

Levitsky A. P., Markov A. V., Pupin T. I., Labush Iu. Z., Selivanskaya I. A., Lapinskaya A. P. Therapeutic and preventive effectiveness of oral application of phytogels “Kvertulin”, “Biotrit” and “Dubovy” in inflammatory complications in the digestive system of rats treated with thermoperoxide sunflower oil. Journal of Education, Health and Sport. 2021;11(2):81-88. eISSN 2391-8306. DOI <http://dx.doi.org/10.12775/JEHS.2021.11.2.009>
<https://apcz.umk.pl/czasopisma/index.php/JEHS/article/view/JEHS.2021.11.2.009>
<https://zenodo.org/record/4562970>

The journal has had 5 points in Ministry of Science and Higher Education parametric evaluation. § 8.2) and § 12.1.2) 22.02.2019.

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The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 11.01.2021. Revised: 10.02.2021. Accepted: 25.02.2021.

UDK 615.07615.015616.98

THERAPEUTIC AND PREVENTIVE EFFECTIVENESS OF ORAL APPLICATION OF PHITOGELS “KVERTULIN”, “BIOTRIT”, AND “DUBOVY” IN INFLAMMATORY COMPLICATIONS IN THE DIGESTIVE SYSTEM OF RATS TREATED WITH THERMOPEROXIDE SUNFLOWER OIL

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Abstract

Aim. It has been established that the consumption of thermoperoxide fats causes the development of pathological processes in the tissues of the mouth, stomach, intestines and liver. The purpose of this work is to determine the possibility of their normalization using oral applications of phytogels.

Methods. Thermoperoxide oil (TPSO) was obtained by heating sunflower oil in the presence of H₂O₂ at a temperature of +180 °C for 60 minutes. Oral TPSO applications were made on the oral mucosa at a dose of 2.25 g/kg daily for 5 days. Used mucose-adhesive phytogels "Kvertulin" (quercetin + inulin), "Biotrit" (juice from wheat sprout) and "Dubovy" (extract of polyphenolic compounds from oak wood) in the form of oral applications at a dose of 2.25 g/kg for half an hour before TPSO applications daily for 5 days. Elastase and urease

activity and malonic dialdehyde (MDA) content were determined in homogenates of the mucous membranes of the cheek, stomach, small and large intestines, as well as in the liver.

Results. Oral applications of TPSO increased the levels of MDA, elastase and urease in the tissues of the digestive system. Applications of phytogels significantly normalized these parameters.

Conclusions. Oral applications of TPSO cause the development of inflammation in the digestive system, especially in the liver. Oral applications of phytogels have a protective effect, especially "Kvertulin".

Key words: thermoperoxide oil; digestive system; phytogels; oral applications.

INTRODUCTION

In our previous works, it was shown that the consumption of thermoperoxide sunflower oil (TPSO) in rats causes the development of inflammatory-dystrophic processes in the digestive system [1-4, 13]. The use of antioxidants to prevent the formation of toxic substances in the oil during heating to high temperatures (above 150°C) has been shown to be ineffective [5].

Therefore, the aim of this work was to study the possibility of using for the prevention of pathological complications in the consumption of TPSO polyfunctional antidisbiotics means containing antioxidants and prebiotics by their oral applications in the composition of phytogels.

MATERIAL AND RESEARCH METHODS

TPSO was used in the work, which was obtained by heating ordinary sunflower oil at a temperature of +180 °C in the presence of 1.5 % H₂O₂ (30 %) for 60 minutes.

Mucosa-adhesive phytogels "Kvertulin" (containing the bioflavonoid quercetin and prebiotic inulin) [6], "Biotrit" (containing juice from wheat germ) [7] and "Dubovy" (containing a complex of phenolic compounds from oak wood) [8] were used as polyfunctional antidisbiotics means.

The experiments were performed on 30 white Wistar rats (females, 4-5 months, 210-230 g), which were divided into 5 groups: 1st - control, 2nd, 3rd, 4th and 5th and received oral applications of TPSO at a dose of 2.25 g/kg for 5 days. Rats of the 3rd group half an hour before the application of TPSO received applications of phytogel "Kvertulin" at a dose of 2.25 g/kg, rats of the 4th group received applications of phytogel "Biotrit" and rats of the 5th group - applications of phytogel "Dubovy" the same in the same way as Kvertulin. Characteristics of phytogels are presented in table 1.

Table1. Characteristics of phytogels containing antioxidants and prebiotics

Phytogel	Composition	Normative documentation
Kvertulin	Quercetin, inulin, mint extract	TS 20.4-13903778-032:2012 Conclusion of the Ministry of Health № 05.03.02-07/5025 dated 05.02.2013
Biotrit	Wheat sprout juice, mint extract	TS 20.4-13903778-032:2012 Conclusion of the Ministry of Health № 05.03.02-07/43417 dated 03.07.2014
Dubovy	Oak extract, mint extract	TS 20.4-13903778-032:2012 Conclusion of the Ministry of Health № 602-123-20-2/11705 dated 20.04.2017

Euthanasia of animals was performed on the 6th day of the experiment under thiopental anesthesia (20 mg/kg) by total bleeding from the heart.

Elastase activity [9], malonic dialdehyde (MDA) content [10] and urease activity [11] were determined in the homogenates of the oral mucosa (OM), stomach, small and large intestines, as well as in the liver.

Pathogenic (pro-inflammatory) action (PIA) TPSO was determined by the formula:

$$PIA = \sum_1^n = \frac{(x_1 - x_0) \cdot 100\%}{x_0}, \text{ where}$$

x_0 – control indicator;

x_1 – indicator of pathology;

n – number of indicators (in our case – 3).

The anti-inflammatory action (AIA) of phytogels was determined by the formula:

$$AIA = \sum_1^n = \frac{(x_1 - x_2) \cdot 100\%}{x_1}, \text{ where}$$

x_1 – indicator of pathology;

x_2 – indicator after the action of phytogel;

n – number of indicators.

Therapeutic and prophylactic efficacy (TPE) of phytogel was determined by the formula.

$$TPE = \frac{AIA}{PIA} \cdot 100\% .$$

The results of experimental studies were subjected to standard statistical processing [12].

RESULTS AND DISCUSSION

In fig. 1 presents the results of determining the activity of the biochemical marker of inflammation of the enzyme elastase in the digestive system of rats, which shows that the highest level of elastase is determined in the small intestinal mucosa and liver, and the lowest in the gastric mucosa. All rats that received oral applications of TPSO significantly increased the activity of elastase, and most of all in the mucous membranes of the stomach and colon. The use of phytogels in almost all cases significantly reduces the activity of elastase, to the greatest extent - in the mucous membranes of the stomach and colon, and the phytogel "Kvertulin" was more effective.

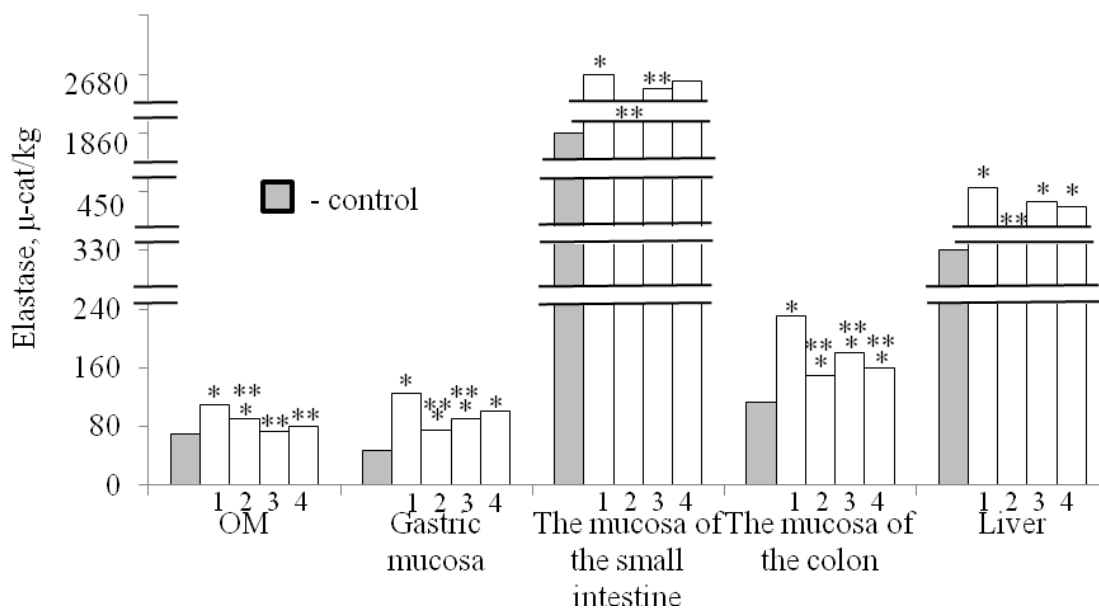


Fig. 1. Influence of oral applications of phytogels "Kvertulin" (2), "Biotrit" (3) and "Dubovy" (4) on the activity of elastase in the digestive system of rats treated with thermoperoxide sunflower oil (1) * - $p < 0,05$ in comparison with gr. The control; ** - $p < 0,05$ in comparison with gr. 1

In fig. 2 presents the results of determining the content of MDA in the digestive system of rats treated with TPSO and phytogels. It is seen that the highest content of MDA is observed in the liver, and the lowest - in the mucous membrane of the small intestine. Oral applications of TPSO significantly increase the content of MDA in all tissues, especially in the liver (almost 3 times). All phytogels significantly reduce the level of MDA, and the phytogel "Kvertulin" proved to be more effective.

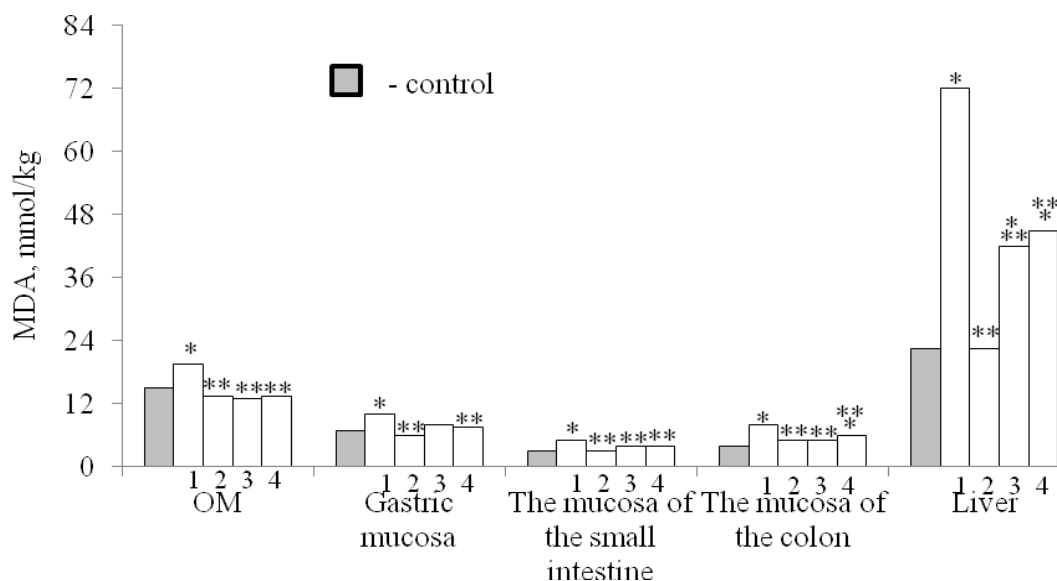


Fig. 2. Influence of oral applications of phytogels "Kvertulin" (2), "Biotrit" (3) and "Dubovy" (4) on the MDA content in the digestive system of rats treated with thermoperoxide sunflower oil (1) * - $p < 0.05$ in comparison with gr. The control; ** - $p < 0.05$ in comparison with gr. 1

In fig. 3 presents the results of determining the activity of the bacterial enzyme urease in the digestive system of rats treated with TPSO and phytogels.

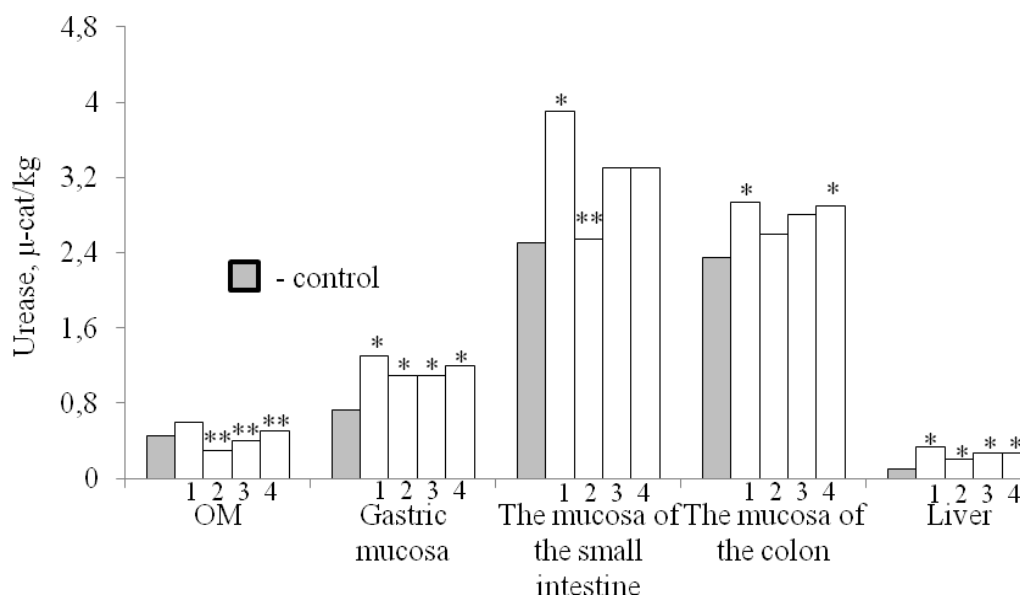


Fig. 3. Influence of oral applications of phytogels "Kvertulin" (2), "Biotrit" (3) and "Dubovy" (4) on the activity of urease in the digestive system of rats treated with thermo-peroxide sunflower oil (1) * - $p < 0.05$ in comparison with gr. The control; ** - $p < 0.05$ in comparison with gr. 1

As expected, the highest urease levels are in the intestine and the lowest in the liver. Consumption of TPSO leads to an increase in urease activity, and oral applications of phytogels significantly reduce it only in OM. Phytogel "Kvertulin" significantly (to normal) reduces the activity of urease in the small intestine.

The results of determining the anti-inflammatory activity of phytogels are presented in table 2. As can be seen from these data, the consumption of TPSO has the greatest effect on the liver, and the least - on OM. All phytogels show anti-inflammatory activity, and to the greatest extent on OM and a mucous membrane of a small intestine.

Table 2. Anti-inflammatory action (AIA) of phytogels on the digestive system of rats treated with TPSO

Organs and tissues	PIA, %	AIA, %		
		Kvertulin	Biotrit	Dubovy
OM	115,6	92,8	96,6	73,9
Stomach	270,2	85,8	63,4	52,3
Small intestine	187,2	98,1	78,8	73,9
Colon	243,9	88,5	69,1	58,8
Liver	524,1	119,1	65,5	45,3

Note: PIA- pro-inflammatory action of TPSO; AIA -anti-inflammatory action of phytogels.

In fig. 4 presents the results of determining the therapeutic and prophylactic efficacy (TPE) of phytogels.

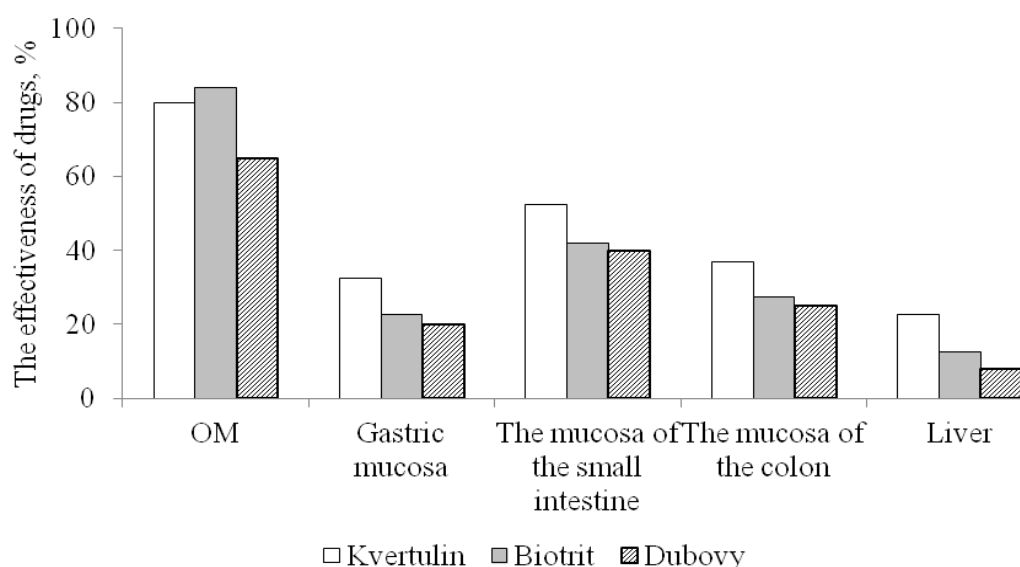


Fig. 4. Therapeutic and prophylactic efficacy (TPE) of oral applications of phytogels "Kvertulin", "Biotrit" and "Dubovy" in the digestive system of rats treated with thermoperoxide sunflower oil

As can be seen from these data, oral applications of phytogels are more effective on OM, and least effective on the liver. Of all the phytogels, the phytogel "Kvertulin" had the largest TPE.

Conclusions

1. Oral applications of TPSO cause the development of pro-inflammatory processes in the digestive system of rats, and mostly in the liver.
2. Oral applications of phytogels have a preventive (anti-inflammatory) effect, mainly on the OM and small intestine, and least of all – on the liver.
3. Of all the phytogels, Kvertulin was the most effective.

REFERENCES

1. Markov AV, Labush IuZ., Khodakov IV [and others]. Influence of oral fatty applications on biochemical indicators of inflammation and dysbiosis in the tissues of the rat mouth. *Journal of Education, Health and Sport*. 2018; 8(10): 392-404. DOI <http://dx.doi.org/10.5281/zenodo.1889334>
2. Labush IuZ. Prevention by anti-dysbiosis mucosal adhesive gels stomatitis in rats treated with oral applications of peroxide sunflower oil. *Dentistry Bulletin*. 2019; 10: 10-13. (in Ukrainian)
3. Markov AV, Pupin TI, Levitsky AP. The therapeutic and prophylactic effect of phytogels on the condition of the gums of rats that received oral application of thermoperoxide sunflower oil. *Phytotherapy*. 2020; 2: 21-25. (in Ukrainian)
4. Markov AV. Development of gingivitis in rats receiving oral applications of peroxide sunflower oil. *Journal of Education, Health and Sport*. 2020; 10(6): 334-340. eISSN 2391-8306. DOI <http://dx.doi.org/10.12775/JEHS.2020.10.06.035>
5. Makarenko MA, Malinkin AD, Bessonov VV [and others]. Products of secondary oxidation of edible oils and fats. Human health risks assessment (Report 1). *Nutrition issues*. 2018; 87(6): 125-138. (in Russian)
6. Levitsky AP, Makarenko OA, Selivanskaya IA [and others]. "Querthulin", Vitamin P, prebiotic, hepatoprotector. *Odessa, KP OGT*, 2012: 20. (in Russian)
7. Bocharov AV. Mucosaprotective action of the phytopreparation "Biotrit" at experimental hepatogenic colitis. *Journal of Education, Health and Sport*. 2017; 7(4): 988-996. eISSN 2391-8306. DOI <http://dx.doi.org/10.5281/zenodo.2651353>

8. Levitsky AP, Makarenko OA, Khodakov IV [and others]. Hepatoprotective properties of polyphenols substances of Oak extract. Journal of Education, Health and Sport. 2016; 6(11): 537-547. eISSN 2391-8306. DOI <http://dx.doi.org/10.5281/zenodo.192393>. (in Russian)
9. Levitsky AP, Stefanov AV. The methods of the determination of the activity of elastase and its inhibitors: method guidelines. Kiev, GFK, 2002:15. (in Russian)
10. Stalnaya ID., Garishvili TG. The method of revelation of malonic dialdehyde with thiobarbituric acid. The contemporary methods in biochemistry. Moskva, Meditsina, 1977: 66-68. (in Russian)
11. Gavrikova LM, Segen IT. Urease activity of oral liquid in patients with acute odontogenic infection of maxillo-facial part. Stomatology. 1996; The extra issue: 49-50. (in Russian)
12. Truhacheva NV. Mathematical Statistics in biomedical research using application package Statistica. Moskow, GJeOTAR-Media, 2012: 379. (in Russian)
13. Advantages of high olein sunflower oil over palm oil according to biochemical research results / A. I. Gozhenko, A. P. Levitsky, V. T. Stepan, I. P. Pustovoi, N. S. Badiuk, A. K. Maslyukov - PhOL – PharmacologyOnLine - N 2. - P. 293-301.