

THERAPEUTIC AND PREVENTIVE EFFECTS OF POLYFUNCTIONAL ANTIDISBIOTICS DRUGS ON THE CONDITION OF PERIODONTAL BONE TISSUE OF RATS, WHO HAVE CONSUMED THERMOPEROXIDE SUNFLOWER OIL FOR A LONG TIME

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Abstract

Aim: to determine the effectiveness of the therapeutic and prophylactic action of various polyfunctional antidisbiotic drugs (PFAD) on the state of the periodontal bone tissue of rats treated with thermoperoxide sunflower oil (TPSO).

Methods: used sunflower oil, oxidized in the presence of copper ions at a temperature of +115 °C for 2 hours. The following PFAD were used: kvertulin, lekvin, lekasil, lysozyme-forte. Rats were injected with food TPSO at a dose of 1 ml per rat for 75 days. PFAD was administered with food at a dose of 300 mg / kg, starting from day 31. The degree of dysbiosis in the tissues of the oral cavity, in the mucous membrane of the colon and in the liver was determined. In the bone tissue of the periodontium, the content of calcium, the activity of alkaline and acid phosphatases, as well, as the degree of atrophy of the bone tissue of the periodontium were determined. The mineralizing index MI was calculated from the ratio of phosphatase activities.

Results: in rats treated with TPSO, the degree of dysbiosis significantly increased in all studied tissues. In bone tissue, the activity of alkaline phosphatase significantly decreases and the activity of acid phosphatase increases. The MI index sharply (2 times) decreases and the degree of atrophy increases significantly. The introduction of PFAD slightly increases the calcium content, significantly increases the alkaline activity and decreases the acid phosphatase activity. Of all PFAD, only lysozyme-forte significantly increases the MI index and reduces the degree of atrophy.

Conclusion: long-term consumption of peroxide oil calls for the development of dystrophic processes in the bone tissue of the periodontium, which can be prevented with the help of PFAD, of which lysozyme-forte turned out to be the most effective.

Keywords: *periodontium, bone tissue, remedies.*

Introduction

In the process of thermal cooking of fats or fat-containing products from unsaturated fatty acids, toxic products (peroxides, trans-isomers, aldehydes, ketones) are formed, which cause the development of inflammatory-dystrophic processes in the body [1].

In the gums of rats treated with thermoperoxide sunflower oil (TPSO), the content of the bacterial enzyme urease increases, the activity of the antimicrobial enzyme lysozyme decreases and the level of inflammatory markers increases significantly: elastase activity and malonic dialdehyde content (MDA) [2, 3].

The use of polyfunctional antidiabetic drugs (PFAD), which contain antioxidants, prebiotics, membrane protectors [4], has significantly prevented the development of inflammatory-dystrophic processes in the gums of rats treated with TPSO [3].

The aim of this work was to determine the therapeutic and prophylactic effect of PFAD on the bone tissue of periodontal rats, which for a long time received with feed TPSO.

Materials and methods

TPSO was obtained by heating sunflower oil in the presence of copper ions at a temperature of 115 °C for 2 hours [5]. PFAD, which were used in the work, are presented in table 1. All of them are made by the SPA "Odessa Biotechnology".

Biological experiments were performed on 41 Wistar rats (males, 7 months, live weight 238-283 g), which were divided into 6 groups: 1 - control, 2-6 groups were fed 1 ml of TPSO daily for 75 days. Rats of the 3rd group, starting from the 31st day of the experiment, received with feed kvertulin at a dose of 300 mg / kg, rats of the 4th group received lekvin similarly, rats of the 5th group lekasil and rats of the 6th group lysozyme-forte.

Euthanasia of animals was performed on day 76 under thiopental anesthesia (20 mg / kg) by total bleeding from the heart. Received the mucous membrane of the cheeks, gums, bone tissue of the alveolar bone of the lower jaw, the mucous membrane of the large intestine and the liver.

In homogenates of all tissues, except bone, the activity of lysozyme [6], urease [6] was determined

and the degree of dysbiosis was calculated according to A.P. Levitsky according to the ratio of their relative activities [7, 8]. The content of calcium [9], the activity of alkaline (ALF) and acid (ACF) phosphatases [9] was determined in the bone tissue homogenate and the mineralizing index of MI was calculated according to their ratio [10]. The degree of atrophy of the alveolar bone was also determined [9].

The research results were subjected to standard statistical processing [11].

Experimental studies were conducted in accordance with the rules established by the Directive of the European Parliament and the Council (2010/63 / EU), by the order of the Ministry of Education and Science, Youth and Sports of Ukraine No. 249 of March 1, 2012 "On Approval of the Procedure for conducting scientific experiments, experiments on animals by scientific institutions " and methodical recommendations.

Results

In fig. 1 presents the results of determining the degree of dysbiosis in the studied tissues of rats treated with TPSO. As can be seen from these data, in rats treated with TPSO, in all tissues significantly increases the degree of dysbiosis, In the tissues of the oral cavity, the degree of dysbiosis in rats treated with TPSO increases by 1.8-2 times, and mostly in the liver (4 times) and in the mucous membrane of the colon (7 times).

Table 2 presents the results of determination of calcium content and phosphatase activity in periodontal bone tissue. As can be seen from these data, the calcium content of rats treated with TPSO tends to decrease (by 9%), but the introduction of PFAD tends to increase: kvertulin by 13%, lekvin by 20%, lekasil by 22% and lysozyme-forte at 23%.

The activity of ALF in the bone tissue of the periodontium is reduced in rats treated with TPSO, by 21%, but with the introduction of PFAD, it increases: kvertulin by 20.5%, lekvin by 31%, lekasil by 28% and lysozyme forte by 19.4%.

ACF activity, in contrast, increased in rats treated with TPSO by 59.5%. The introduction of PFAD significantly reduces the activity of AF: kvertulin by 23.5%, lekvin by 21.6%, lekasil by 37.8% and lysozyme-forte by 79.5%.

In fig. 2 presents the results of determining the bone mineralization index (MI) and the degree of atrophy of the alveolar bone. As can be seen from these data, in rats treated with TPSO, MI is reduced by half, but in rats treated with PFAD, this figure increases significantly: after kvertulin by 57.6%, after lekvin by 67.7%, after lekasil by 107 %, and after lysozyme-forte by 136.4%.

In rats treated with TPSO, there is a tendency to increase atrophy (by 7.4%). The introduction of PFAD tends to reduce the degree of atrophy, but only lysozyme-forte significantly reduces the degree of atrophy by 16.4%.

Thus, we have shown that long-term consumption of TPSO causes the development of dysbiosis in the body, against which dystrophic processes occur in the bone tissue of the periodontium. Perhaps the main pathogenic factor of dysbiosis, namely lipopolysaccharide [12], activates osteoclasts, as evidenced by a significant increase in acid phosphatase [13].

Of all the PFAD we studied, lysozyme-forte, which contains the enzyme lysozyme, which is able to bind lipopolysaccharide, proved to be the most effective [14].

Conclusions

1. Consumption of thermoperoxide sunflower oil causes the development of dysbiosis in the organism.

2. Against the background of dysbiosis develops periodontal atrophy.

3. Lysozyme-forte was the most effective treatment and prevention.

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Table 1. The composition of PFAD

PFAD	Composition
Kvertulin	Bioflavonoid quercetin, prebiotic inulin, calcium citrate
Lekvin	Lecithin, quercetin, inulin, calcium citrate
Lekasil	Lecithin, milk thistle pomace, calcium citrate
Lysozyme-forte	Lysozyme, quercetin, inulin, gelatin, calcium citrate

Table 2. The effect of different PFAD on calcium content and phosphatase activity in the periodontal bone tissue of rats treated with TPSO

NºNº	Groups	Calcium, mol / kg	ALF, mk-cat / kg	ACF, mk-cat / kg
1	Control	1,73±0,24	46,1±3,5	2,32±0,09
2	TPSO	1,57±0,15 p>0,3	36,7±3,3 p<0,05	3,70±0,19 p<0,01
3	TPSO + kvertulin	1,78±0,15 p>0,6 p ₁ >0,3	44,3±5,6 p>0,5 p ₁ >0,3	2,83±0,15 p<0,05 p ₁ <0,05
4	TPSO + lekvin	1,89±0,11 p>0,3 p ₁ >0,05	48,1±2,6 p>0,3 p ₁ <0,05	2,90±0,15 p<0,05 p ₁ <0,05
5	TPSO + leckasil	1,91±0,13 p>0,3 p ₁ >0,05	47,1±5,9 p>0,5 p ₁ >0,05	2,30±0,21 p>0,8 p ₁ <0,01
6	TPSO + lysozyme-forte	1,93±0,17 p>0,3 p ₁ >0,05	43,9±4,4 p>0,5 p ₁ >0,05	1,87±0,30 p>0,05 p ₁ <0,05

Note: p – in comparison with gr. 1; p₁ – in comparison with gr. 2

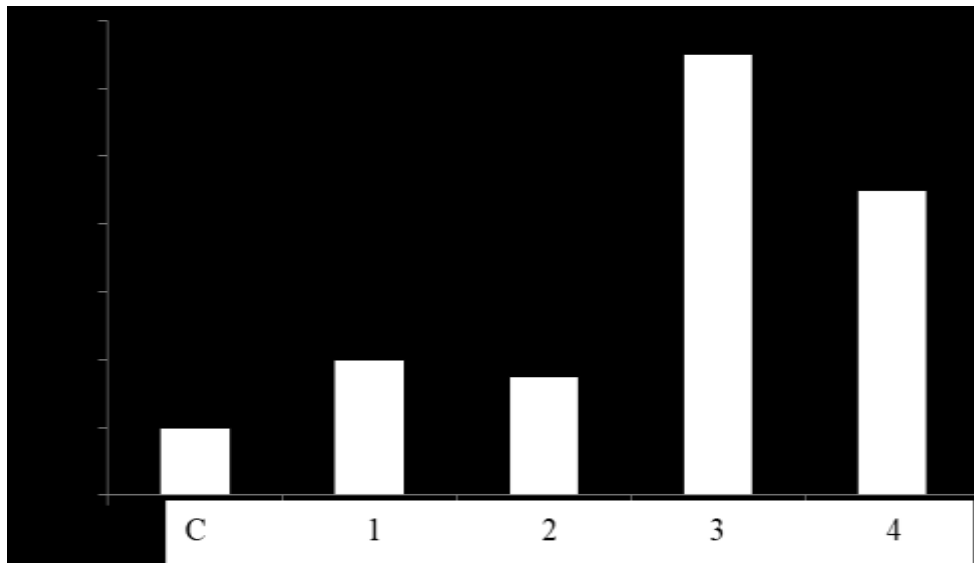


Figure 1. The degree of dysbiosis in the tissues of rats treated with TPSO (C – control, 1 – the mucous membrane of the cheek, 2 – the gums, 3 – the mucous membrane of the colon, 4 – the liver)

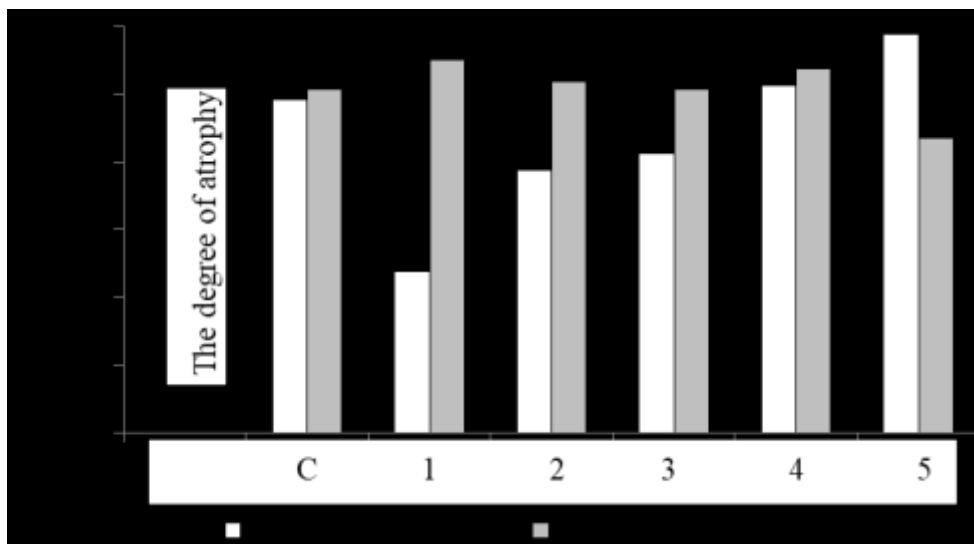


Figure 2. The effect of different PFAD on the level of mineralizing index MI and the degree of atrophy of the periodontal tissue of rats treated with TPSO (C – control, 1 – TPSO, 2 – TPSO + kvertulin, 3 – TPSO + lekvin, 4 – TPSO + lekasil, 5 – TPSO + lysozyme-forte)
* – in comparison with gr.1; ** – in comparison with gr.2