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ANTI-INFLAMMATORY ACTION ON KIDNEYS OF RATS OF THE PREPARATION OF POLYUNSATURATED FATTY ACIDS (PUFA)

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Abstract

Background. To determine the renoprotective effect of PUFA.

Methods. The preparation of essential PUFA “Liposan-C” was used, which was administered to rats on a fat-free diet in an amount of 1% of the diet weight for 32 days. The activity of elastase, urease, lysozyme, catalase and the content of MDA were determined in the homogenate of the kidneys. According to these indicators, the degree of dysbiosis and intensity of inflammation were calculated.

Results. A decrease in the activity of urease, elastase and the degree of dysbiosis in rats treated with Liposan-C was established.

Conclusion. The drug PUFA "Liposan-C" has anti-inflammatory, antimicrobial and anti-disbiotic effect on the kidneys.

Keywords: kidney, PUFA, inflammation, dysbiosis.

INTRODUCTION

Polyunsaturated fatty acids (PUFAs), which include linoleic, linolenic, arachidonic, eicosapentaenoic, docosapentaenoic and docosahexaenoic fatty acids, are defined as essential (indispensable) nutrition factors called vitamin F [1-4].

Their biological role is associated, on the one hand, with the unique structure of the polyunsaturated fatty acids molecules that make up all biomembranes, and on the other hand, with their ability to transform into biologically active compounds, eicosanoids and decosanoids, to which prostaglandins, leukotrienes, thromboxanes, and others belong [5, 6].

Many convincing evidence has been obtained of their positive effect on the cardiovascular and immune systems, on the function of the nervous and endocrine systems [7-9].

Recently, it was shown that the content of PUFA in the rat is significantly reduced by high fat diets due to the suppression of their biosynthesis from the main precursor linoleic acid [10, 11].

The purpose of this study was to determine the effect of PUFA on the condition of the kidneys in the absence of dietary fat (fat free diet). The condition of the kidneys was assessed by the nature of changes in biochemical parameters - markers of inflammation, dysbiosis and antioxidant system.

MATERIALS AND RESEARCH METHODS

The dietary supplement Liposan-C containing fish oil, carotino-tocopherol oil "Katomas"[12] and sunflower meal as a carrier was used as a PUFA preparation. Production of the loose form "Liposan-C" is carried out by the NPA "Odessa Biotechnology" in accordance with TU U 10.8-37420386-002: 2015.

The content of fatty acids in "Liposan-C" was determined using the method of gas chromatography on the device of the company "Shimadzu".

Fat-free diet (FFD) was prepared according to the recipe presented in table 1.

Table 1. Fat free diet composition [13]

Components	Content, %
Wheat starch	66
Soybean meal (fat content <0.6%)	15
Ovalbumin	5
Sucrose	9
Mineral mixture [14]	4
Vitamin mixture [14]	1

Biological studies were performed on white Wistar rats (males, 4 months, average live weight 220 ± 10 g), divided into 2 groups of 5 rats each: the first group received FFD, the second group received FFD + 1% of the drug "Liposan-C".

Feeding ad libitum lasted 32 days, after which the rats were killed under thiopental anesthesia (20 mg / kg) by total bleeding from the heart. The kidneys were removed and the elastase activity (inflammation indicator) [15], urease (microbial contamination index) [16], malondialdehyde content (MDA) as the final product of lipid peroxidation [17], lysozyme activity (indicator of the level of nonspecific immunity [18], catalase activity (antioxidant enzyme) [19]. The degree of dysbiosis was calculated by the ratio of relative activities of urease and lysozyme [20], and the antioxidant-prooxidant index API - by the ratio of catalase activity and MDA content [21].

The research results were subjected to standard statistical processing [22].

RESULTS AND DISCUSSION

The results of determination of ω -3 PUFA in the composition of lipids "Liposan-C" are presented in Table 2. Eicosapentaenoic acid is predominant - the main substrate for the formation of anti-inflammatory eicosanoids [6].

Table 2. The content of ω -3 PUFA in "Liposan-C"

PUFA	%
Linolenic, C _{18:3}	2,64
Eicosapentaenoic, C _{20:5}	3,61
Docosapentaenoic, C _{22:5}	0,78
Docosahexaenoic, C _{22:6}	2,52
Total	9,55

Absolute values of biochemical parameters and their calculated derivatives (API index and degree of dysbiosis) of the kidneys of rats treated with FFD are presented in Table 3. It is noteworthy that the lysozyme is very high, tens of times greater than the activity of this enzyme in other tissues, which was first shown in [23]. The second feature of the kidney is the high activity of the proteolytic enzyme elastase, which is considered as a pro-inflammatory factor [15, 21].

Table 3. Absolute values of rat kidney biochemical parameters, receiving FFD (M±m)

№№	Indicators	Absolute values
1	Elastase, µc-kat /kg	374±16
2	Urease, µc-kat /kg	0,213±0,052
3	MDA, mmol/kg	36,0±1,8
4	Lysozyme, u/kg	3703±102
5	Catalase, mkat/kg	6,20±0,04
6	API index	1,72±0,09
7	Degree of dysbiosis	1,00±0,12

The relative levels of these biochemical parameters in the kidneys of rats treated with Liposan-C against FFD are shown in the figure. The value of indicators of the kidneys in control rats treated with FFD without "Liposan-C" taken as 100%.

As can be seen from these data, the introduction of Liposan-C reliably and very significantly reduces the activity of elastase, which indicates its anti-inflammatory action. The urease activity, reflecting the degree of microbial seeding, is also significantly reduced. The remaining indicators of kidneys of rats treated with Liposan-C differ little from those of the control. It should be noted a tendency to reduce the degree of dysbiosis due to a significant reduction in urease. The decrease in the latter can be explained by some increase in the content of MDA, reflecting the intensity of free radical oxidation (FRO) of lipids. And as you know, reactive oxygen species (ROS), formed as a result of FRO, have a strong bactericidal effect.

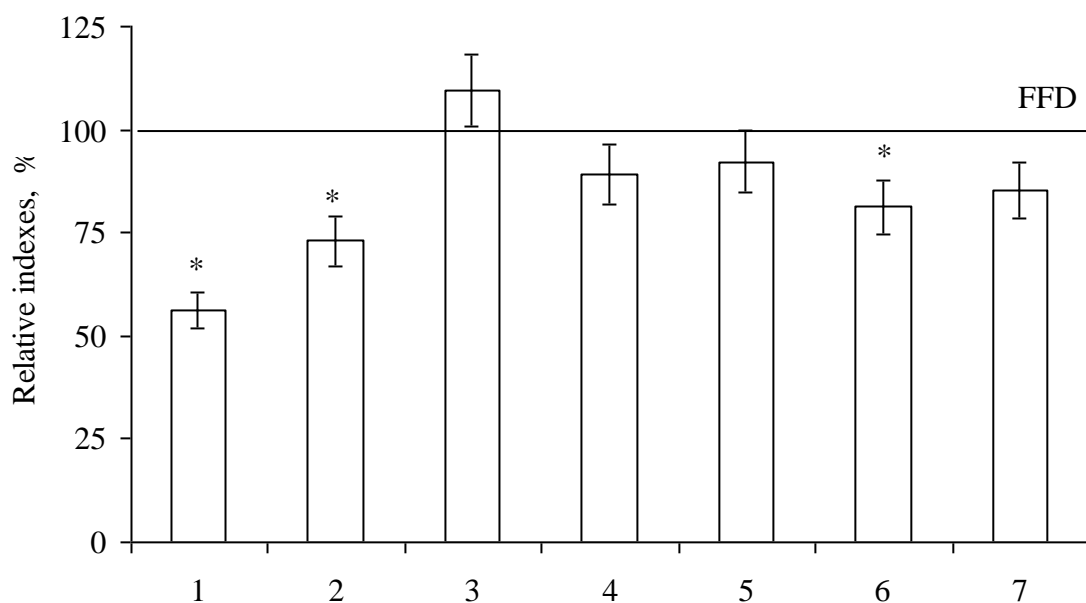


Fig. The effect of "Liposan-C" on the biochemical parameters of the kidneys of rats, receiving fat free diet (FFD)

(1 – elastase, 2 – urease, 3 – MDA, 4 – lysozyme, 5 – catalase, 6 – API index, 7 – degree of dysbiosis)

CONCLUSIONS

The drug PUFA "Liposan-C" has anti-inflammatory and anti-disbiotic effect on the kidneys in rats fed a fat-free diet.

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