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DEVELOPMENT OF GINGIVITIS IN RATS RECEIVING ORAL APPLICATIONS OF PEROXIDE SUNFLOWER OIL

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Abstract

Aim. Determine the condition of the gums in rats receiving oral applications of peroxide sunflower oil (PSO).

Methods. PSO was obtained by heating sunflower oil in the presence of H_2O_2 at +180°C for 60 minutes. PSO in a dose of 0.5 ml per rat was applied to the oral mucosa for 3 or 5 days. The activity of elastase, urease, lysozyme, catalase and the content of MDA (malondialdehyde) were determined in the gum. The antioxidant-prooxidant API index was calculated by the ratio of catalase and MDA, and the degree of dysbiosis was calculated by the ratio of the relative activities of urease and lysozyme..

Results. After 5 days of PSO applications, an increase in elastase activity, urease, MDA content and the degree of dysbiosis against the background of a decrease in lysozyme activity, catalase and the API index was established.

Conclusion. Oral applications of PSO cause a decrease in the level of non-specific immunity, antioxidant defense, an increase in microbial seeding, the degree of dysbiosis and the development of gingivitis.

Key words: periodontium; fat peroxidation; gingivitis; dysbiosis; lysozyme; antioxidant protection.

Introduction

Recently, the use of thermal fat cooking has become significantly more widespread, the negative consequence of which is the formation of toxic peroxidation products [1-3].

The data of experimental researches in which the negative influence of peroxide sunflower oil (PSO) on a condition of fabrics of an oral cavity at its long introduction into an organism with a food are established [4, 5]. The negative effect of PSO on the condition of other organs and tissues was noted: the mucous membrane of the colon [6] and the liver [7]. It is possible that the pathological processes that develop in the tissues of the oral cavity during the consumption of PSO are secondary, due to peroxide intoxication of other organs, including the liver, by the mechanisms of hepato-oral syndrome [8].

The aim of this work was to study the condition of the gums of rats after oral applications of PSO for a short period of research (3-5 days).

Material and research methods

PSO was obtained by heating unrefined sunflower oil at +180°C in the presence of 1.5% H_2O_2 (30 % solution) for 60 minutes.

The experiments were performed on 18 white Wistar rats (females, 4-5 months, live weight 210±12 g). Animals received complete feed (Table). Applications of PSO to the oral mucosa (OM) were made daily at a dose of 0.5 ml per rat for three or five days. After euthanasia, gums were isolated and the level of markers of inflammation was determined in their homogenate [9]: elastase activity [10] and malonic dialdehyde (MDA) content [11], as well as the activity of antioxidant enzyme catalase [12], bacterial enzyme urease [13], activity lysozyme (one of the factors of nonspecific immunity) [14].

Table. The composition of feed for rats (%)

Component	Content, %
Wheat grain is crushed	80
Soybean meal	15
Mineral mixture [18]	4
Vitamin mixture [18]	1

According to the ratio of catalase activity and MDA content, the antioxidant-prooxidant index of API was calculated [9], and according to the ratio of relative activities of urease and lysozyme, the degree of dysbiosis was calculated according to A. P. Levitsky [15].

The condition of peroxidation of PSO was determined in accordance with the recommendations [16].

The results of the experiments were subjected to standard statistical processing [17].

Results and discussion

Analysis of PSO peroxidation products showed that the content of dieneconjugates increased 6 times (2.5 mmol / l in sunflower oil and 15 mmol / l in PSO), and the MDA content increased almost 14 times (0.51 mmol / l in sunflower oil and 6.92 mmol / l in PSO).

In fig. 1 shows the level of biochemical markers of inflammation (elastase and MDA) in the gums of rats receiving oral applications of PSO. It is seen that after 3 days of application the activity of elastase increases by 27%, and after 5 days - by 51%. The content of MDA after 3 days of applications increases by 15% ($p > 0.1$), and after 5 days - by 28% ($p < 0.05$).

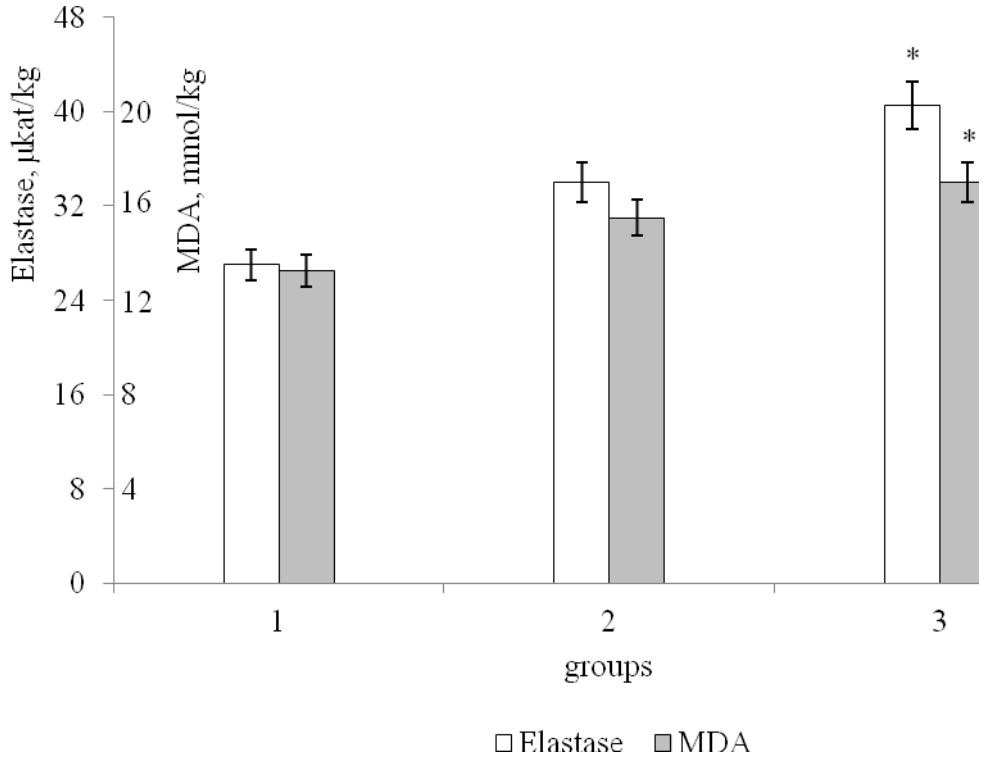

Fig. 1. The level of markers of inflammation in the gums of rats who received oral applications of PSO

(1 – control; 2 – PSO, 3 days; 3 – PSO, 5 days) * – $p < 0,05$ in comparison with gr. 1

The data obtained indicate that PSO applications cause the development of inflammatory-dystrophic process in the gums (i.e., gingivitis).

In fig. 2 shows the effect of oral PSO applications on catalase activity and API index. As can be seen from these data, catalase activity after 3 days is reduced by 3% (p> 0.05), and after 5 days by 23% (p <0.05). The API index significantly decreases after 3 days of applications (by 21%), and after 5 days by 39%.

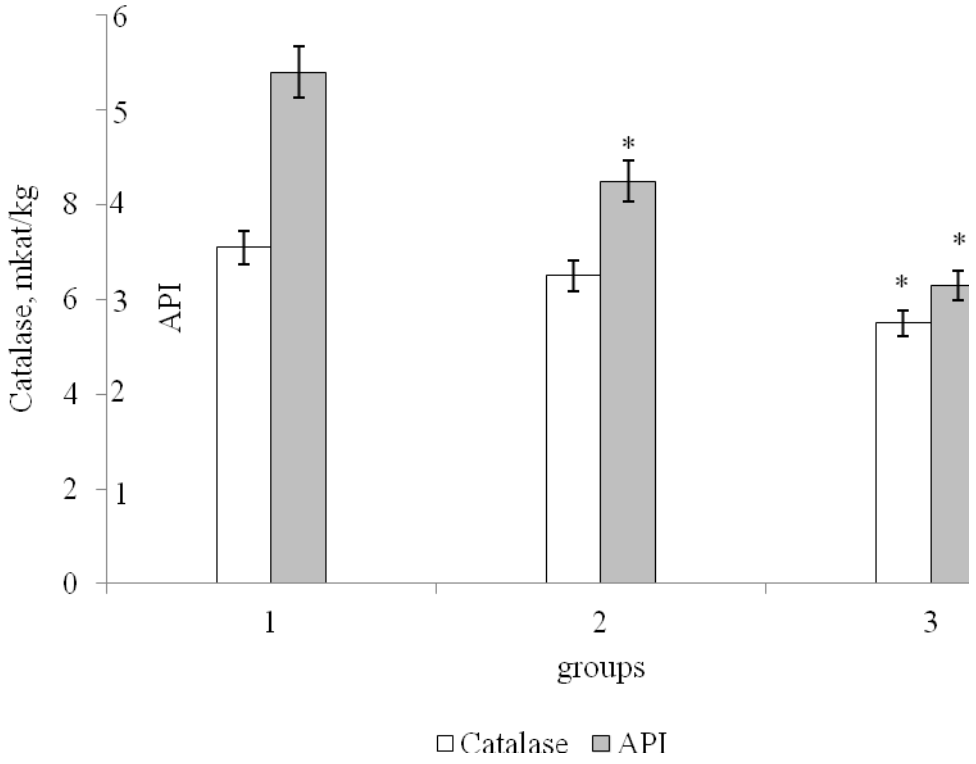

Fig. 2. Catalase activity and API index in the gums of rats receiving oral applications of PSO (1-3 – see Fig. 1) * – p <0.05 compared with gr. 1

These data indicate the suppression of the antioxidant protection system of the periodontium under the influence of PSO.

In fig. 3 presents the results of determination in the gums of rats, which made oral applications of PSO, urease activity, lysozyme and the degree of dysbiosis. It is seen that urease activity significantly increases after 3 days of PSO applications (by 70%), and after 5 days by 132%. This indicates a significant increase in bacterial contamination of the gums of rats, which made applications of PSO.

Lysozyme activity, on the contrary, decreases after 3 days by 18% (however p> 0.05), and after 5 days decreases by 44% (p <0.01). The obtained data indicate a decrease in the level of nonspecific immunity in the periodontium of rats treated with PSO.

As a result, we have a significant increase in the degree of dysbiosis in the gums: after 3 days almost 2 times, and after 5 days - 4 times.

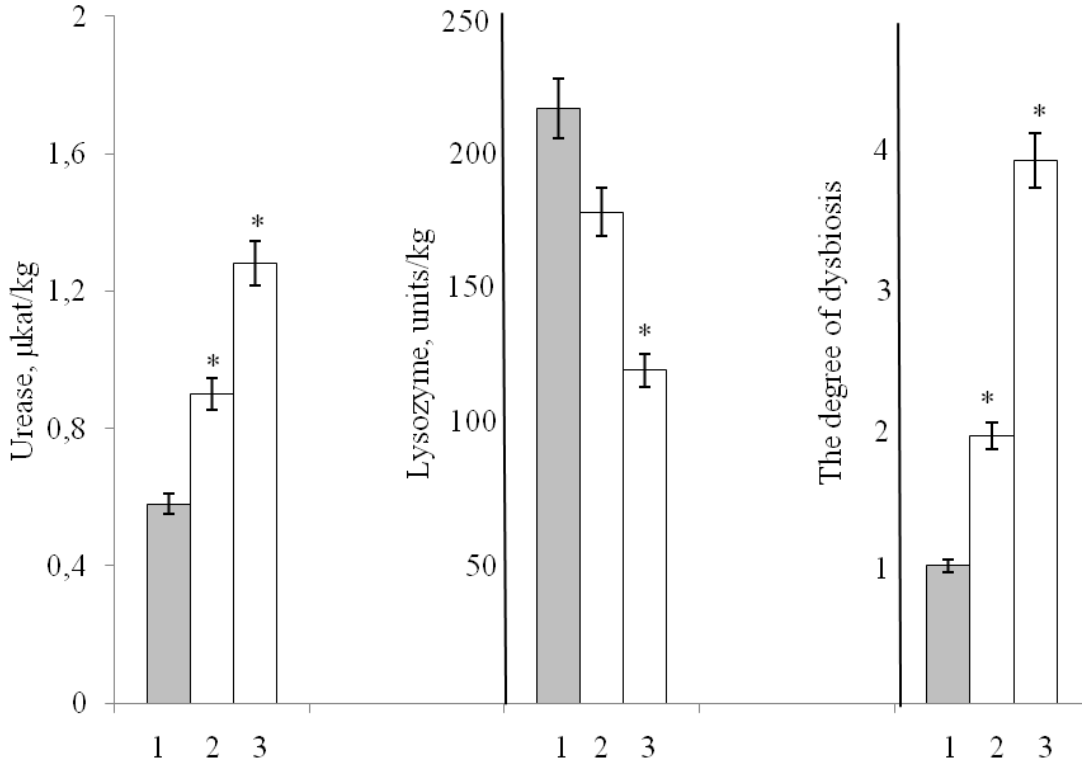

Fig. 3. The activity of urease, lysozyme and the degree of dysbiosis in the gums of rats who received oral applications of PSO (1-3 – see Fig. 1) * – p <0,05 compared with gr. 1

In a number of experimental works [19, 20] it was shown that the development of dental complications with long-term consumption of PSO can be prevented by the introduction of multifunctional means with food.

Given the results of this study, which showed the direct effect of toxic substances PSO on the condition of the periodontium, there is a need to use somatotropic antiperoxides (in the form of mucosa-adhesive gels or dental elixirs).

Unfortunately, it is very difficult to limit the consumption of thermally oxidized dietary fats to a large extent, given the conservatism of human taste preferences.

Conclusions

1. Oral applications of peroxide sunflower oil reduce the level of nonspecific immunity and antioxidant protection in the periodontium, resulting in the development of dysbiosis and inflammation.

2. To prevent dental complications when consuming thermally oxidized fats, it is necessary to limit their consumption or search for protective equipment.

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