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Violation of the regulation of cytokine in chronic catarrhal gingivitis in overweight children

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ABSTRACT

Introduction. The development of inflammation in the periodontium is inextricably linked to the system processes in the organism, including an accompanying pathology, which is often parallel. The WHO particularly emphasizes the dissemination of overweight among children. Against the background of excessive weight gain in children there are the series metabolic disorders that provoke chronic diseases, including chronic catarrhal gingivitis.
Aim. The aim of this study was to identify the dynamics of cytokines (IL-4, IL-6) in oral fluid and characterize the immune system of the oral cavity in children with overweight and obesity.
Material and Methods. This study presents the results of examination of 80 children with overweight and obese patients with chronic catarrhal gingivitis (CCG), aged 12–15 years. Based on anthropometric surveys body mass index (BMI) was calculated. Also the obtained measurements and calculations were evaluated by percentile tables that were designed by the WHO in 2007 for children and adolescents 5 to 19 years for both sexes separately (WHO, 2007). The content of interleukin (IL-4; IL-6) in oral fluid in children was determined by using kits of reagents of company "Vector-Best" (Russia), based on solid-phase "sandwich" variant of immunoenzyme analysis.
Results. The level of IL-4 in the oral fluid of children with chronic catarrhal gingivitis decreases (1.8 times) with increasing of age and with the deepening of violations of fat metabolism. The level of IL-6 in the oral fluid of children with chronic catarrhal gingivitis increases (2.9 times) with increasing of age and the presence of excess body weight and obesity.
Conclusions. Further study of interleukin imbalance in the oral fluid of patients with chronic catarrhal gingivitis and overweight is a promising area of research to develop methods of prevention and pathogenic therapy.

Keywords: cytokine, chronic catarrhal gingivitis, overweight children, oral fluid.

Introduction

The problem of the origin and development of the diseases of periodontal tissues is relevant not only for adults but also for children. The significant place in the structure of periodontal tissue diseases in children is occupied by chronic catarrhal gingivitis [4–6]. It is known that the development of inflammation in the periodontium is inextricably linked to the system processes in the organism, including an accompanying pathology, which is often parallel.

The WHO particularly emphasizes the dissemination of overweight among children. Against the background of excessive weight gain in children there are the series metabolic disorders that provoke chronic diseases [7]. It is known that adipocytes of the fat tissue secrete over 50 biologically active substances - adipokines, which have different biological effects that may cause the development of obesity related metabolic abnormalities, including insulin resistance and dyslipidemia. The increased expression of adipokines in children with excessive fat deposition is associated not only with increased volume of fat, but also with elevating their synthesis per unit of mass of fatty tissue. Chronic increase in local and / or systemic concentrations of adipokines makes a significant contribution in the development of metabolic syndrome. Thus,

TNF-α, interleukin-6 (IL-6) and resistin play a key role in the development of chronic inflammation. It is also known that TNF-α is the main factor that determines the development of insulin resistance in obesity [1].

Therefore, research content and activity of cytokines in oral fluid in children with overweight and obesity may be considered relevant and appropriate.

The aim of this study was to identify the dynamics of cytokines (IL-4, IL-6) in oral fluid and characterize the immune system of the oral cavity in children with overweight and obesity.

Material and Methods

This study presents the results of examination of 80 children with overweight and obese patients with chronic catarrhal gingivitis (CCG), aged 12–15 years. 40 children of the group were 12 years old (20 overweight, 20 obese) and 40 children were 15 years old (20 overweight, 20 obese) from Lviv schools № 4, 28, 53. In comparative terms and in full methodological volume there were examined 30 somatically healthy children (aged 12–15 years) with normal body weight (a comparison group) and chronic catarrhal gingivitis.

Dental diagnosis was set on the totality of clinical manifestations of the disease, according to the classification by M.F. Danilevsky. Evaluation of the physical development of children was conducted according to anthropometric measurements. Based on anthropometric surveys body mass index (BMI) was calculated. Also the obtained measurements and calculations were evaluated by percentile tables that were designed by the WHO in 2007 for children and adolescents 5 to 19 years for both sexes separately [12].

The collection of the oral fluid for laboratory tests was carried out in the morning on an empty stomach by spitting into the measuring centrifuge tubes volume of 5 ml. The content of interleukin (IL-4; IL-6) in oral fluid in children was determined by using kits of reagents of company "Vector-Best" (Russia), based on solid-phase "sandwich" variant of immunoenzyme analysis. Interleukin in oral fluid of children with overweight and obese patients with chronic catarrhal gingivitis (CCG) was analysed and compared with healthy children with normal weight and with chronic catarrhal gingivitis (CCG).

The research was approved by the Human Research Ethics Committee of the Danylo Halytsky Lviv National Medical University on 20.01.2015, protocol № 1.

Results and Discussion

As it is shown in **Table 1**, the investigated levels of interleukin in oral fluid were significantly different in the examined groups of children. The content of IL-4 in the group of 12-year-old overweight children with CCG decreased 1.14 times comparing with the group of children with normal weight and CCG (the comparison group). In 12-year-old children with obesity a marked reduction in the concentration of IL-4; 1.3 times less than in the comparison group and 1.15 times less than in the peer group of overweight children was observed. The 15-year-old children with similar disorders and overweight also experienced a reduction of IL-4 in the oral fluid; 1.4 times less than in the comparison group and 1.23 times less than in the 12-year-olds who were overweight. The lowest level of IL-4 was observed in the group of 15-year-old obese children, 1.8 times than in the comparison group and 1.4 times than in the group of 12-year-olds with obesity.

The level of IL-6 in the oral fluid of the examined groups of children on the contrary increased. So in a group of 12-year-old overweight children with CCG upward trend in the concentration of IL-6 ($p > 0.05$) was observed. But in oral liquid of children of the same age, but with obesity content of IL-6 was 1.9 times higher than in the comparison group and 1.8 times higher than in the 12-year-old overweight children. In oral liquid of 15-year-old overweigh children with CCG the increase of the concentration of IL-6 in 2.5 times compared with the group of children with CCG but with normal body

Table 1. Levels of IL-4 and IL-6 in the oral fluid of 12- and 15-year-old children with chronic catarrhal gingivitis (CCG) with normal weight (comparison group), overweight and obesity

The examined groups	IL-4pg / ml	IL-6pg / ml	IL-6/IL-4
The comparison group	2,34 ± 0,12	6,72 ± 0,48	2,8
12-year-old overweight children with CCG	2,05 ± 0,07*	7,04 ± 0,50	3,4
12-year-old obese children with CCG	1,78 ± 0,06*Δ	13,05 ± 0,65*Δ	7,3
15-year-old overweight children with CCG	1,67 ± 0,05*#	16,6 ± 0,75*#	9,9
15-year-old obese children with CCG	1,27 ± 0,05*Δ#	19,4 ± 0,85*Δ#	15,3

Notes:
* – The likelihood of differences compared to those of controls ($p < 0.05$).
Δ – probability differences compared with those in a group of children the same age who are overweight ($p < 0.05$).
– the likelihood of differences compared with those in the group of children with some metabolic disorders, but different age ($p < 0.05$).

weight and 2.3 times compared with a similar group of 12-year-oldchildren was observed. The most pronounced increase in the content of IL-6 in the oral fluid was observed in the 15-year-old obese children: 2.9 times more than in the comparison group, at 1.17 times than in their peers who are overweight and 1.5 times compared to the group of 12-year-old children with obesity.

The imbalance between the levels of IL-4 and IL-6 in the oral fluid of groups of surveyed children is most noticeable when analyzing the ratio of these cytokines. As can be seen in **Table 1**, the value of the index increases with the age of children and the deepening of the disruption of lipid metabolism. Adipose tissue, according to researchers [3, 8] is an important endocrine organ with a number of effects, including immune system and cytokine profile. In particular, adipose tissue secretion is the source of a number of proinflammatory mediators. At the same time, obesity inhibited the synthesis of proinflammatory cytokines [10]. As a result of our research, we saw the most pronounced decrease in IL-4 in the oral fluid of 15-year-olds with obesity (1.8 times compared to the level in children with normal body weight). Several studies [2, 11] found that IL-4 inhibits destructive-inflammation in periodontal and reduces osteoporosis. Reduction of IL-4 in the oral fluid of our examined children may be associated with the presence of chronic catarrhal gingivitis.

IL-6 is one of the key mediators of inflammation in obesity. It is known that about 30% of circulating IL-6 is synthesized in adipose tissue. Rising concentrations of proinflammatory cytokines (IL-1β, IL-6) and reducing anti-inflammatory IL-4 for obesity was noted by researchers [9] in patients with deforming osteoarthritis. Our research showed that in the 15-year-old children with obesity and CCG the level of IL-6 was higher than in other groups of the surveyed children.

The study of cytokine levels in oral fluid for gingivitis allows to find out the changes of the immune regulation in the inflammation and it is not invasive and safe method for the patient.

Therefore the level of IL-4 in the oral fluid of children with chronic catarrhal gingivitis decreases (1.8 times) with increasing of age and with the deepening of violations of fat metabolism. The level of IL-6 in the oral fluid of children with chronic catarrhal gingivitis increases (2.9 times) with increasing of age and the presence of excess body weight and obesity. Further study of interleukin imbalance in the oral fluid of patients with chronic catarrhal gingivitis and overweight is a promising area of research to develop methods of prevention and pathogenetic therapy.

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Conflict of interest statement
The authors declare no conflict of interest.

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