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ASSESSMENT OF BIOCHEMICAL INDICATORS OF ORAL FLUID IN CHILDREN WITH EXCESSIVE BODY WEIGHT WITH THE USE OF THERAPEUTIC AND PREVENTIVE COMPLEX

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The study is devoted to the study of biochemical indicators of the oral fluid of children with major dental diseases against the background of excess body weight in the process of carrying out the developed therapeutic and preventive measures. 48 children aged 15 to 18 took part in the clinical examinations according to the "inclusion/exclusion" criteria. The children were divided into 2 groups (the main group – 25 children and the comparison group – 23 children). In the comparison group, only basic therapy (sanitation of the oral cavity and professional hygiene) was carried out. In addition to the basic therapy, the patients of the main group were prescribed a developed treatment and prevention complex. The use of the developed complex made it possible after 1 year to reduce the activity of the inflammatory process, increase antioxidant and non-specific antimicrobial protection and normalize the microbiocenosis of the oral cavity.

Key words: dental indicators, biochemical markers, children, excessive body weight, preventive complex.

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ОЦІНКА БІОХІМІЧНИХ ПОКАЗНИКІВ РОТОВОЇ РІДИНИ У ДІТЕЙ З НАДМІРНОЮ МАСОЮ ТІЛА ПРИ ЗАСТОСУВАННІ ЛІКУВАЛЬНО-ПРОФІЛАКТИЧНОГО КОМПЛЕКСУ

Дослідження було присвячено вивченню біохімічних показників ротової рідини дітей з основними стоматологічними захворюваннями на тлі надмірної маси тіла в процесі проведення розроблених лікувально-профілактичних заходів. У клінічних обстеженнях брало участь 48 дітей віком від 15 до 18 років за критеріями «включення/виключення». Діти були поділені на 2 групи (основна група – 25 дітей та група порівняння – 23 дитини). У групі порівняння проводилася тільки базова терапія (санація порожнини рота і професійна гігієна). Пацієнтам основної групи призначали крім базової терапії розроблений лікувально-профілактичний комплекс. Застосування розробленого комплексу дозволило через 1 рік знизити активність запального процесу, підвищити антиоксидантний і неспецифічний антимікробний захист та нормалізувати мікробіоценоз порожнини рота.

Ключові слова: стоматологічні показники, біохімічні маркери, діти, надмірна маса тіла, профілактичний комплекс.

The work is a fragment of the research project "Correction of pathogenetic mechanisms of disorders of carbohydrate and lipid metabolism in the body and tissues of the oral cavity in patients depending on environmental and nutritional factors affecting carbohydrate and lipid metabolism", state registration No. 0118U006966.

According to the report of the obesity committee of the World Health Organization, obesity was recognized by WHO as a new non-infectious epidemic of our time [7, 9, 10, 14]. Almost all over the world, the number of sick children is steadily growing and doubling every three decades, Ukraine is no exception [13].

The prevalence of periodontal diseases is extremely high, and in recent decades, its significant increase in young people has been noted, a more aggressive course of periodontal diseases has been revealed on the background of somatic pathology, as well as on the background of overweight (EBW) [1, 11, 12]. Numerous works emphasize that generalized forms of gingivitis and periodontitis are diagnosed in 15–18-year-old children in 10–15 % of cases [5].

The development and course of periodontal disease and caries at a young age on the background of EBW has its own characteristics and requires detailed study. These comorbid conditions are factors that provoke diseases of periodontal tissues and hard tissues of teeth and worsen their course. It should be noted that the treatment of children with such comorbid diseases has certain difficulties, which is associated with mutually aggravating pathogenesis and with a significant number of drugs that are not always sufficiently effective and safe for this category of patients. At the same time, dysbiosis in the oral cavity of such patients can be both a consequence of various diseases, and lead to an exacerbation and aggravation of the course of caries, gingivitis, periodontitis, stomatitis and other dental diseases, and can complicate their diagnosis and treatment [15].

Therefore, the study of biochemical indicators of the oral fluid of children with the main dental diseases on the background of excess body weight in the process of carrying out the developed treatment and preventive measures is an urgent task of dentistry.

The purpose of study was to investigate the biochemical indices of the oral fluid in children with major dental diseases on the background of excess body weight in the process of carrying out the developed therapeutic and preventive measures.

Materials and methods. 48 children aged 15 to 18 took part in clinical examinations according to the "inclusion/exclusion" criteria.

The "inclusion/exclusion" criteria for children of the main group with major dental diseases on the background of excess body weight were as follows:

Inclusion – children aged 15–18 years, excessive body weight (EBW), signs of primary dental disease (gingivitis, periodontitis, caries).

Exclusion – refusal to participate in the study, presence of acute infection, acute pathology and decompensation of any severe somatic concomitant pathology that could affect the results of the study, endocrinological obesity, metabolic syndrome, oncological pathology.

All children and their parents were informed about the essence of the clinical study, and the child was finally enrolled in the study only after signing the informed consent. Dental examination was conducted in the dental office at the Department of Epidemiology and Prevention of Major Dental Diseases, Pediatric Dentistry and Orthodontics of the SE "The Institute of stomatology and maxilla-facial surgery National academy of medical sciences of Ukraine" (SE "ISMFS NAMS").

The children were divided into 2 groups (the main group – 25 children and the comparison group – 23 children). In the comparison group, only basic therapy (sanitation of the oral cavity and professional hygiene) was carried out. That is, professional oral hygiene is ultrasonic and manual scaling, tooth polishing with professional pastes, and, if necessary, local antimicrobial and anti-inflammatory therapy was prescribed. Children were trained in hygienic care of the oral cavity and familiarized with hygiene products such as intradental brushes, superfloss.

The patients of the main group were prescribed, in addition to the basic therapy, the developed treatment and prevention complex (TPC) 2 times a year for two weeks at night, which included "Symbiter" gel and "Quertulidon" gel, manufactured according to TC U 20.4–13903778–032 based on 4 % sodium salt of carboxymethylcellulose ("Biochimtech" LLC, Odesa, Ukraine). Both gels were applied topically to the mucous membrane of the oral cavity, first the "Quertulidon" gel for 10 minutes, and after 30 minutes the "Symbiter" gel was also applied for 10 minutes. The specified drugs were prescribed together with a pediatrician who was involved in the correction of fat metabolism and physical activity in these children, namely, all patients received recommendations on the organization of a rational daily routine according to the age of the child and regular dosed physical activity.

The effectiveness of TPC of the main dental diseases in the studied groups was evaluated after 1, 3, 6, 9, 12 months from the beginning of the use of drugs.

Evaluation of the proposed TPC was studied using biochemical indicators of oral fluid (markers of inflammation – elastase activity, antioxidant protection – antioxidant-prooxidant index (API); enzyme of antimicrobial protection – lysozyme; and the degree of dysbiosis (DD) was calculated [2, 8].

During the statistical processing of the obtained results, the computer program Microsoft Office Excel 2016 was used to assess their reliability and measurement errors. Statistical processing of the experimental study results was carried out by the methods of variation analysis using the Student's test. The difference was considered statistically significant at $p<0.01$ [4].

Results of the study and their discussion. Changes in elastase activity in oral fluid under the influence of our proposed TPC were analyzed (Table 1).

Table 1

The effect of TPC on the activity of elastase in the oral fluid of children with major dental diseases (MDD) on the background of excess body weight, μ-cat/l (M±m)

Groups of children	Terms			
	Before treatment	1 month later	3 months later	A year later
Norm	0.50±0.03			
Main group, n=25	1.47±0.10 $p_2<0.05$	0.61±0.08 $p_1<0.05$ $p_2>0.05$	0.75±0.05 $p_1<0.05$ $p_2<0.05$	0.54±0.06 $p_1<0.05$ $p_2>0.05$
Comparison group, n=23	1.33±0.09 $p>0.05$ $p_2<0.05$	1.04±0.09 $p<0.05$ $p_1<0.05$ $p_2<0.05$	1.52±0.05 $p<0.05$ $p_1>0.05$ $p_2<0.001$	1.39±0.14 $p<0.05$ $p_1>0.05$ $p_2<0.01$

Note. p – the probability of differences between indices in the comparison group and the main group; p_1 – probability of differences in relation to the initial level; p_2 – probability of differences in relation to the norm.

The results of determining elastase activity show that high values of this marker of inflammation in the oral fluid of children were registered before treatment in both groups. Basic treatment in the comparison group led to a decrease in elastase activity after 1 month by 1.3 times, and additional administration of quertulidone in the main one by 2.4 times. It should be noted that after 1 month's elastase activity in the oral fluid of the main group corresponded to the normal level, and in the comparison group it was significantly higher ($p_2<0.05$).

An analysis after 3 months showed an increase in elastase activity in the oral fluid of the comparison group to the initial level. In the main group of children, the activity of elastase after 3 months also increased slightly, but, nevertheless, it was almost 2 times lower than the high values before treatment ($p_1<0.05$). The obtained results indicate the anti-inflammatory effectiveness of the "Quertulidon" complex.

A more pronounced decrease in urease activity after prophylactic use of quertulidone can be explained by an increase in antimicrobial protection in the oral cavity under the influence of the complex, as evidenced by the results of research into the activity of one of the main enzymes of this system – lysozyme (Table 2).

Table 2

The effect of quertulin-containing drugs on the activity of lysozyme in the oral fluid of children with excess body weight and gingivitis, unit/l (M±m)

Groups of children	Terms			
	Before treatment	1 month later	3 months later	A year later
Norm	0.158±0.006			
Main group, n=25	0.052±0.003 $p_2<0.001$	0.095±0.008 $p_1<0.05$ $p_2<0.05$	0.137±0.012 $p_1<0.05$ $p_2<0.05$	0.125±0.010 $p_1<0.05$ $p_2<0.05$
Comparison group, n=23	0.057±0.006 $p>0.05$ $p_2<0.001$	0.078±0.006 $p<0.05$ $p_1<0.05$ $p_2<0.05$	0.069±0.008 $p<0.05$ $p_1>0.05$ $p_2<0.05$	0.061±0.007 $p<0.05$ $p_1>0.05$ $p_2<0.001$

Note. p – the probability of differences between indices in the comparison group and the main group; p_1 – probability of differences in relation to the initial level; p_2 – probability of differences in relation to the norm.

It was shown that the initial level of lysozyme in the oral fluid of the observed children was on average reduced by 65 % and indicates a very low activity of antimicrobial protection in the oral cavity of children with gingivitis on the background of EBW. The basic treatment of gingivitis after 1 month slightly increased the activity of lysozyme in the oral fluid of the children of the comparison group ($p_1<0.05$). But if this indicator in the comparison group increased by 36.8 %, then in the case of the main group after the additional use of quertulin preparations – by 82.6 % ($p<0.05$).

Further studies conducted after 3 months and after a year revealed a low level of lysozyme activity in the oral fluid of the children of the comparison group – corresponding to the initial values ($p_1>0.05$). Regular prophylaxis with the oral administration of quertulidone in combination with the local application of "Quertulidon" gel to the tissues of the oral cavity contributed to maintaining the activity of lysozyme, and therefore the antimicrobial protection of the oral cavity, at a fairly high level ($p<0.05$ and $p_1<0.05$), although significantly low compared to the norm ($p_2<0.05$). The DD index more clearly demonstrates the state of microbiocenosis in the oral cavity. The results of the calculation of this indicator are shown in Fig. 1. The initial values of DD in children with MDD on the background of excess body weight are 20 times higher than the norm.

1 month after sanitation in the oral cavity of the comparison group, the level of DD decreased by 1.75 times, and after the additional use of quertulin preparations – by 5.91 times ($p<0.001$). After 3 months, DD in the oral cavity of the children of the comparison group increased slightly, and after a year – it was no longer different from the initial high values ($p<0.001$, $p_1>0.05$ and $p_2<0.001$).

A slightly different picture was observed with DD in the main group, which was prescribed regular courses of quertulidone. Thus, after 3 months, this figure was about the same as after 1 month. When examined after 1 year, an even lower level of DD was registered in the oral cavity of the children of the main group, although it was significantly lower than normal values. However, after 1 year, DD in the oral cavity of children who took courses of quertulidone was an order of magnitude lower than the initial level ($p_1<0.001$).

The obtained results indicate the ability of TPC to increase the level of non-specific antimicrobial protection, reduce the degree of contamination by pathogenic microbiota, and as a result normalize the microbiocenosis in the oral cavity due to a pronounced decrease in the degree of dysbiosis.

The state of the "antioxidant protection (AOP) – peroxide processes" system most clearly reflects the API, the values of which are presented in Fig. 2.

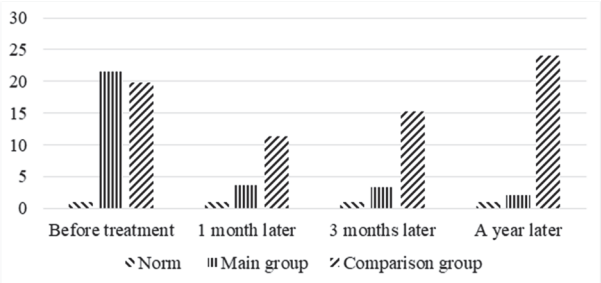

Fig.1. The effect of TPL on the degree of dysbiosis in the oral cavity of children with MDD on the background of overweight, c.u.

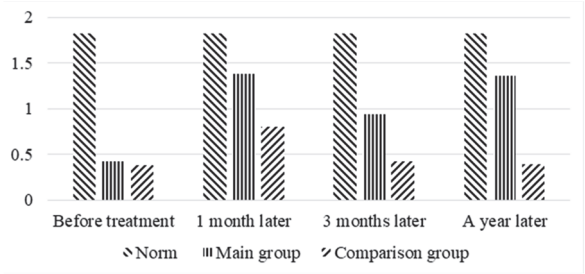

Fig.2. The effect of TPC on the antioxidant-prooxidant index in the oral cavity of children with MDD against the background of excess body weight, c.u.

The initial level of API in the oral fluid of children with MDD against the background of excess body weight is reduced by 4.6 times, which indicates the predominance of peroxide processes and a low level of AOP in the oral cavity.

In the oral cavity of children in the comparison group, API significantly increased 1 month after sanitation (by 2.1 times, $p_1<0.05$). At the same time, in the main group, whose children took a course of quertulin-containing drugs, API increased more significantly after 1 month (3.2 times, $p<0.05$, $p_1<0.001$). When analyzing the oral fluid of children after 3 months, it was found that in patients of the comparison group, API decreased to the initial level ($p_1>0.05$), which remained after a year ($p_1>0.05$).

Regular courses of topical application of mucosal adhesive gels helped to maintain a high level of API in the oral cavity of children with MDD on the background of EBW. Thus, after 3 months this indicator was 2.2 times higher, and after a year – 3.2 times higher than the initial values, although it was significantly lower than the normal level ($p_2<0.05$).

A steady increase of the API index in the oral cavity of children who used quertulidone indicates the ability of the study drug to effectively increase the activity of AOP and, due to this, to inhibit the distorted processes in the tissues that accompany pathological phenomena. Thus, the conducted biochemical study allows us to note the following. The basic treatment of MDD in children on the background of EBW does not provide a sustainable anti-inflammatory, antimicrobial and antioxidant effect, which often leads to relapses. Additional appointment of regular courses of local use of gels, including "Quertulin", on the mucous tissue of the gums contributes to prolonged anti-inflammatory, antimicrobial and antioxidant action in the oral cavity of children with MDD on the background of excess body weight. Probably, the established properties of "Quertulidone" are carried out, first of all, thanks to the quercetin that is part of the drug. It is known that quercetin is the most powerful antioxidant among bioflavonoids, effectively inhibiting the generation of reactive oxygen species and peroxide. In addition, there is information about the anti-inflammatory properties of quercetin, carried out by inhibiting the activity of such pro-inflammatory enzymes as leukocyte elastase, A_2, hyaluronidase, etc. Also known is the antimicrobial effect of quercetin, aimed at inhibiting the opportunistic and pathogenic microbiota and reducing its translocation, due to the capillary-fixing action. In combination with the prebiotic inulin, another component of quertulin, quercetin stimulates the actual antimicrobial protection, as well as the growth and reproduction of indigenous microbiota, thereby effectively normalizing the state of microbiocenosis in the body and the oral cavity, in particular [3, 6, 13].

Conclusions

1. For the prevention of major dental diseases in children with overweight, a set of measures was developed and it was shown that its use made it possible to reduce the activity of the inflammatory process after 1 year (decrease in elastase activity by 2.57 times in relation to the comparison group), increase antioxidant (increase in the API index 3.49 times) and non-specific antimicrobial protection (increase in lysozyme activity by 2.05 times) and normalize oral microbiocenosis (decrease in DD by 11.53 times).

2. For the prevention of major dental diseases in children with excessive body weight, it is recommended to use a set of measures, which involves the use of mucosal gels "Quertulidon" and "Symbiter".

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STUDY OF THE INFLUENCE OF BIOCOMPATIBLE CONSTRUCTION MATERIALS ON INDICATORS OF ORAL FLUID OF PATIENTS WITH AN ALLERGIC STATUS DURING ORTHOPEDIC TREATMENT WITH REMOVABLE PROSTHESES

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An analysis of the results of clinical studies showed that from 15 % to 43 % of people who are forced to use orthopedic constructions have “intolerance” of certain materials of crowns and dental prostheses. The obtained data prove the effect of structural materials on the parameters of the oral fluid of patients with an allergic status – a significant deterioration of the quality of the oral fluid was recorded due to a decrease in pH, an increase in galvanic currents and electrical conductivity already 1 day after the application of arc prostheses. The conducted research made it possible to improve the quality of orthopedic treatment of patients with an allergic status by using alternative biocompatible materials in the manufacture of removable structures of dental prostheses.

Key words: orthopedic treatment, intolerance, allergic status, brace prostheses, glass ceramics, oral fluid.

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ДОСЛІДЖЕННЯ ВПЛИВУ БІОСУМІСНИХ КОНСТРУКЦІЙНИХ МАТЕРІАЛІВ НА ПОКАЗНИКИ РОТОВОЇ РІДИНИ ПАЦІЄНТІВ ІЗ АЛЕРГОЛОГІЧНИМ СТАТУСОМ ПРИ ОРТОПЕДИЧНОМУ ЛІКУВАННІ ЗНІМНИМИ ПРОТЕЗАМИ

Аналіз результатів клінічних досліджень показав, що від 15 % до 43 % людей, які вимушено користуються ортопедичними конструкціями, мають «непереносимість» певних матеріалів коронок і зубних протезів. Отримані у дослідженні дані доводять вплив конструкційних матеріалів на показники ротової рідини пацієнтів із алергологічним статусом – зафіксовано достовірне погіршення якостей ротової рідини за рахунок зниження pH, збільшення гальванічних струмів і електропровідності уже через 1 день після накладення бюгельних протезів. Проведене дослідження дало змогу підвищити якість ортопедичного лікування пацієнтів із алергологічним статусом шляхом застосування альтернативних біосумісних матеріалів при виготовленні знімних конструкцій зубних протезів.

Ключові слова: ортопедичне лікування, непереносимість, алергологічний статус, бюгельні протези, склокераміка, ротова рідина.

The study is a fragment of the research project “Optimization of methods for diagnosis and treatment of basic dental diseases”, state registration No. 0119U002899.

Modern orthopedic dentistry is concerned about the increase in the number of cases of diseases caused by the patient's “individual intolerance” of the materials from which the prostheses used by him are made. Analysis of the results of clinical studies showed that from 15 % to 43 % of people who are forced to use orthopedic constructions have an "intolerance" of certain materials of crowns and dental prostheses [1, 4]. It is believed that the basis of this phenomenon lies in the corrosion processes of metals of orthopedic