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I.O. Tsushko, A.E. Dienga, S.A. Shnaider, V.N. Horokhivsky¹, P.D. Rozhko¹,
K.P. Rozhko¹, T.O. Lysenko¹

SE “The Institute of stomatology and maxilla-facial surgery National academy
of medical sciences of Ukraine”, Odessa; ¹Odessa National Medical University, Odessa

BIOCHEMICAL INDICATORS IN THE ORAL FLUID IN CHILDREN WITH CARIES AND GINGIVITIS ON THE BACKGROUND OF EXCESS BODY WEIGHT

e-mail: oksanadenga@gmail.com

The study is devoted to the research of biochemical indices of oral fluid of 15–18-year-old children with major dental diseases against the background of excess body weight. 88 children aged 15 to 18 participated in clinical examinations, and were divided into 3 groups (the main group – 48 children with main dental diseases and excess body weight, the comparison group – 20 children with main dental diseases and somatically healthy, and the control group – 20 children who were dentally and somatically healthy). Biochemical indices of oral fluid were studied in children. The conducted studies showed that in all children with major dental diseases, a decrease in local non-specific resistance, a weakening of antioxidant protection, an increase in inflammatory processes, a dysbiotic shift, and a violation of functional reactions in the oral cavity were observed.

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

I.O. Цушко, А.Е. Дєньга, С.А. Шнайдер, В.Н. Горохівський, П.Д. Рожко,
К.П. Рожко, Т.О. Лисенко

БІОХІМІЧНІ ПОКАЗНИКИ РОТОВОЇ РІДИНИ У ДІТЕЙ З КАРІССОМ ТА ГІНГІВІТОМ НА ТЛІ НАДМІРНОЇ МАСИ ТІЛА

Дослідження присвячене вивченню біохімічних показників ротової рідини діти віком 15–18 років з основними стоматологічними захворюваннями на тлі надмірної маси тіла. У клінічних обстеженнях брало участь 88 дітей віком від 15 до 18 років, які були розподілені на 3 групи (основна група – 48 дітей з основними стоматологічними захворюваннями та надмірною масою тіла, група порівняння – 20 дітей з основними стоматологічними захворюваннями та соматично здорові, та група контролю – 20 дітей, які були стоматологічно і соматично здорові). У дітей вивчали біохімічні показники ротової рідини. Проведені дослідження показали, що у всіх дітей з основними стоматологічними захворюваннями спостерігалось зниження місцевої неспецифічної резистентності, послаблення антиоксидантного захисту, посилення запальних процесів, дисбіотичний зсув, порушення функціональних реакцій в порожнині 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.

Development and implementation of methods and means of prevention of major dental diseases (MDD) in children is an important problem of public health in Ukraine [7]. Therefore, the study of the development trends and features of the course of caries, periodontal tissue disease and deterioration of oral hygiene in children, especially on the background of combined somatic pathology or excess body weight (EBW) and obesity is extremely relevant [4, 8].

According to a report by the World Health Organization's Committee on Obesity, overweight and obesity are now so common that they affect public health more than traditional public health problems, including starvation and infectious diseases [6]. In Ukraine, as well as in the Odesa region, there is an increase in the prevalence of obesity and EBW among children [1].

Today, special attention is paid to the state of microbiocenosis, or more precisely, dysbiosis in the oral cavity, which in turn 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 [15]. Therefore, the microflora of the oral cavity is a highly sensitive indicator system that reacts with qualitative and quantitative changes to alterations in the state of various organs and systems of the body, especially in childhood, and requires further study.

The purpose of the study was to establish the biochemical indicators of the oral fluid of children with major dental diseases against the background of excess body weight and its direct correction of the microbial composition of the oral cavity for such a population.

Materials and methods. 88 children aged 15 to 18 took part in clinical examinations. The main cohort group was formed according to the "inclusion/exclusion" criteria, which included 48 children, a comparison group of 20 children of the same age with major dental diseases on the background of harmonious physical development, and a control group of 20 children who were dentally and physically healthy.

The criteria for selecting healthy children were: the complete absence of chronic somatic and infectious diseases, the absence of acute diseases during the 3 weeks before the examination, the absence of complaints, the correspondence of the biological age to the passport, physical development was noted as harmonious (HPD) and met the age standards of physical development by all anthropometric indicators, currently operating in Ukraine and in comparison with the standards recommended by the WHO for the European region.

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.

The study was randomized. Allocation of patients into groups was carried out by the method of simple randomization with elements of stratification. Verification of the diagnosis was carried out on the basis of generally accepted diagnostic methods and according to diagnostic protocols. All children and their parents were informed about the essence of the clinical study and the child was finally enrolled in the cohort group only after signing the informed consent. At this stage, biochemical indicators of oral fluid were studied in depth (markers of inflammation – elastase activity and malondialdehyde (MDH) content, antioxidant protection – catalase activity, antioxidant-prooxidant index (API); enzyme of antimicrobial protection – lysozyme; the degree of growth and reproduction of pathogenic and conditionally pathogenic microflora – urease activity and the degree of dysbiosis (DD) was calculated [2, 3, 9].

The results were processed by variational statistical methods of analysis using the Microsoft Office Excel 2016 software. 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 $p < 0.01$ [5].

Results of the study and their discussion. Table 1 shows the results of the study of the level of inflammatory markers in observed children.

Table 1

Inflammatory markers in the oral fluid of children with MDD on the background of EBW, $M \pm m$

Indices	MDH content mmol/l	Elastase activity, $\mu\text{kat/l}$
Groups		
Control group	0.150 ± 0.008	0.50 ± 0.03
Comparison group	0.224 ± 0.007 $p < 0.05$	0.92 ± 0.05 $p < 0.05$
Main group	0.356 ± 0.020 $p < 0.05$ $p_1 < 0.05$	1.47 ± 0.05 $p < 0.001$ $p_1 < 0.05$

Note. p – the index of the reliability of differences relative to a control group; p_1 – the index of the reliability of differences relative to the comparison group.

The presence of MDD also leads to an increase in lipid peroxidation in the oral cavity, as evidenced by an increase in the level of MDH in the oral fluid of children with HPD. When gingivitis or periodontitis is combined with EBW, the MDH content in the oral fluid increases to a greater extent. Thus, if the MDH level increased by 1.49 times in the children of the comparison group, this indicator was increased by 2.37 times in the oral fluid of the children of the main group compared to the values in the control group.

Elastase is one of the most powerful destructive enzymes produced by leukocytes and microorganisms. The activity of this marker of inflammation in the oral fluid of children with MDD on the background of HPD is increased 1.84 times. The presence of EBW in children with MDD leads to a 2.94-fold increase in elastase activity in their oral fluid compared to controls.

Table 2 summarizes the results of the study of the main indicators of the antioxidant system.

Table 2

Indices of catalase activity and API index in the oral fluid of children with MDD on the background of EBW, M \pm m

Groups	Catalase activity, mcat/l	API
Control group	0.274 \pm 0.010	1.82 \pm 0.20
Comparison group	0.195 \pm 0.006 p<0.05	0.87 \pm 0.07 p<0.05
Main group	0.151 \pm 0.009 p<0.05 p ₁ <0.05	0.42 \pm 0.05 p<0.001 p ₁ <0.05

Note. p – the index of the reliability of differences relative to a control group; p₁ – the index of the reliability of differences relative to the comparison group.

On the background of intensification of inflammatory processes in the oral cavity of children with gingivitis, antioxidant protection is reduced, as evidenced by the indicators of oral fluid, namely a 28.8 % decrease in the activity of the main antioxidant enzyme catalase. In the oral fluid of children of the main group, catalase activity decreased by 44.9 % compared to this indicator in the control group.

The API index most strongly indicates violations in the “antioxidant protection – peroxide processes” system. Thus, in children of the comparison group, it is reduced by 52.2 %, and in the presence of combined pathology (main group) – by 76.9 %.

We determined the presence of violations of local nonspecific reactivity of the oral cavity, by determining the activity of lysozyme and urease, as mediated factors of dysbiotic disorders of the oral cavity in children with EBW. Since opportunistic and pathogenic microbiota, unlike normal ones, produce urease, it is enough to limit the definition of these indicators in order to judge dysbiotic changes in the oral fluid microbiota.

The results of the study of the activity of urease and lysozyme in the oral fluid, as well as the calculation of the degree of dysbiosis in the oral cavity in the examined children are presented in figures 1–3.

In children with EBW, this indicator of urease activity significantly increases by 7.1 times compared to the index in the control group and by 2.7 times – compared to the values of the comparison group children (p<0.001; p<0.05; accordingly). These data indicate that not only inflammatory processes in the periodontium, but also EBW increase the reproduction of pathogenic bacteria in the oral cavity.

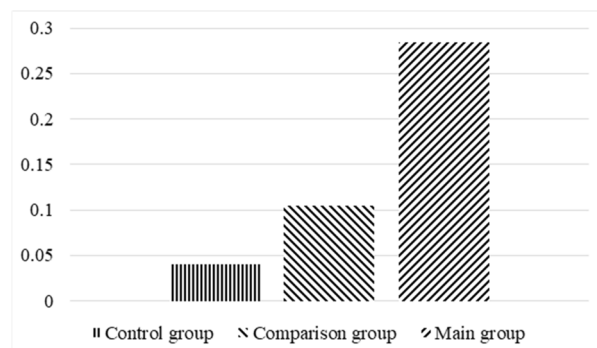


Fig. 1. Indices of urease activity in the oral fluid of children with MDD on the background of EBW, μkat/l

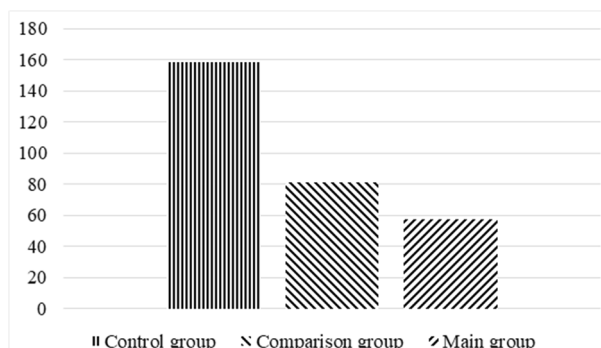


Fig. 2. Indices of lysozyme activity in the oral fluid of children with MDD on the background of EBW, units/l.

Probably, one of the reasons for the excessive reproduction of pathogenic microbiota can be a decrease in the activity of lysozyme, since this enzyme is key in the system of antimicrobial protection of mucous membranes, including the oral cavity. Thus, the activity of lysozyme in the oral fluid of the children of the comparison group decreased by 48.7 %, and in the children of the main group – by 63.9 %.

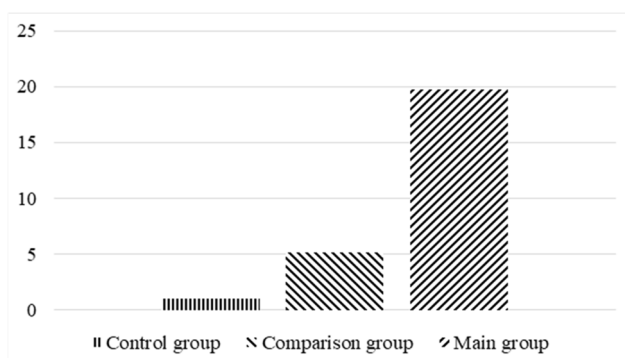


Fig.3. Indicators of the degree of dysbiosis in the oral fluid of children with MDD on the background of EBW, units/l.

Therefore, an increase in the activity of urease and a simultaneous decrease in the activity of lysozyme in the oral fluid indicates an excessive growth of opportunistic and pathogenic microbiota on the background of a decrease in non-specific antimicrobial protection in the oral cavity, which is more pronounced in children of the main group. The degree of dysbiosis most clearly reflects these disorders. DD in the oral cavity increased by 5.1 times in children of the comparison group, and by 19.7 times compared to the values of the control group in patients of the main group with combined pathology.

It is known that the occurrence and course of periodontal tissue diseases are influenced by metabolic disorders in the human body. At the same time, the fact that the percentage of children and adolescents with metabolic syndrome and, in particular, with EBW is increasing every year, which is due to an unfavorable environmental situation, excessive stress loads, the spread of bad habits and an unhealthy lifestyle [10–14], as well as deterioration of the quality and structure of the population's diet and a sedentary lifestyle. Therefore, there are only isolated reports devoted to the study of changes in the microbiocenosis of the oral cavity in children with dietary and constitutional obesity. Considering the fact that today there is no single comprehensive approach to the assessment of the state of the microbiocenosis of the oral cavity in patients with EBW, as well as no methods of treatment and prevention of dysbiotic changes in the oral cavity in patients with concomitant somatic pathology, including obesity and EBW, have been developed, solving these issues is extremely urgent. Clinical and laboratory studies have shown that in all children with major dental diseases there was a decrease in local non-specific resistance, a weakening of antioxidant protection, an increase in inflammatory processes, a dysbiotic shift, a violation of functional reactions in the oral cavity, however, in children with excessive body weight, violations in 1.3–3.9 times higher than similar indicators in children with harmonious physical development. The fact of changes in the microbiota of the oral cavity in children with EBW requires the admission of more correct and differentiated schemes of prevention and therapy of this change in order not only to restore the microscape of the oral cavity, but also to reduce the inflammatory process of mucous tissues in it. Thus, in children with EBW, the activity of lysozyme is significantly reduced and the activity of urease is sharply increased, which indicates a shift in the ratio of normal microbiota in the body as a result of the development of disorders of local non-specific immunity, which can become the basis for further research in this direction, as well as the basis for prescribing preventive and therapeutic means.

Conclusion

Our studies confirmed the presence of inflammatory reactions, intensification of peroxidation and the reproduction of opportunistic and pathogenic microbiota on the background of a decrease in non-specific antimicrobial and antioxidant protection in the oral cavity during gingivitis.

1. Excessive body weight significantly worsens the already existing disturbances in the oral cavity during gingivitis. Most likely, the root cause of pathological changes in the oral cavity is dysbiosis or increased growth of opportunistic and pathogenic bacteria in EBW.

2. The given data suggest that pathogenic bacteria in dysbiosis in the oral cavity and/or intestines provoke the development of systemic inflammation with the activation of free-radical peroxide reactions, thereby increasing pathological changes in the oral cavity in MDD in children.

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A.D. Shkodina, K.A. Taryanyk
Poltava State Medical University, Poltava

THE USAGE OF ELECTRONEUROMYOGRAPHY FOR OPTIMIZATION DIAGNOSTIC APPROACHES TO PARKINSON'S DISEASE

e-mail: a.shkodina@pdmu.edu.ua

Motor and sensory symptoms in patients with Parkinson's disease are usually measured by clinical scales with subjective assessments. That is why the development of new techniques and improvement of objective methodology is necessary for clinical practice. We conducted an analytical cross-sectional study based on the Parkinson's disease and other neurodegenerative diseases centre based on Poltava State Medical University in the period 2020–2021. We performed a factor analysis of features of electroneuromyography. We determined indicators and their relationships that characterize the tremor and the severity of the cubital syndrome on the dominant side, as well as the severity of the carpal syndrome on the non-dominant side in patients with Parkinson's disease. Thus, the usage of factor loads determined by the results of our study allows optimizing the diagnostic approach to peripheral lesions in Parkinson's disease by calculating the severity of tremor and tunnel neuropathies in these patients.

Key words: Parkinson's disease, tremor, carpal tunnel syndrome, cubital tunnel syndrome, electromyography, factor analysis.

A.D. Шкодіна, К.А. Таряник

ВИКОРИСТАННЯ ЕЛЕКТРОНЕЙРОМІОГРАФІЇ ДЛЯ ОПТИМІЗАЦІЇ ДІАГНОСТИЧНИХ ПІДХОДІВ ПРИ ХВОРОБІ ПАРКІНСОНА

Хвороба Паркінсона характеризується розвитком моторних симптомів, зокрема брадикінезії, м'язової ригідності та тремору, а також немоторних симптомів, зокрема порушень сну, настрою, серцево-судинної та травної системи і сенсорні розлади. Моторні та сенсорні симптоми зазвичай при хворобі Паркінсона аналізуються за клінічними шкалами з суб'єктивними оцінками. Тому необхідний розвиток нових технік та оптимізація об'єктивних методик у клінічній практиці. Нами проведено крос-секційне аналітичне дослідження на базі центру хвороби Паркінсона та інших нейродегенеративних захворювань при Полтавському державному медичному університеті у період 2020–2021 рр. Нами виконано факторний аналіз електронейроміографічних показників. Було визначено показники, які характеризують тремор та тяжкість карпального і кубітального тунельних синдромів у пацієнтів з хворобою Паркінсона. Так використання факторних навантажень, встановлених за результатами нашого дослідження, дозволяють оптимізувати діагностичні підходи до периферичних уражень при хворобі Паркінсона та розрахувати тяжкість тунельних нейропатій і вираженість тремору.

Ключові слова: хвороба Паркінсона, тремор, карпальний тунельний синдром, кубітальний тунельний синдром, електронейроміографія, факторний аналіз.

The study is a fragment of the research project "Clinical, molecular genetics and neurophysiologic features of the course of the various forms of Parkinson's disease", state registration No. 0119U102848.

Parkinson's disease (PD) is a common neurodegenerative disease of the nervous system, characterized by steady progression, which inevitably leads to disability [10]. PD is a chronic, progressive age-related disorder characterized by motor (bradykinesia, muscle rigidity, tremor) and non-motor symptoms, including neuropsychiatric, sensory, autonomic, and olfactory disorders [13].

Neurophysiological methods play an important role in diagnosing PD and comorbid disturbances. One of them is electroneuromyography (ENMG) which assesses the function of peripheral nerves and