The experiment involved male white rats weighing 130-160 g. Fluorinated bottled water was administered intragastrically twice a day for 4 weeks. Control animals were administered distilled water in an equivalent volume. The following were used as indicators of the functional state of the animals: survival during the experiment, general condition, animal activity, body weight dynamics, morphological composition of peripheral blood, content of total protein, albumin, glucose, ALT, AST, alkaline phosphatase activity.

During the entire observation period, no deviations in behavior or general condition were observed in the animals. No signs of intoxication or lethal outcomes were observed. The dynamics of body weight gain in white rats is presented in Table 8.

As can be seen from the data presented in Table 8, no statistically significant delays in body weight gain were found.

Therefore, the obtained results indicate the absence of a negative effect of fluoridated water on the physiological growth of laboratory animals.

Table 8.

Dynamics of body weight of white rats after repeated intragastric administration of bottled water with fluoride content of 0.7 and 1.0 mg/l over a month, g.

Name groups animals	Doses, mg/kg	Stat. Bye-covered	Animal weight, g		Growth in %
			Original	On the day of slaughter	
Control	-	M±m	137.0±2.9	162.0±1.6	18.2
Bottled fluoridated water (0.7 mg/L)	0.084	M±m	143.7±4.4	156.3±5.0	6.1
	0.098	M±m	128.2±2.5	155.3±3.1	17.4
Bottled fluoridated water (1.0 mg/L)	0.12	M±m	133.2±1.4	155.0±2.1	16.4
	0.14	M±m	135.7±4.4	165.3±5.0	21.8

### Study under conditions of chronic experience

Under chronic experimental conditions, the toxicity of fluoridated bottled water was studied by administering water to white rats per os 2 times a day for 90 days. The experiment involved white male rats weighing 130-160 g. The study of the dynamics of hemoglobin, erythrocytes, leukocytes, eosinophils, lymphocytes, monocytes, platelets and segmented cells, color index and ESR in peripheral blood did not reveal statistically significant differences in animals of the experimental group compared to the control data (Tables 7-8).

Analysis of the research results revealed that in the group of animals exposed to water with a fluoride concentration of 1.0 mg/l, the values of the indicators were close to the control, while when exposed to fluoride at a concentration of 0.7 mg/l, they were slightly lower than the control.

Thus, the values of hemoglobin, erythrocytes, leukocytes, eosinophils, lymphocytes, monocytes, platelets and segmented nuclei, color index and ESR in

the peripheral blood of animals are closer to the control figures, which allows us to assume that a fluorine concentration of 1.0 mg/l is optimal.

Table 9.

The content of hemoglobin, erythrocytes and leukocytes in the peripheral blood of white rats after intragastric administration for a month bottled fluoridated water

Name of groups Animals	Doses, mg/kg	Statist. Indicators	Hematological parameters		
			Content hemoglobin, g/l	Content Erythrocyte emission, G/l	Content leukocytes, T/l
Control	-	M±m	136.3 ± 4.4	4.43 ± 0.13	4.93 ± 0.43
Bottled fluoridated water (0.7 mg/L)	0.084	M±m	128.3 ± 2.3	4.7 ± 0.2	4.32±0.31
	0.098	M±m	130.7±2.4	3.80±0.3	4.51±0.62
Bottled fluoridated water (1.0 mg/L)	0.12	M±m	137.3 ± 3.3	4.4 ± 0.13	4.77±0.38
	0.14	M±m	135.7±4.4	4.38±0.12	4.92±0.45

Table 10.

Content of color index, platelets and segmented nuclei in the peripheral blood of white rats after intragastric administration of bottled fluoridated water for a month

Name of groups Animals	Doses, mg/kg	Statist. indicators	Hematological parameters		
			Color indicator	Content Platelet count, 10 <sup>9</sup> /l	Segmented, %
Control	-	M±m	0.92±0.03	274.7±15.0	52.7±3.7
Bottled fluoridated water (0.7 mg/L)	0.084	M±m	0.76 ± 0.04	255.8 ± 10.8	50.7±2.2
	0.098	M±m	0.75±0.03	265.4±12.0	54.5±3.6
Bottled fluoridated water (1.0 mg/L)	0.12	M±m	0.88 ± 0.02	265.7 ± 11.2	52.5±3.2
	0.14	M±m	0.85±0.02	275.6±14.2	51.7±4.6

Analysis of the obtained data showed that in experimental animals, the levels of total protein, albumin, glucose, transaminase enzymes (ALT, AST) and alkaline phosphatase activity in the blood did not differ significantly from the control values.

Table 11 .

Content of eosinophils, lymphocytes, monocytes and ESR in the peripheral blood of white rats after intragastric administration for a month bottled fluoridated water

Name of groups Animals	Dose s, mg/k g	Extra indicat ors	Hematological parameters			
			Eosinophils ,%	L Lymphocyt es, %	Monocytes, %	ESR, mm/h
Control	-	M±m	1.17±0.17	37.3±2.8	5.8±0.6	5.8±0.9
Bottled fluoridated water (0.7 mg/L)	0.084	M±m	1.33 ± 0.21	41.2 ± 4.0	6.5±0.8	5.7±1.2
	0.098	M±m	1.17±0.22	36.8±3.5	6.3±1.1	6.3±0.7
Bottled fluoridated water (1.0 mg/L)	0.12	M±m	1.21 ± 0.3	37.8 ± 4.0	5.9±0.4	5.9±0.10
	0.14	M±m	1.26±0.43	36.6±1.5	6.2±0.9	6.5.0±1. 5

Table 12.

Biochemical parameters of white rats after 90-day intragastric administration of bottled fluoridated water

Groups	Doses, mg/kg	Total protein, g/l	Albumin, g/l	Glucose, E/l	ALT, E/l	
Intact	-	73.41±2.29	42.08±0.86	5.71±0.67	27.33±6.26	
Bottled fluoridated water (0.7 mg/L)	0.084	72.94±0.82	44.2±1.0	5.8±0.9	26.4±3.03	
	0.098	70.4±1.5	46.0±1.9	5.5±0.9	25.8±2.6	
Bottled fluoridated water (1.0 mg/L)	0.12	72.94±2.77	41.13±1.33	5.15±0.58	26.58±5.68	
	0.14	74.36±1.22	43.43±0.98	5.68±0.68	24.83±4.97	

Thus, the results of the studied biochemical parameters of the blood of experimental animals exposed to bottled water in doses of fluorine of 0.084, 0.098, 0.12 and 0.14 mg/kg of animal weight fluctuate within the physiological norms and do not differ from the control values.

**Quantitative determination of pituitary thyroid stimulating hormone (TSH) in blood serum**

Quantitative determination of pituitary thyroid-stimulating hormone (TSH) in the blood serum of rats was performed on days 3, 7, 10 and 14 after birth. For 90 days before pregnancy and 30 days after birth, mothers of rats were administered fluoridated bottled water with fluoride concentrations of 0.7 and 1.0 mg/l twice daily intragastrically. Quantitative determination of TSH in the blood serum of rats using the enzyme immunoassay allowed us to judge the functional state of the pituitary gland and thyroid gland (TG) in ontogenesis under the influence of fluoridated water. Thyroid-stimulating hormone of the pituitary gland (TSH) is a glycoprotein hormone that stimulates the formation and secretion of thyroid hormones (T3 and T4). It is produced by the anterior pituitary gland; according to its chemical structure, it is a glycoprotein hormone. Blood test for TSH is a necessary stage in the diagnosis of thyroid diseases, showing deviations from the norm: TSH - decreased or increased TSH. If the result of the hormonal analysis is decreased, this gives reason to suspect hypothyroidism (HPT), adrenal insufficiency, etc. Increased TSH can occur as a result of exposure to fluoridated water.

The studies were conducted on 72 rat pups born to females exposed to water with fluoride concentrations of 0.7 and 1.0 mg/l for 4 months. The newborn rat pups were divided into 3 experimental groups:

Group 1 - intact animals - 6; Group 2 - animals that received daily milk from a mother that was exposed to water with a fluoride concentration of 0.7 mg/l; Group 3 - animals that received daily milk from a mother that was exposed to water with a fluoride concentration of 1.0 mg/l.

Analysis of the research results did not reveal any characteristic shifts in the content of pituitary TSH in rats. The concentration of pituitary TSH in intact animals was determined at 0.56 mIU /ml, with a fluorine concentration of 0.7 mg/l and 1.0 mg/l 0.50 and 0.59 mIU /ml, respectively.

The obtained data indicate that intragastric administration of bottled water with fluoride doses of 0.084, 0.098, 0.12 and 0.14 mg/kg

did not cause statistically significant deviations in the concentrations of pituitary TSH. Almost identical levels of thyroid hormones in animals of all three groups indicate normal development and functioning of the pituitary gland and thyroid gland when exposed to bottled water with the studied doses of fluoride.

The results of the studies can be taken into account in clinical practice, when predicting the course and outcome of functional recovery in individuals with thyroid pathology, such as hypothyroidism. Analysis of the results of studies of antioxidants, stem cells, vaccines, and various surgical techniques allow us to conclude that new effective means are needed to treat thyroid pathology of the GPT type. Despite intensive research, it should be noted that modern achievements are actually

unsuccessful in attempts to treat a specific thyroid disease of the GPT type, which usually leads to severe disability. Taking into account the multifactorial and multiphase model of the development of thyroid pathologies, such as GPT, a strategy of therapy with fluoridated water with a fluoride concentration of 0.7 mg/l and 1.0 mg/l depending on the season of the year can be effective.

### **Results of microscopic morphological studies thyroid gland and femur of rat pups**

Much attention in the studies was paid to the issue of fluorine transport through the placenta, i.e. to find out the possibility of the effect of fluorine in drinking water on fetal development, mineralization of teeth and bones in the embryonic and postnatal period. Of considerable interest was also the study of fluorine content in mother's milk, since it is the only food for newborns. In breast milk, up to 25% of fluorine is associated with casein, and most of the rest is associated with albumins. Milk fluoride is absorbed more slowly than water fluoride, but their absorption coefficients are almost the same.

The fluorine content of bones is linearly related to the F- concentration in water. The highest fluorine content is in the femur from the periosteum to the endosteum . More fluorine is incorporated into the superficial and actively growing areas with better blood supply.

The mechanism of fluoride exchange between mother and fetus was studied in two experimental models:

1. Study of the effect of bottled water with fluoride concentrations of 0.7 and 1.0 mg/l in the embryonic and postnatal periods of development of the pituitary gland and thyroid gland in rats.
2. Histomorphological study of the pituitary gland and osteogenesis of the femur in rats.

The dynamics of development of specific cellular formations of the thyroid gland (TG) and the pineal gland of the tibia (TB) based on the results of microscopic studies are summarized for clarity in Table 12.

Table 13.

Dynamics of development of specific structural formations of the thyroid gland and tibia when exposed to fluorine concentrations of 0.7 and 1.0 mg/l in bottled water

Organs	Indicators	Concentration 0.7 mg/l				Concentration 1.0		
		3 days	7 days	10 days	14 days	3 days	7 days	days
thyroid gland	colloid	-	-	-	+	-	-	

BK	Spongy bone	-	-	+	++	+	++	
	OKM	-	-	+	++	-	++	
	ECM	-	-	+	++	-	-	
	KMK	-	-	+	++	-	-	

Notes: - - absent; + - single cells; ++ - few mature cells; +++ - numerous; ++++ - continuous.

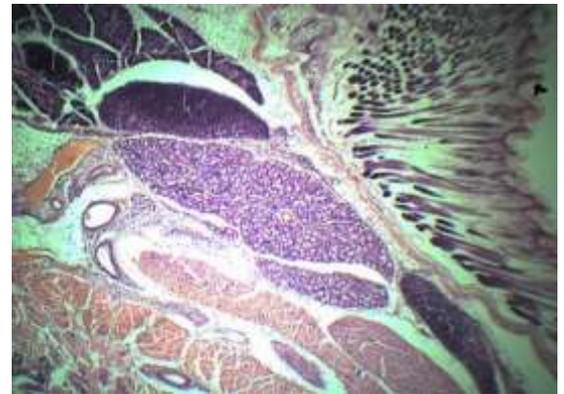
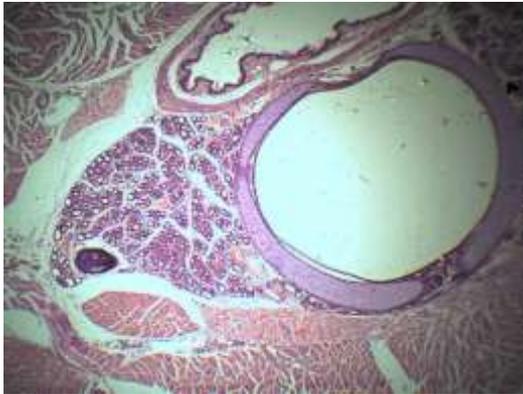


Fig. 1. Thyroid gland of a rat on the 14th day Fig. 2. Thyroid gland of a rat on the 14th day when exposed to a fluorine concentration of 0.7 mg/l when exposed to a fluorine concentration of 1.0 mg/l in bottled water. in bottled water.

Hematoxylin and eosin staining. Hematoxylin and eosin staining.

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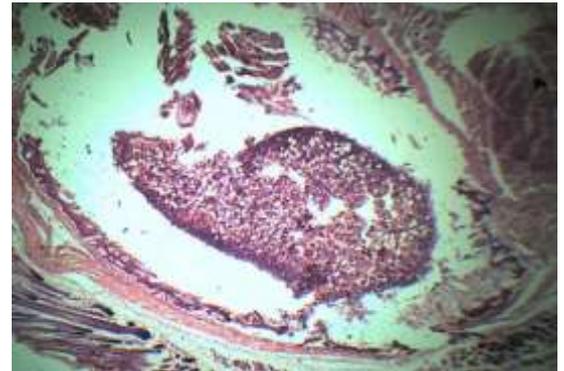
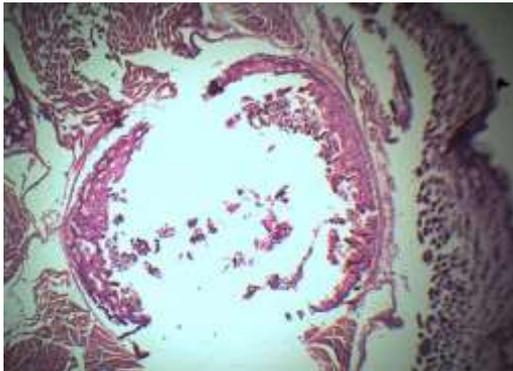


Fig. 3. Rat tibia on day 14 Fig. 4. Rat tibia on day 14 when exposed to a fluorine concentration of 1.0 mg/l when exposed to a fluorine concentration of 0.7 mg/l in bottled water. in bottled water.

Hematoxylin and eosin staining. Hematoxylin and eosin staining.

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Thus, the microscopic picture of the dynamics of thyroid gland development under the influence of fluorine in concentrations of 0.7 and 1.0 mg/l showed similar stages and periods of development. Only on the 14th day of the experiments a single colloid was detected.

A completely different picture was revealed when studying the effect of fluorine on osteogenesis in the embryonic period and postnatal development. A fluorine concentration of 1.0 mg/l accelerates the processes of formation of erythropoietic, osteoblastic and erythroblastic bone marrow.

A fluoride concentration of 0.7 mg/l has a less pronounced effect on osteogenesis.

### **Results of macroscopic and microscopic morphological studies of internal organs**

Fluoride is excreted from the body mainly through urine, and also through feces, sweat, epidermal formations (sloughing epithelium, nails, hair), and in nursing women - through breast milk. To clarify the question of the possible effect of fluoride in bottled water on the gastrointestinal tract and kidneys, macro- and microscopic morphological studies of the liver, kidneys, large and small intestines were conducted.

The results of a general examination of the bodies of animals exposed to bottled water with fluoride doses of 0.084, 0.098, 0.12 and 0.14 mg/kg body weight showed the absence of macroscopically recognizable deviations compared to the control group in all series of experiments.

Based on a comparative histomorphological study of the organs and tissues of control and experimental animals, it can be concluded that intragastric administration of bottled water for 30 days in fluorine doses of 0.084, 0.098, 0.12 and 0.14 mg/kg body weight does not cause pathological changes.

The mass indices of the internal organs of white rats after intragastric administration of bottled water for 3 months are presented in Table 14.

**Table 14.**

Relative mass indices of internal organs of white rats after intramuscular administration of bottled water with fluoride content of 0.7 and 1.0 mg/l, g.

Name groups animals	Doses, mg/kK	Brain	Liver	Kidneys	Spleen	Heart	Stomach	Lungs
Intact		0.87±0.03	3.11±0.12	0.66±0.02	0.47±0.03	0.45±0.01	0.81±0.03	0.67±0.02
Bottled fluoridated water (0.7 mg/L)	0.084	0.95±0.02	3.26±0.11	0.64±0.01	0.45±0.02	0.46±0.02	0.90±0.03	0.69±0.02
	0.098	0.91±0.02	3.46±0.13	0.65±0.03	0.46±0.04	0.47±0.01	0.87±0.02	0.73±0.02

Bottled fluoridated water (1.0 mg/L)	0.12	0.89±0. 04	3.02±0. 12	0.67±0. 01	0.47±0. 03	0.46±0. 02	0.84±0. 02	0.68±0 .05
	0.14	0.89±0. 02	3.61±0. 13	0.67±0. 02	0.46±0. 04	0.47±0. 01	0.87±0. 02	0.73±0 .02

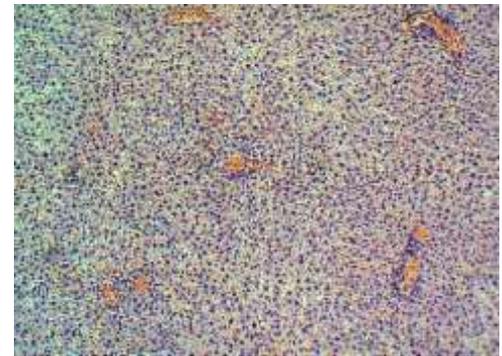
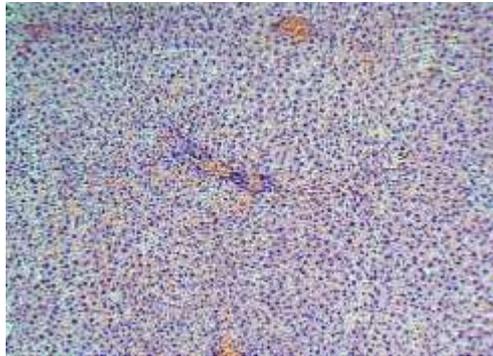


Fig. 5. Rat liver after intra-abdominal administration of fluorine dose of 0.084 mg/kg. Fig. 6. Rat liver after intra-abdominal administration of fluorine dose of 0.14 mg/kg.

Hematoxylin and eosin staining. Hematoxylin and eosin staining.  
Ob. 4/10 approx.10. Ob. 4/10 approx.10.

Therefore, the pathological examination of the internal organs during autopsy of the animals after the end of the experiments showed that the relative mass indices of the internal organs in the experimental animals after long-term exposure to bottled water with fluorine concentrations of 0.7 and 1.0 mg/l do not differ from those of intact animals. These results confirm that bottled water with fluorine concentrations of 0.7 and 1.0 mg/l does not have toxic properties.

#### **Study of the mutagenic effect on somatic cells of bottled water with fluoride concentrations of 0.7 and 1.0 mg/l.**

Bottled water recommended for the national economy must be thoroughly studied from the point of view of its safety. One of the main issues in this regard is the assessment of its mutagenic activity, which, as shown in a number of laboratories around the world, correlates to a high degree with carcinogenic activity and significantly with teratogenesis (development of deformities). The consequence of mutations in germ cells is the death of zygotes, embryos, fetuses at early stages of development and the transmission of mutations from generation to generation. Mutations in somatic cells inevitably lead to a violation of genetic homeostasis and can cause acceleration of aging processes, an increase in general morbidity and the formation of malignant tumors.

A study was conducted of bottled water with fluorine concentrations of 0.7 and 1.0 mg/l for the manifestation of mutagenic activity when exposed to a culture of human lymphocyte cells. For this purpose, the number of chromosomal aberrations was determined when exposed to fluorine concentrations of 0.7 and 1.0 mg/l on a culture of human lymphocyte cells at doses of 0.098 and 0.14 mg/10<sup>6</sup> cells for 72 h. Human lymphocytes were obtained from the peripheral blood of healthy donors. A total of 3 donor blood samples were used, each sample was exposed to bottled water containing fluorine at doses of 0.098 and 0.14 mg/10<sup>6</sup> cells. The results of determining the mutagenic activity are presented in Table 15.

The average number of chromosome aberrations in the studied samples of lymphocytes from human peripheral blood exposed for 72 hours to fluoridated bottled water at doses of 0.098 and 0.14 mg/10<sup>6</sup> cells was: for a dose of 0.098 mg/10<sup>6</sup> cells – 0%; for a dose of 0.14 mg/10<sup>6</sup> cells – 0.66±0.6%; for the control – 1.33±0.6%. The average number of chromosome aberrations encountered in human lymphocytes (according to literature data) is 2-4%.

Consequently, the study of the mutagenic activity of fluoridated bottled water when exposed to a culture of human lymphocyte cells at doses of 0.098 and 0.14 mg/10<sup>6</sup> cells for 72 hours made it possible to establish that bottled water with fluoride concentrations of 0.7 and 1.0 mg/l does not have mutagenic activity at the doses studied.

**Table 15.**

Determination of mutagenic activity of fluoridated bottled water when exposed to human lymphocyte cell culture

Sample (lymphocytes from donor blood)	Exposure Dose of Fluoridated Bottled Water, mg/10 <sup>6</sup> cells (time – 72 h)	Number of metaphase plates examined	Number of metaphase plates with aberrations	Chromosome aberrations, %
Sample 1	0.098	50	0	0
	0.14	50	1	2
	0 (control)	50	0	0
Sample 2	0.098	50	0	0
	0.14	50	0	0
	0 (control)	50	1	2
Sample 3	0.098	50	0	0
	0.14	50	0	0
	0 (control)	50	1	2

The results of the studies showed that there is no reason to expect any negative consequences from the use of the studied fluoride concentrations of 0.7 and 1.0 mg/l in bottled water.

Based on the toxicological studies conducted, **the following main conclusions were made:**

- in Uzbekistan there are no studies to clarify the optimal and maximum concentrations of fluoride in BFW. Studies of this kind are extremely important for our region due to the widespread prevalence of caries in children and adults. Therefore, the development of BFW seems to be very relevant;

- BFW with fluorine content of 0.7 and 1.0 mg/l *does not have a negative impact* on the health of experimental animals, *does not cause* local irritant effect on the skin and mucous membranes, does not have skin-resorptive and cumulative, mutagenic properties. According to the degree of toxicity, it belongs to class 4 - low-toxic substances, *does not have mutagenic activity* ;

- the use of BFW with a fluoride concentration of 0.7 and 1.0 mg/l, depending on the season, allows for effective caries prevention both at the individual and social levels of the population.

## **Chapter 5. EVALUATION OF THE EFFICIENCY OF ENDOGENOUS FLUORIDE PROPHYLAXIS OF DENTAL CARIES IN PRESCHOOL CHILDREN ATTENDING PRESCHOOL EDUCATIONAL INSTITUTIONS**

Based on modern concepts of the occurrence of dental caries, it is known that the reduction of the prevalence and intensity of development of dental caries in children is possible only through the widespread introduction of preventive measures. In numerous issues of etiology and pathogenesis, treatment and prevention of caries, there is one circumstance that unites them - the attitude to fluoride. The most important role of fluorides in the prevention of dental caries is now absolutely proven, scientifically substantiated and implemented in practice by millions of people on Earth. In regions with low fluoride ion content in drinking water, caries is widespread. With normal fluorine content in the body, it ensures the formation (mineralization) of bone tissue, dentin and tooth enamel. The most pronounced effect of caries prevention is observed with optimal fluorine intake into the body during the period of development, mineralization and subsequent

maturation of teeth, that is, in childhood. There are reports of the beneficial effect of small doses of fluoride on the non-specific resistance of the body and on the state of local immunity of the oral cavity [Suntsov V.G., Kiselnikova L.P., 2007].

The most radical and effective method of caries prevention is considered to be water fluoridation, which averages a 30-50% reduction in dental caries when used for caries prevention. Drinking water fluoridation is carried out in areas where the fluoride content in sources does not exceed 0.7 mg/liter. The results of studies by the American Dental Association ( ADA ) have shown that the use of fluoridated 1 mg/l drinking water reduced tooth decay by 40-65%. Similar studies conducted in many countries around the world (England, Belgium, Brazil, Germany, Greece, Czechoslovakia, Norway, etc.) and the CIS countries (Russia, Belarus, Ukraine, Kazakhstan, Kyrgyzstan, etc. ) confirm the caries-preventive effect of fluoridated drinking water not only in children, but also in adults.

WHO recommends fluoridation of drinking water in all countries of the world for the prevention of dental caries, with the following maximum concentrations in it: 0.5 mg/l for southern countries and 1.0 mg/l in northern countries of the world [WHO-95]. Therefore, the search for optimal doses of fluorides in drinking water, given their insufficient content in the Republic of Uzbekistan, its use for fluoride prevention of caries in preschool children, is a promising problem that undoubtedly requires a solution.

Children with carious teeth of varying degrees of damage were selected for the experiments. The examined children were divided into 4 groups. The 1st preventive group included children aged 3-4 years and the 2nd - children aged 5-6 years who consumed BFW during the day (under control) in a volume of 200 ml. The 3rd preventive group included control children aged 3-4 years and the 4th - control children aged 5-6 years who consumed ordinary boiled water. In each group of children, before and after prevention, the hygienic index according to Fedorov-Volodkina was determined , as well as quantitative indicators of the rate of saliva secretion (SSR ), viscosity and pH of the oral fluid. SSR was determined using the method of T. L. Redinova , A. R. Pozdeeva (1994), and the viscosity of saliva was studied using a capillary viscometer VK-4 and the results were expressed in relative units. The preventive effectiveness of BFW "Aqua dental" on the examined children was judged by the increase in the intensity of dental caries, as well as by their reduction in the preventive groups compared to similar indicators of children in the control groups.

The results of the study showed that systemic fluoride prophylaxis of dental caries in both the 1st and 2nd prophylactic groups of children using the BFW "Aqua

dental" contributes to a reliable positive improvement in the quality of oral fluid, as well as the hygienic index.

In the course of research to control the condition and properties of oral fluid in preschool children before and after fluoride prophylaxis using the BFW "Aqua dental", the rate of salivation of saliva (SSR), viscosity, calcium content, changes in the pH of the oral fluid environment and the hygienic index were studied.

The obtained results of the research show that the SSR indices in the control groups of children from the Almazar district averaged  $0.43 \pm 0.01$  and  $0.39 \pm 0.02$  ml/min. The use of BFW by preschoolers leads to an increase in the SSR indices (Fig. 7). In particular, it was found that two-month fluoride prophylaxis of caries leads to a reliable improvement in the quality of oral fluid, i.e. the SSR after 2 and 4 months in the 1st group of children increases by 11.62 and 13.95%, and in the 2nd by 12.82 and 20.05, respectively. In the control groups of children from the Kibray district, the SSR of oral fluid averaged  $0.44 \pm 0.06$  and  $0.37 \pm 0.05$  ml/min. When using BFW "Aqua dental" there is a tendency to increase the SSR of oral fluid after 2 and 4 months in the 1st group of children increases by 11.36 and 18.18%, and in the 2nd 16.21 and 24.32%, respectively (Fig. 1). Based on the above analyzed SSR data, it can be concluded that fluoride caries prevention BFW "Aqua dental" leads to a reliable positive increase in the SSR indicator and leads to an improvement in the quality of oral fluid, including the oral cavity in both the 1st and 2nd prophylactic groups of children.

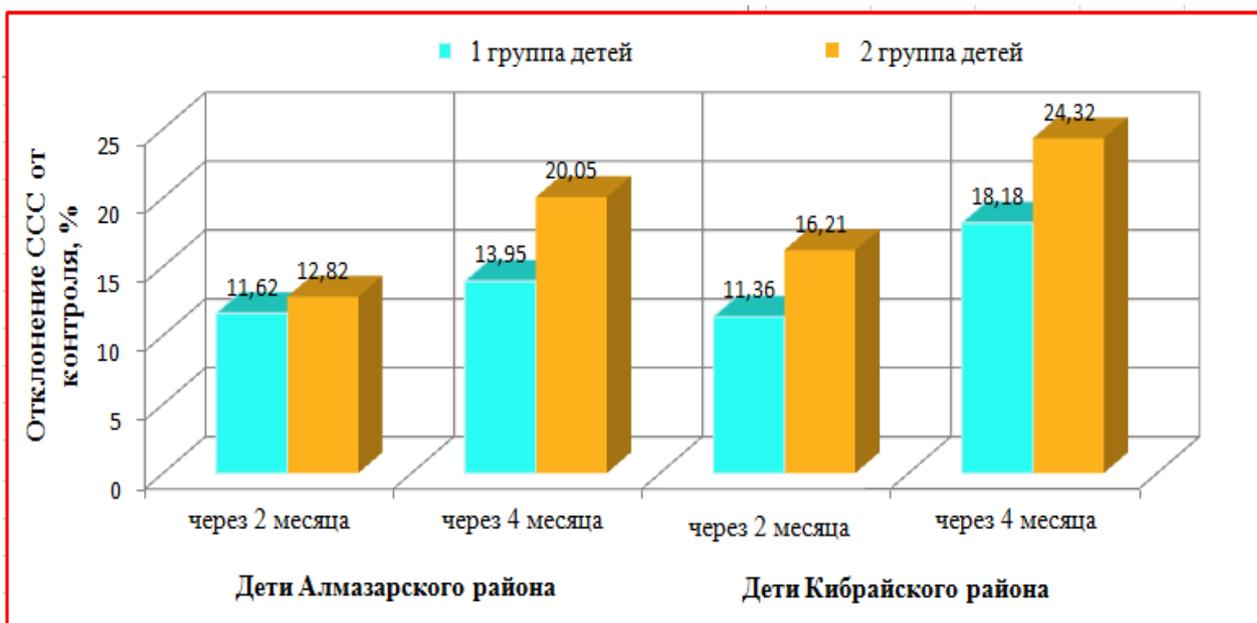


Figure 7. Histograms of positive deviation of the SSR indicator after endogenous fluoride prophylaxis with BFW "Aqua dental" in groups of children.

**Viscosity of oral fluid.** Metabolic processes in tooth enamel, moistened with viscous saliva, slow down the diffusion processes of mineral ions in the oral fluid, which creates conditions for the development of caries. From a review of the literature it is known that the regulation of mineral metabolism in tooth enamel depends not only on the concentration of the corresponding elements and their compounds in the oral fluid, but also on the possibility of their access to the surface of the tooth enamel, which significantly worsens with an increase in the viscosity of the oral fluid [Anisimova I.V. et al., 2005; Voevoda E.A., Golubeva I.N., Ostapko E.I., 2014].

It is known that the regulation of mineral metabolism in tooth enamel depends not only on the concentration of the corresponding macro and microelements in the oral fluid, but also on the possibility of their access to the surface of the tooth enamel, which significantly worsens with an increase in the viscosity of the oral fluid. The viscosity of the oral fluid in the control groups of children in the Almazar district consuming ordinary boiled water averages  $1.37 \pm 0.02$  and  $1.43 \pm 0.03$  relative units.

The use of BFW "Aqua dental " leads to a decrease in the viscosity of oral fluid: after 2 months of caries prevention, the value of the indicator decreased in the 1st group of children to  $1.23 \pm 0.04$  and in the 2nd to  $1.28 \pm 0.05$  relative units ( $p < 0.05$ ), and after 4 months of prevention - to  $1.19 \pm 0.03$  and  $1.25 \pm 0.03$  relative units. respectively, which was significantly lower ( $p < 0.01$ ) than in children who consumed ordinary boiled water. A positive increase in the degree of viscosity is also observed in children of the Kibraysky district after 2 and 4 months of examination. The obtained results regarding the study of saliva viscosity in children of preschool educational institutions are well confirmed by the data presented in the literature. Moreover, a direct correlation was established between the viscosity of the saliva of the examined children and the intensity of the carious process in them.

**Study of hydrogen ion concentration (pH).** One of the important conditions of homeostasis in the oral cavity is maintaining the concentration of  $H^+$  ions in it, i.e. pH constancy. It determines many parameters of the state of colloidal systems: their osmosis, dispersion, value and sign of the membrane boundary potential, precipitation of salts or transition to a suspended state. In the oral cavity, in most cases, pH fluctuates within 6.5 - 7.5. Its shift to the "acidic side" in the saliva environment entails serious disruptions in the function and composition of tooth enamel. Saliva has a significant effect on the pH level of dental plaque, including the preparation of the food bolus for swallowing, as a result of which mechanical and chemical cleaning of the oral cavity occurs, food residues that stick to the smooth surface of the tooth are removed. At the same time, they are partially cleaned enzymatically . Both of these processes are essential for the prevention of caries. It

has been established that in practically healthy children the pH of mixed saliva is on average  $7.2 \pm 0.15$  [28; -17 sec.]. The critical value, when saliva turns from supersaturated to saturated, from mineralizing to demineralizing, is pH 6.0-6.2. The average values of the main physicochemical indicators of mixed saliva of children aged 3-4, as well as 5-6 years, including pH, allow us to evaluate and identify the characteristics of oral fluid specifically for each child and, based on this, draw up or adjust an individual plan of preventive measures.

From the analysis of scientific information provided in the literature, it should be noted that the pH of the oral fluid plays an important role in diffusion and osmosis, dispersion of colloidal solutions, precipitation of salts and their adsorption, etc. Therefore, even a slight increase in the pH of the oral fluid towards an alkaline environment contributes to better mineralization of the enamel of temporary teeth. Consequently, the effect of BFW "Aqua dental" on the acidity of the oral fluid environment of preschoolers was studied. It was established that the pH value of the oral fluid of children before the introduction of fluoride prophylaxis of dental caries in children of the 1st group of Almazarsky The pH of the oral fluid in the first group was  $6.15 \pm 0.03$ , and in the 2nd group of children  $6.09 \pm 0.05$ . Consumption of BFW "Aqua dental" by children for 2 months led to a reliable increase in pH to  $6.49 \pm 0.02$  and  $6.27 \pm 0.03$  ( $p < 0.001$ ), i.e. the pH of oral fluid increased by 5.52 and 2.95%, respectively. After 4 months of fluoride prophylaxis, the pH values increased to 6.50 and 6.23%, respectively, compared with similar values in children in the control groups. An increase in absolute pH values is also observed in groups of children from the Kibray district. In particular, it was found that the pH value of oral fluid in control children in the 1st and 2nd groups was  $5.95 \pm 0.03$  and  $5.80 \pm 0.03$ . Consumption of BFW "Aqua dental" by children for 2 months resulted in a reliable increase in the pH value to  $6.40 \pm 0.02$  and  $6.30 \pm 0.06$  ( $p < 0.001$ ), which increased by 5.52%, respectively, and after 4 months of fluoride prophylaxis to 6.50 and 6.23%, respectively. This, naturally, helps to reduce the risk of developing caries in children. Full compliance of the results of the oral fluid parameters after fluoride prophylaxis of preschoolers such as SSS, viscosity and pH of the environment with the data of the oral hygiene index in the examined children was established. The indicators of the oral hygiene index after two months of prophylaxis in children of the 1st prophylactic group of Almazarsky district improved from 9.92 to 13.30, and in the second from 13.10 to 16.7% (Fig. 8). In the first group of children from the Kibray district, the HI indicators improved from 13.11 to 16.39%, and in the second from 14.93 to 15.85%, which was significantly lower ( $P < 0.001$ ) than in children in the control groups.

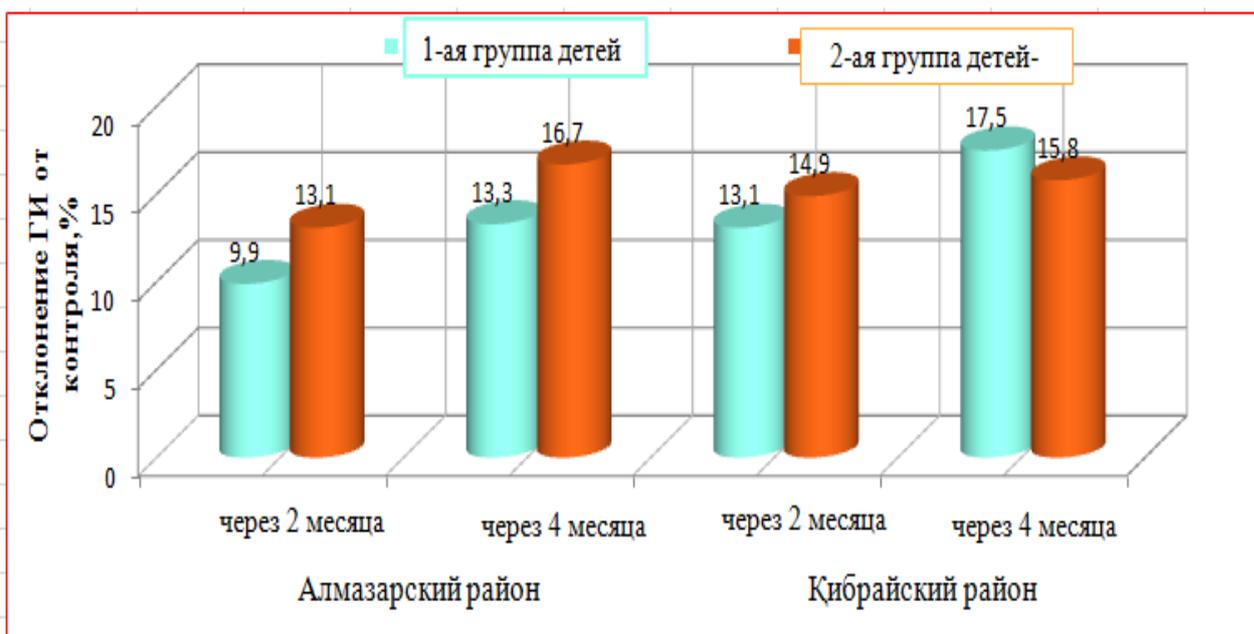


Figure 8. Histograms of positive deviation of the HI index after endogenous fluoride prophylaxis with BFW “Aqua dental ” in children.

The results of the indicators of the hygienic index of the oral cavity indicate that fluoride prophylaxis of teeth with BFW in both the first and second prophylactic groups of children leads to an improvement in the quality and hygienic index of oral fluid. This, in turn, leads to a decrease in the intensity of development and growth of caries and its reduction. The prophylactic effectiveness of BFW in the examined preschool children was judged by the increase in the intensity of dental caries, as well as by their reduction in the prophylactic groups compared with similar indicators of children in the control groups (Fig. 9).

#### **Analysis of calcium and phosphorus content in the oral fluid of children.**

Prevention of dental caries in children should be aimed at creating optimal conditions for the maturation of tooth enamel and increasing its resistance. The mineralizing properties of oral fluid determine the resistance of hard dental tissues to caries after their eruption, ensuring the processes of enamel maturation. The leading role in the implementation of the mineralizing function of saliva belongs to calcium and phosphorus - the main components of the structure-forming elements of tooth enamel. Calcium, along with other macronutrients, is very important for the normal functioning of the body. Its deficiency, as well as its excess, negatively affects the functioning of almost all organs and systems of the child's body. However, the works presented in modern literature devoted to the study of the mineralizing potential of the vitamin-mineral complex (VMC) and the biophysical characteristics of saliva in preschoolers are contradictory.

In order to study changes in the mineral composition of oral fluid in preschool children who underwent dental caries prevention using BFW, and to compare the indicators in children of the control groups, changes in the concentration of ions of some mineral elements of saliva were studied, the results of which are presented in Tables 16 and 17. Analysis of the content of Ca and P in the oral fluid of children participating in the dental caries prevention program using BFW revealed that the content of mineral components in it became higher. Thus, a study of the output of Ca and P in the oral fluid before the introduction of fluoride prophylaxis of dental caries in children of group 1 (3-4 years old) of the Almazar district showed that the output of Ca was  $0.521 \pm 0.013$  mmol / l, and P -  $0.310 \pm 0.013$  mmol / l.

Table 16

Indicators of Ca , P and HI ( $M \pm m$ ) properties of oral fluid

1-group of children who used BFW from Almazarsky district

Indicators	Examination dates				
	Control group	Through 2 months	Deviation from control, %	Through 4 months	Deviation from control,%
Ca , mmol/l	$0.521 \pm 0.013$	$0.586 \pm 0.016$	12.47	$0.595 \pm 0.013$	14.20
P, mol/l	$1.310 \pm 0.013$	$1.423 \pm 0.012$	8.62	$1.455 \pm 0.021$	11.06

Consumption of BFW by children for 2 months resulted in a reliable ( $p < 0.001$ ) increase in the output of Ca to  $0.586 \pm 0.016$  mmol/l and P -  $1.423 \pm 0.012$  mmol/l. The output of Ca increased by 12.47%, and the output of P - by 8.62%\_relative to the initial level of calcium and phosphorus release in oral fluid. Oral fluid analysis after 4 months fluoroprophyllactic tiki the use of BFW revealed a significantly higher content of Ca and P ( $p < 0.01$ ) , relative to the initial output of Ca and P , which amounted to 14.20 and 11.06%\_respectively (Table 16). Consumption of BFW by children of the 2nd group of children (children aged 5-6 years) for 2 months also led to a reliable ( $p < 0.001$ ) increase in the output of Ca to  $0.586 \pm 0.017$  mmol/l and P -  $1.448 \pm 0.020$  mmol/l, which constitutes a positive increase in the content of Ca and P in oral fluid by 15.35, respectively\_ and 11.81%, relative to the initial level of Ca and P output in the oral fluid (Table 17). From the above results it follows that the prevention of dental caries in children with BFW leads to a reliable increase in the SSR index, a decrease in viscosity indices, an increase in the pH of the environment ( i.e. an increase in the alkalinity of the environment), etc. contributes to the improvement of the condition and quality of oral fluid in both the 1st and 2nd

preventive groups of children. This, naturally, helps to reduce the risk of developing caries in children.

Table 17.

Indicators of Ca and P (M± m ) properties of oral fluid

2 groups of children who used BFW in Almazarsky district

Indicators	Examination dates				
	Control group	Through 2 months	Deviation from control, %	Through 4 months	Deviation from control, %
Ca , mmol/l	0.508 ± 0.015	0.578 ± 0.014	13.77	0.586 ± 0.017	15.35
R, mol /l	1.295 ± 0.017	1.399 ± 0.017	10.4	1.448 ± 0.020	11.81

The results of the survey showed that the rate of morbidity development was similar in all children of the Almazar and Kibray districts. The increase in the intensity of dental caries in the preventive groups of the Almazar district for 6 months was: 0.14 (group 1 of children) and 0.17 (group 2 of children), which is significantly less than in the control groups 0.27 and - 0.31, respectively. The increase in the intensity of dental caries in group 1 of children of the Kibray district was 0.11, and in the 2nd group of children - 0.14, which is also significantly less than in the control groups 0.25 and 0.30, respectively. From the obtained data on the increase in caries intensity, the reduction in intensity in the preventive groups of children was calculated. Thus, the reduction in the intensity of dental caries in the preventive groups of children of the Almazar district per year was: 48.1% (group 1 of children) and 45.2% (group 2 of children). The reduction in the intensity of dental caries in the first group of children in the Kibray district was 56.0, and in the second group of children - 53.3%.

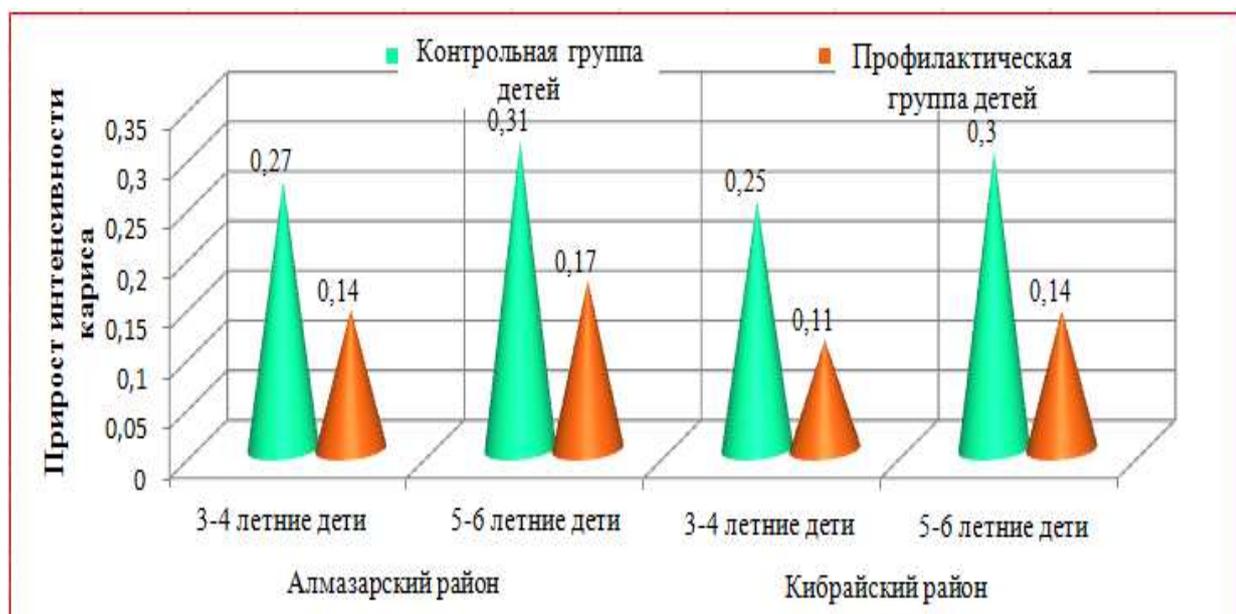


Figure 9. Histograms of the increase in caries intensity after endogenous fluoride prophylaxis with the BFW “Aqua dental” in groups of children.

Thus, the endogenous fluoride prophylaxis of dental caries in children conducted by BFW, regardless of the regional location of kindergartens, led to a decrease in the intensity of dental caries in the preventive groups of children. It is shown that the used method of fluoride prophylaxis of childhood caries BFW is the cheapest, most accessible and quite effective method. It is established that the contrasting improvement of the oral cavity condition, oral fluid indices, hygienic index, as well as a decrease in the development of dental caries and an increase in its intensity in the examined groups of children, contributes to a decrease in the risk of developing dental caries and will undoubtedly reduce the costs of its treatment. Consequently, BFW can be recommended for use in fluoride prophylaxis of childhood caries in organized preschool institutions.

## CONCLUSION

Caries is one of the most common dental diseases typical for the population of developed countries. The main areas of research in dentistry continue to be the issues of prevention of dental caries. According to the authors, in the Republic of Uzbekistan, caries is a disease that is considered one of the markers-indicators of the general dental health of the population and ranks first in dentistry in terms of prevalence. It was found that the prevalence of caries and its complications continues to increase in young children, which is of particular concern, since it is during this age period that the development and formation of enamel and the entire dental system of the child continues. In the prevention of dental caries and inflammatory

periodontal diseases, rational nutrition is important as one of the areas of a healthy lifestyle. Today, there is a doctrine of balanced nutrition, which provides for optimal ratios of essential nutrients: proteins, fats, carbohydrates, vitamins and minerals [ Shaikhova G.I. et al.].

Protein foods play a caries-protective role, since proteins affect the quality of saliva: when eating cheese, beans, eggs, milk, nuts, the mineralizing potential of saliva increases, which creates opportunities to compensate for the negative impact of sugars on oral fluid. Protein deficiency during the period of tooth development leads to a decrease in their size and weight, disruption of the structure of tooth enamel. Fats help protect against caries, since during a short stay in the oral cavity they play the role of a hydrophobic coating that prevents the formation and growth of dental plaque. Carbohydrates are attracting increasing attention from scientists as one of the main factors in the development of dental caries, since sugar consumption by the population, regardless of age, continues to increase. More than half of the people surveyed eat sweets 3 times a day and in large quantities (3 teaspoons of sugar per day, as well as confectionery and flour products at each meal). Teenagers especially often eat sweets and quick snacks. An increase in the amount of easily digestible carbohydrates in the diet, especially during the period of teething and enamel maturation, leads to high reactivity of teeth to caries. Increased carbohydrate content in food and insufficient protein makes a person's diet cariogenic . The negative effect of sucrose on the condition of hard dental tissues is most intense when eating sweet foods between meals. At the same time, granulated sugar, compared to lump refined sugar, is less cariogenic , since its direct contact time with teeth is shorter. Traces of sugar soluble in an aqueous solution remain in the oral cavity for 15 minutes, while solid sugar remains in saliva for a long time. Foods such as bread, candies, baked goods with a high content of butter or margarine can remain on the surface of the teeth for more than an hour.

According to Pakhomov G.N., vitamins A, D, K, and P belong to the group of vitamins that play a major role in the development of dental and periodontal diseases. Long-term vitamin A deficiency during the period of dental development leads to yellow pigmentation and enamel hypoplasia, increased susceptibility of teeth to caries due to imperfections of hard tissues. When vitamin D deficiency is combined with a lack of calcium and phosphorus in food, rickets quickly develops in infants. With a vitamin D deficiency and normal calcium and phosphorus content in food, young dogs develop osteoporosis of the alveolar bone, widening of the periodontal gap, and cementum resorption. With a lack of phosphorus and a normal amount of vitamin D and calcium in the diet, there is a slowdown in jaw growth and tooth eruption, accompanied by incorrect occlusion.

Water-soluble vitamins B1, B2, B12, folic acid, vitamin PP (nicotinic acid) and vitamin C also play an extremely important role in the metabolism of oral tissues. With a lack of vitamin C, there is a disruption in the formation of collagen - the main substance of mucopolysaccharides and intercellular cementing substrate in mesenchymal tissues. In this case, slow bone formation and osteoporosis are observed.

A significant part of the nutrients entering the body are minerals such as potassium, sodium, chlorine, as well as phosphates and calcium. They accumulate in the body, providing optimal pH, osmotic pressure and potentials of intercellular membranes. Calcium deficiency caused by nutritional disorders is expressed in an increase in the development of dental and periodontal diseases. Micro and macroelements are components of substances that participate in the body's metabolic processes or regulate them, and can also have an indirect effect on the resistance and susceptibility of teeth to caries. At the same time, some issues related to microelements have not been sufficiently studied.

Some microelements do not have a direct effect on the prevalence of dental diseases. Fluorine is an exception, since its role in the occurrence of caries has already been proven (at low content in water). The effect of fluorine on the formation of clinical changes in teeth was discovered unexpectedly, when a connection was established between the increased content of fluorine in drinking water and the detection of dental fluorosis. Subsequently, numerous studies were conducted that clearly demonstrated the possibility of preventing dental caries by fluoridating drinking water and, conversely, defluoridating water to prevent fluorosis. Sufficient fluorine intake increases the resistance of the upper layers of tooth enamel (due to the formation of fluorapatite in them) to the action of pathological factors, such as metabolic products in dental plaque, and suppresses the activity of cariogenic microflora. The leading place in dental caries belongs to calcium, phosphorus and fluorine.

At the first stage, the following was studied: detection of prevalence and intensity of dental caries, comprehensive assessment of actual nutrition of preschool children, children aged 3-6 years, attending preschool educational institutions of Tashkent . During the study, indicators of prevalence and intensity of caries of temporary and permanent teeth of preschool children were obtained. From the results of the studies it follows that by 5-6 years, more than 80% of teeth of these children are affected by caries, with high intensity.

The study of the prevalence and intensity of caries in primary teeth in children aged 3 to 6 years in preschool institutions of the Kibray and Zangiota districts of the Tashkent region showed that the prevalence of caries in preschoolers of the Kibray

district was within  $69.52 \pm 0.57 - 78.70 \pm 0.43\%$  with an intensity of  $2.33 \pm 0.05$  and  $4.75 \pm 0.05$ . At the same time, the intensity of caries in preschoolers of the Zagyatinsky district ranged from  $2.45 \pm 0.03$  to  $4.88 \pm 0.05$  with a prevalence of  $70.23 \pm 0.15$  to  $80.85 \pm 0.37\%$ . Nevertheless, these data generally correspond to the average indicators for the republic. The prevalence of dental caries in children of groups 2-4 in both regions is estimated as high. Statistical processing of dental caries incidence rates in the examined children of the regions of the oblast revealed their statistical difference. Analysis of dental caries intensity index rates in the examined preschool children of the Kibray and Zangiota districts shows that in the first and second groups of examined children the intensity level can be assessed as low and moderate (from  $2.33 \pm 0.05$  to  $3.62 \pm 0.04$ ), and in the third ( $4.12 \pm 0.03$ ) and fourth groups of children ( $4.88 \pm 0.05$ ) the caries intensity has a high degree. Comparison of dental caries intensity rates by the index « КП , КП+КПІУ » also revealed statistical significance of their differences. It was established that the degree of dental caries intensity both in the Kibray and Zangiota districts increases with the age of children and reaches a high mark. In a comparative study of the index " kp , kp+KPU " by dental caries groups in preschool children of the Tashkent region, a predominance of carious teeth was found almost twice as high as filled teeth. A study of the depth of dental caries showed that superficial and fissure caries were quite rare in the examined children. This can be explained by the fact that the carious process in children develops very quickly, contributing to the transition of superficial caries to medium and then deep.

Thus, in a comparative study of dental caries in preschool children of two districts of the Tashkent region, it was shown that the prevalence and intensity of dental caries increases with age . A study of the localization and structure of dental lesions established that molars and incisors are affected to a greater extent, and canines are affected much less often. In the course of a comparative epidemiological study, it was established that the observed patterns and changes associated with the prevalence and intensity of dental caries in preschool children are more clearly expressed in the preschool institution of the Zangiata district.

At the next stage of the work, the actual nutrition of preschoolers attending preschool educational institutions (PEI) of Mirzo Ulugbek district of Tashkent was studied . It was revealed that the diets of children in preschool educational institutions and at home do not satisfy their need for proteins, fats (in particular, of animal origin), vitamins and minerals. The deficit of meat and meat products consumption in the examined children in different periods of the year ranges from 20.0 to 27.1%. Children consume negligible amounts of milk and dairy products. Drinking and mineral water are not popular. Preference is given to foods and drinks

rich in sugar. The content of carbohydrates in the actual diet of preschoolers exceeds the norm by 56.6%. The consumption of macro- and microelements with food, in particular calcium (its deficit ranges from 25.0 to 38.9%), was clearly insufficient. The diet was virtually devoid of fluoride-containing foods. Deficiencies in proteins, fats, minerals and vitamins, as well as excess carbohydrates in the diet, are known to lead to increased susceptibility of teeth to caries and its development.

Thus, the study of the actual nutrition of preschoolers with dental caries revealed pronounced violations of the nutrition structure. The diet of preschoolers with dental caries is characterized by quantitative and qualitative inadequacy. 61.6% of the examined children consume a lot of confectionery (candies, ice cream, cakes, pastries, waffles, buns, jam, sugar-containing and soft drinks: lemonade, fruit juices). Of the total number of children, 58.3% consume the specified products between main meals or before bedtime without subsequent brushing of teeth.

Thus, the diet of preschool and school-age children should be optimal and balanced. Insufficient intake of nutrients and failure to follow the diet can be the cause of caries in baby teeth.

Systematic hygienic education of children and their parents promotes awareness of their health as an enduring value, the formation of skills and habits of a healthy lifestyle. It was revealed that the issues of hygienic education and training (HET) among preschoolers are poorly developed. Despite certain successes achieved in solving this problem, to date, the motivation for hygienic education of preschool children has not been studied, the role of parents, educators and medical workers of preschool educational institutions in developing motivation for oral hygiene has not been predetermined.

Based on the data obtained, it should be noted that further research involving systems of age dynamics of the development of the child's body, psychological reactions of children, features of persuasion and assimilation can significantly increase the effectiveness of the entire system of preventive measures.

Water fluoridation is a large-scale, complex problem. At present, water fluoridation is widely introduced into practice due to its high anti-caries efficiency, low material costs, significant economic effect, and simple water fluoridation technology. Thus, in the USA, the average cost of water fluoridation is assumed to be 10 cents per person per year, i.e. 7-10 dollars over a lifetime (with the cost of dental care per year being 80 dollars). The cost varies depending on the amount of water supplied per capita by the water supply system (from 2.5 to 22.5 cents) and the reagent used ( $\text{Na}_2\text{SiF}_6$  - on average 4.6 cents, NaF - 8.5,  $\text{H}_2\text{SiF}_6$  - 11 cents). Capital costs for a fluoridation unit are approximately equal to operating costs for 1 year. A typical fluoridation unit for a village with a population of up to 1,000 people

costs 100-200 dollars, and the cost of water fluoridation is 1.22 dollars per person per year.

When considering indications for a set of measures for water fluoridation, doctors and dentists may ask themselves the following questions: is it not more reasonable in this case to use other methods of fluoride prevention of caries, for example, fluoride tablets or fluoridation of table salt and milk, local fluoridation of teeth? But when answering these questions, it is noted that these methods are difficult to use in the conditions of a large settlement with a centralized domestic and drinking water supply.

The practice of foreign countries demonstrates that, compared to other methods, water fluoridation requires lower operating costs. When water fluoridation is combined with measures to improve oral hygiene skills, rationalization of nutrition (reducing the consumption of sweet products, teaching healthy eating skills, especially for children and pregnant women, providing calcium and vitamins), it leads to good indicators and a decrease in the growth of dental caries.

Meanwhile, medicinal methods of systemic fluoride prophylaxis have a risk of a reduced level of discipline during administration (human factor), which reduces the unambiguity of the preventive effect. Unlike the effectiveness of drinking water fluoridation, the level of evidence of the effectiveness of fluoride-containing drugs is clearly insufficient. At the same time, the risk of developing fluorosis when taking fluoride-containing drugs has been proven, associated with both the possibility of an overdose and the likelihood of an individual decrease in the level of tolerance to the systemic intake of fluorides into the body. It is necessary to take into account that the cost of fluoridated milk and salt is higher than fluoridated bottled water. From an economic point of view, with mass production, the cost of bottled fluoridated water will be significantly lower.

The hygienic problems of drinking water fluoridation require the coordination of scientific research by hygienists, dentists, biologists, geneticists, chemists, specialists in centralized domestic and drinking water supply, etc.

The most relevant area of research on the problem of water fluoridation is experimental modeling on animals of the validity of the benefits, harm or neutrality of fluoride in the prenatal period, in infancy and early childhood.

In Uzbekistan, there are no studies to clarify the optimal and maximum concentrations of fluoride in bottled drinking water. Studies of this kind are extremely important for our region due to the widespread prevalence of dental caries in children and adults. The developed bottled drinking water enriched with fluoride met the organoleptic requirements of Q zDSt 540. The water is white, transparent, without foreign odor and taste. Microbiological indicators met the requirements of

GOST 18963. The fluoride content in one liter of water is 0.7 mg / dm<sup>3</sup>. Based on the data obtained, a technological instruction for the production of fluoridated water for preschool children was developed, approved by the Main Directorate of the Sanitary and Epidemiological Center of the Republic of Uzbekistan. ( SanPIN ).

The next stage of research was devoted to toxicological studies of bottled water containing fluoride at concentrations of 0.7 and 1.0 mg/l.

BASED on the results of our own research, examination of the submitted documentation and literature data, it was established that bottled water with a fluoride content of 0.7 and 1.0 mg/l does not have a negative impact on the health of experimental animals, does not cause local irritant effects on the skin and mucous membranes, does not have skin-resorptive and cumulative , mutagenic properties. According to the degree of toxicity, it belongs to class 4 - low-toxic substances.

Bottled water with fluoride content of 0.7 and 1.0 mg/l did not affect the content of hemoglobin, erythrocytes, leukocytes, eosinophils, lymphocytes, monocytes, platelets and segmented nucleocytes, color index and ESR in the peripheral blood of animals in the experimental group compared to the control. Indicators of total protein, albumin, glucose, transaminase enzymes (ALT, AST) and alkaline phosphatase activity in blood serum did not differ from control values.

The results of histomorphological studies of tissues of internal organs with intragastric administration of bottled water with fluoride concentrations of 0.7 and 1.0 mg/l confirm the absence of toxic effects of the studied bottled fluorinated water. The noted structural features of the studied tissues reflect the normal functional activity of internal organs.

Analysis of the results of the study of the effect of bottled water with fluoride concentrations of 0.7 and 1.0 mg/l in the embryonic and postnatal periods of development of the pituitary gland and thyroid gland of rats did not reveal characteristic shifts in the content of pituitary TSH in rats. The concentration of pituitary TSH in intact animals was determined at a level of 0.56 mIU /ml, with a fluoride concentration of 0.7 mg/l and 1.0 mg/l 0.50 and 0.59 mIU /ml, respectively.

The obtained data indicate that intragastric administration of bottled water with fluoride doses of 0.084, 0.098, 0.12 and 0.14 mg/kg

did not cause statistically significant deviations in the concentrations of pituitary TSH. Almost identical levels of thyroid hormones in animals of all three groups indicate normal development and functioning of the pituitary gland and thyroid gland when exposed to bottled water with the studied doses of fluoride.

The results of the studies can be taken into account in clinical practice, when predicting the course and outcome of functional recovery in individuals with thyroid pathology, such as hypothyroidism. Analysis of the results of studies of antioxidants,

stem cells, vaccines, and various surgical techniques allow us to conclude that new effective means are needed to treat thyroid pathology of the GPT type. Despite intensive research, it should be noted that modern achievements are actually unsuccessful in attempts to treat a specific thyroid disease of the GPT type, which usually leads to severe disability. Taking into account the multifactorial and multiphase model of the development of thyroid pathologies, such as GPT, a strategy of therapy with fluoridated water with a fluoride concentration of 0.7 mg/l and 1.0 mg/l depending on the season of the year can be effective.

The histomorphological picture of the dynamics of thyroid gland development under the influence of fluorine in concentrations of 0.7 and 1.0 mg/l showed similar stages and terms of organ development. Only on the 14th day of the experiments a single colloid was detected.

The results of the study of the effect of fluorine on osteogenesis in the embryonic period and postnatal development confirm that a fluorine concentration of 1.0 mg/l accelerates the processes of formation of erythropoietic, osteoblastic and erythroblastic bone marrow and accelerates the processes of osteogenesis. A fluorine concentration of 0.7 mg/l has a less pronounced effect on osteogenesis.

Study of mutagenic activity of fluorine concentrations of 0.7 and 1.0 mg/l when exposed on a culture of human lymphocyte cells at doses of 0.098 and 0.14 mg/10<sup>6</sup> cells for 72 hours made it possible to establish that fluoride in bottled drinking water does not have mutagenic activity.

Results studies conducted on bottled water with fluoride concentrations of 0.7 and 1.0 mg/l allow us to draw a conclusion about the safety of the studied concentrations of fluoride in bottled water for children's health.

The use of an express method for determining the concentration of fluorine in the urine of children who have been drinking fluoridated water for at least 3 weeks allows for the regulation of the required amount of fluorine in drinking water. If the average concentration of fluorine in the urine is below 0.9-1.1 mg/l, the concentration of fluorine should be increased; if it is higher, it should be decreased. The use of selective fluorine electrodes for direct potentiometric determination of fluorine concentration in the urine significantly simplifies control, since the concentration of fluorine in the urine reflects all the conditions taken into account and not taken into account when choosing the concentration of fluorine.

A less prompt but mandatory method of control is an examination for fluorosis. It can be used only 2-3 years after the start of drinking fluoridated bottled water.

Such approaches to the selection and regulation of fluoride concentration in drinking water guarantee the safety of bottled fluoridated water. One-time fluctuations should not exceed  $\pm 0.1$  mg/l, and average monthly fluctuations should

not exceed  $\pm 0.05$  mg/l from the established fluoride concentration (WHO Expert Committee on FV). Random and isolated increases in fluoride concentration to 2-3 mg/l will not have a negative impact on health.

When choosing the optimal concentration of fluoride in bottled water, it is also necessary to take into account climatic conditions, i.e. adhere to. seasonal principle of water fluoridation. For the summer period at temperatures above  $26.2^{\circ}\text{C} - 30^{\circ}\text{C}$ , it is preferable to give children bottled water with a fluoride concentration of  $0.7 \pm 0.1$  mg/l, and for the autumn-winter season - with a fluorine concentration of  $1.0 \pm 0.1$  mg/l since at this time children's water consumption decreases. Along with this, it is necessary to take into account the amount of milk, vegetables and other nutritional features consumed.

It has been established that in all examined preventive groups of children, there is a contrasting improvement in the indicators of oral fluid, the state of the oral cavity, as well as a decrease in the intensity indicators and an increase in the reduction of caries, which, naturally, will help reduce the risk of developing dental caries in preschool children and the costs of its treatment. Consequently, bottled fluoride-containing water "Aqua dental" can be recommended for effective prevention of childhood caries in organized children's groups.

Thus, the use of bottled fluoridated water with an optimally selected fluoride concentration of 0.7 and 1.0 mg/l allows for the most effective prevention of caries and osteoporosis at both the individual and social levels.