



EFFECT OF FATTY OIL EXTRACT FROM SEEDS OF NIGELLA DAMASCENA L. ON LIPID SPECTRUM IN RATS WITH SIMULATED DYSLIPIDEMIA

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The aim of the study is to determine a lipid spectrum of blood plasma and liver in rats in with simulated dyslipidemia against the background of the administration of the fatty oil extract from the seeds of *Nigella damascena* L.

Materials and methods. Laboratory animals – Wistar male rats – were used in the work. To study the hypolipidemic activity, such models as acute Tween, subchronic vitamin-D2 models and a model of chronic heart failure were used. The identifiable parameters were the concentration of cholesterol and triglycerides in the blood serum and liver, as well as the concentration of atherogenic and non-atherogenic lipoproteins in the blood serum, and the atherogenic coefficient.

Results. As a result of the study, it was found out that a course administration of the fatty oil extract from the seeds of *Nigella damascena* L. against the background of simulated chronic heart failure (CHF) by the right ventricular type, normalizes the lipid spectrum of the experimental animals' blood serum, causing an increase in the concentration of high-density (non-atherogenic) lipoproteins, and reduces the concentration of low-density (atherogenic) lipoproteins. A single administration of the fatty oil extract from the seeds of *Nigella damascena* L. promotes the correction of lipid metabolism disorders under the conditions of acute Tween lipidopathy, while the direction of the object being studied reduces the concentration of cholesterol and triglycerides in the liver and blood serum under the conditions of subchronic dyslipidemia. At the same time, the effect of the use of the fatty oil extract from the seeds of *Nigella damascena* L. was not inferior to "Omacor", the reference drug.

Conclusion. The possibility of using a fatty oil extract from the seeds of *Nigella damascena* L. for preventive and therapeutic aims in cardiovascular diseases has been established.

Keywords: dyslipidemia, *Nigella damascena* L., Omacor, cholesterol, chronic heart failure

ВЛИЯНИЕ ЭКСТРАКТА ЖИРНОГО МАСЛА ИЗ СЕМЯН ЧЕРНУШКИ ДАМАССКОЙ (NIGELLA DAMASCENA L.) НА ЛИПИДНЫЙ СПЕКТР КРЫС ПРИ МОДЕЛИРОВАННОЙ ДИСЛИПИДЕМИИ

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Цель исследования. Провести исследование по определению липидного спектра плазмы крови и печени у крыс при моделированной дислипидемии на фоне введения экстракта жирного масла из семян чернушки дамасской.

Материалы и методы. В работе использовались лабораторные животные – крысы самцы линии Wistar. Для изучения гиполлипидемической активности использовали такие модели как – острую твиновую, субхроническую D₂-витаминную модели и модель хронической сердечной недостаточности. Определяемыми параметрами служили концентра-

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ция холестерина и триглицеридов в сыворотке крови и печени, а также концентрация атерогенных и неатерогенных липопротеидов в сыворотке крови, и коэффициент атерогенности.

Результаты. В результате исследования было установлено, что курсовое введение экстракта жирного масла из семян чернушки дамасской на фоне моделированной хронической сердечной недостаточности (ХСН) по правожелудочковому типу, нормализует липидный спектр сыворотки крови экспериментальных животных, вызывая увеличение концентрации липопротеидов высокой плотности (не атерогенных), и снижает концентрацию липопротеидов низкой плотности (атерогенных). Однократное введение экстракта жирного масла из семян чернушки дамасской способствует коррекции нарушений липидного обмена в условиях острой твиновой липидопатии, в то время как курсовое применение изучаемого объекта снижает концентрацию холестерина и триглицеридов печени, и сыворотки крови в условиях субхронической дислипидемии. При этом эффект от применения экстракта жирного масла из семян чернушки дамасской не уступал таковому у препарата сравнения «Омакор».

Заключение. Возможность применения экстракта жирного масла из семян чернушки дамасской в профилактических и лечебных целях при сердечнососудистых патологиях.

Ключевые слова: дислипидемия, чернушка дамасская, Омакор, холестерин, хроническая сердечная недостаточность

INTRODUCTION

Nowadays, cardiovascular diseases are the leading cause of mortality in both developed and economically developing countries. In many ways, a significant number of deaths are associated with a significant number of risk factors, which include dyslipidemia [1]. It has been established that lipid metabolism disorders play a significant role in the development of atherosclerosis and, as a consequence, coronary heart disease, myocardial infarction, ischemic stroke, chronic heart failure (CHF). That implies the need for correction of lipid imbalance [2].

The main lipid-lowering drugs include statins, fibrates and anion-exchange resins, which are recommended as one of the components of the treatment strategy, as well as a primary or secondary prevention of cardiovascular diseases in adults with a 20% or higher risk of developing pathologies of the cardiovascular system [3]. In large, randomized, controlled studies of statins, the use of statin drugs has been shown to reduce the risk of coronary heart disease and, in addition, to reduce overall mortality [4]. Therefore, these drugs are recommended as the first line of therapy, while fibrates and anion exchange resins are considered as the second line or means for combination therapy when statins are used [5]. However, despite the high efficiency, these drugs have a significant number of side effects limiting their use in patients with moderate increase of cholesterol and triglycerides in blood [6]. It was established that the composition of the extract of a fatty oil extract from the seeds of *Nigella Damascena* L. includes polyunsaturated fatty acids (oleic, eicosadiene, eicosan), amino acids, organic acids (myristic acid, benzoic acid), as well as tocopherol, β -sitosterol [9]. Thus, the rich chemical composition of a fatty oil extract from the seeds of *Nigella damascena* L. served as the basis for the inclusion of this object in the study. Alternative means of therapy in individuals with a moderate risk of atherogenesis may be drugs containing polyunsaturated fatty acids, which demonstrate a high level of efficacy and safety of use, both under experimental and clinical conditions [7, 8]. It has been established that a fatty oil extract from the seeds of *Nigella damascena* L. contains polyunsaturated fatty acids (oleic, eicosadienic, and eicosanoic), amino acids, organic acids (myristic acid, benzoic acid), as well as tocopherol, β -sitosterol [9]. Thus, the rich chemical composition of a fatty oil extract from the seeds of *Nigella damascena* L. has served the basis for the inclusion of this object in the study.

MATERIALS AND METHODS

Biological model

The experiment involved male Wistar rats weighing 220–240 grams in an amount of 150 individuals. The animals for the study had been grown in the vivarium of the Research Institute of Pharmacology Living Systems of Belgorod State University, Belgorod, and kept in a standard vivarium mode: the ambient temperature $22 \pm 20^\circ\text{C}$, a 12-hour synchronized light mode; they were given combined food and water ad libitum. The experiment on the laboratory animals was conducted on the basis of the guidelines of the generally accepted bioethical principles of “the three R’s”, as well as the provisions of the Helsinki Declaration of the World Medical Association (2000), and the principles of humane experimental equipment under the UFAW program [10, 11]. Lipid-lowering properties of the a fatty oil extract from the seeds of *Nigella Damascena* L. were studied on three models of lipidopathy: acute Tween, subchronic D_2 -vitamin models and a model of chronic heart failure (CHF) by the right ventricular type, at single and course administrations of the studied object. Hereby, 5 equal experimental groups of the animals ($n = 10$) were formed for each of the experimental models of dyslipidemia. The first group was represented by intact animals. The second group was a group of negative control rats (NC) with replicated lipidopathy, but devoid of pharmacological support. The third and the fourth groups of the animals received the investigated substance at the dose of 2.3 ml/kg given as a single dose and as a course administration (prophylactically for 14 days), respectively. The fifth group of the animals was administered the reference drug “Omacor” at the dose of 2 ml/kg. The studied substance and the reference drug were administered per os.

Model of acute Tween dyslipidemia

This model was reproduced by a single intraperitoneal injection of Tween 80 (250 mg/100 g animal weight in 1 ml of water for injection). 12 hours after the introduction of Tween 80, the rats were euthanized in the morning by the method of cervical dislocation. The blood serum and liver of the tested rats were taken for the study. [12].

Modeling subchronic D_2 -vitamin lipidopathy

Subchronic hyperlipidemia was simulated by a course administration of vitamin – D_2 in conjunction with the daily administration of alimentary cholesterol and merkazolil to inhibit the metabolism for 4 days. On the

5th day, the animals were decapitated and the biomaterial was collected – the serum and liver [13].

Model of chronic heart failure

By Pyatnitsky N.N. and Blinkov Yu.A. method (1970), chronic heart failure by the right ventricular type was simulated. Under hexenal anesthesia (100 mg/kg body weight intraperitoneally) the rats were fractionally injected silicone oil into each pleural cavity (1.5 ml/100 g weight) [14]. After 30 days, another 1 ml of oil was added per 100 g of rat weight to each pleural cavity. The studied extract was administered a day after the reinjection of silicone oil for 14 days [15].

Biomaterial sampling and sample preparation

A standard set of reagents “Lahema” was used to identify the concentration of total cholesterol and triglycerides in the blood serum. In the liver, cholesterol concentration was evaluated by a colorimetric method based on the Lieberman-Burchard reaction. The extraction from the liver tissue was performed according to Kolmakov's method [13]. The content of triglycerides in the liver was determined after its extraction, similar to the extraction of cholesterol, using a standard set of reagents “Lahema” [16].

The determination of low density lipoprotein (LDL), very low-density lipoproteins (VLDL) and high density lipoproteins (HDL) in the blood serum was carried out by turbidimetric analysis of Burstein and Samai. The principle of the method is the following: low density lipoprotein (LDL), very low-density lipoproteins (VLDL) and high density lipoproteins (HDL) form a complex with heparin, which is deposited without denaturation in the presence of calcium chloride. The presence of LDL and VLDL indicates the degree of turbidity. The treated solutions were measured at CPK-2 with the wavelength of 720 nm [17]. The coefficient of plasma atherogenicity (K_a) was also calculated using the formula [18]:

$$K_a = \frac{TC - HDL}{HDL}, \text{ where}$$

TC – total cholesterol,
HDL – high density lipoproteins

The determination of lipoprotein lipase (LPL) in serum was performed according to the method of Titz et al. The test serum was applied to the stabilized suspension

of olive oil. The released fatty acids were titrated with sodium hydroxide solution. The results were expressed in lipase units (LUs) [19].

Methods of statistical analysis

The data obtained were statistically processed in the Microsoft Excel Ver 9, 2000 computer program package. The results were presented as $M \pm SEM$. Student's t-test was used to compare the groups of means [20].

RESULTS

In the group of NC rats the under the conditions of acute Tween lipidopathy, an increase in the concentration of cholesterol and triglycerides in the blood serum was observed in relation to intact animals by 70.1% ($p < 0.001$) and 70.15% ($p < 0.001$), respectively, with an increase in cholesterol and triglycerides in the liver by 23.5% ($p < 0.001$) and 75% ($p < 0.001$), respectively. It was also found out that the use of the fatty oil extract from the seeds of *Nigella damascena* L. at the dose of 2.3 ml/kg had significant hypocholesterolemic and hypotriglyceridemic effects in single and course administrations under the conditions of acute lipidopathy. In comparison with the control group, a decrease of the cholesterol level in the serum was observed with a single injection of the studied substance by 23.32% ($p < 0.001$) and by 42.46% ($p < 0.001$) during a course administration. In the liver, in relation to the negative control group of rats, the cholesterol content decreased by 27.16% ($p < 0.001$) with a single use of the studied substance. The contents of triglycerides in the blood serum and liver decreased (relative to the control group) by 57.46% ($p < 0.001$) and 25.82% ($p < 0.001$) after a single administration of the fatty oil extract from the seeds of *Nigella damascena* L. In the course of the administration of the studied substance, the contents of triglycerides in the liver and serum decreased in comparison with the control group of rats by 43.86% ($p < 0.001$) and 35.19% ($p < 0.001$), respectively. With the administration of “Omacor”, the concentration of cholesterol and triglycerides in the blood serum of the animals decreased by 55.87% ($p < 0.001$) and 44.74% ($p < 0.001$), respectively. In the liver, these figures decreased by 47.65% ($p < 0.001$) and 47.80% ($p < 0.001$), respectively, relative to the control group.

Table 1 – Changes in lipid metabolism in the blood serum and liver after the administration of fatty oil extract from the seeds of *Nigella Damascena* L. under the conditions of acute Tween dyslipidemia

Animal groups	Cholesterol, mmol/l Blood serum	Triglycerides, mmol/l Blood serum	Cholesterol, mg/g Liver	Triglycerides, μmol/g Liver
Intact animals	4.21±0.14	1.34±0.01	3.28±0.23	1.04±0.01
Negative control animals	7.16±0.33#	2.28±0.12#	4.05±0.13#	1.82±0.02#
Fatty oil extract from the seeds of <i>Nigella damascena</i> L. (single administration)	5.49±0.25*	0.97±0.02*	2.95±0.15*	1.35±0.23*
Fatty oil extract from the seeds of <i>Nigella damascena</i> L. (course administration)	4.12±0.31*	1.28±0.12	4.12±0.31#	1.18±0.11*
“Omacor”	3.16±0.21*	1.26±0.11*	2.12±0.05*#	0.95±0.02*

Note: # – statistically significant relative to intact animals ($p < 0.001$);

* – statistically significant relative to the NC group of rats ($p < 0.001$).

The influence of the lipoproteinlipase enzyme serum was also taken into account. The effect of the fatty oil extract from the seeds of *Nigella damascena* L. at the dose of 2.3 ml/kg on the lipoprotein lipase activity was determined in intact white rats and the rats with simulated Tween hyperlipidemia.

The experiments have shown (Table 2) that the activity of lipoprotein lipase in intact animals was 1.213 ± 0.21 lipase units (LUs). Against the background of a single injection of a fatty oil extract from the seeds of *Nigella damascena* L. at the dose of 2.3 ml/kg, the enzyme activity was increased to 2.833 ± 0.17 LUs, i.e., by 133.6%% ($p < 0.001$). A slightly less pronounced effect was observed when a course administration of a fatty oil extract from the seeds of *Nigella damascena* L. to healthy animals was performed. The activity of LPL in these experiments increased to 2.45 ± 0.24 LUs. This is 102% ($p < 0.001$)

higher than that of intact animals. In experimental hyperlipidemia in the group of control animals treated with physiological solution, there was an unreliable decrease in the activity of the enzyme compared with its value in intact animals ($p < 0.05$). The increase in LPL activity in experimental animals with a simulated acute pathology after single and course administrations of the studied fatty oil extract from the seeds of *Nigella damascena* L. at the dose of 2.3 ml / kg amounted to 1.784 ± 0.13 LUs and 1.321 ± 0.20 LUs, respectively. It should be noted that, against the background of Tween intoxication, with a single injection of a fatty oil extract from the seeds of *Nigella damascena* L., the activity of LPL was higher than with a course administration. Against the background of the use of "Omacor", LPL activity increased relative to the control group by 123.1% ($p < 0.001$) and by 64.1% ($p < 0.001$) in comparison with the intact group of animals.

Table 2 – Effect of fatty oil extract from the seeds of *Nigella damascena* L. at the dose of 2.3 ml/kg on LPL serum activity

Animal groups	LPL, LU	
	M±m	% , P
Intact animals	1.213 ± 0.21	100%
Fatty oil extract from the seeds of <i>Nigella damascena</i> L. (single administration), 2,3 ml/kg	2.833 ± 0.17	+133.6% $p_1 < 0.001$
Fatty oil extract from the seeds of <i>Nigella damascena</i> L. (course administration), 2,3 ml/kg	2.45 ± 0.24	+102% $p_1 < 0.001$
Physiological solution+Tween (control)	0.892 ± 0.25	-26.5% $p_1 > 0.5$
Fatty oil extract from the seeds of <i>Nigella damascena</i> L. (single administration), 2,3 ml/kg + Tween 80	1.784 ± 0.13	+47.07% $p_1 < 0.5$ +100% $p_2 < 0.001$
Fatty oil extract from the seeds of <i>Nigella damascena</i> L. (course administration), 2,3 ml/kg + Tween 80	1.321 ± 0.20	+8.9% $p_1 < 0.001$ +48.1% $p_2 < 0.001$
Omacor	1.99 ± 0.361	+64.1% $p_1 < 0.001$ +123.1% $p_2 < 0.001$

Note: p_1 – significance of differences with respect to indicators of intact animals;

p_2 – significance of differences with respect to indicators of control animals

In the animals of the NC group, serum and liver cholesterol concentrations increased by 112.04% ($p < 0.001$) and 85.6%, respectively, with subchronic D2-vitamin lipidopathy, while the serum and liver triglycerides increased 131.5% ($p < 0.001$) and 211.5% ($p < 0.001$), respectively. Under the conditions of vitamin-D₂ lipidopathy (Table 3), a course administration of a fatty oil extract from the seeds of *Nigella damascena* L. contributed to a decrease in serum cholesterol and triglycerides, compared to the NC group of rats, by 24.4% ($p < 0.001$) and 25.73% ($p < 0.001$), respectively. After a single administration of a fatty oil extract from the seeds of *Nigella damascena* L., the concentration of serum cholesterol and triglycerides did not change statistically significantly

in comparison with the NC group of the animals. In the liver, the cholesterol content decreased in relation to the NC group of rats by 24.6% ($p < 0.001$) and 22% ($p < 0.001$), respectively, with a single and course administration of a fatty oil extract from the seeds of *Nigella damascena* L. In the liver, the concentration of triglycerides decreased only while the course administration of a fatty oil extract from the seeds of *Nigella damascena* L. – by 36.7% ($p < 0.001$) relative to the animals of the NC group (Table 3). The use of "Omacor" contributed to the decrease in serum and liver cholesterol levels in comparison with the NC group of rats by 45.7% ($p < 0.001$) and 43.5% ($p < 0.001$), respectively, while the concentration of triglycerides decreased by 30.8% ($p < 0.001$) and 32.7% ($p < 0.001$), respectively.

Table 3 – Changes in lipid metabolism in the blood serum and liver after the administration of a fatty oil extract from the seeds of *Nigella damascena* L. under the conditions of subchronic D₂-vitamin dyslipidemia

Animal groups	Cholesterol, mmol/l Blood serum	Triglycerides, mmol/l Blood serum	Cholesterol mg/g Liver	Triglycerides, μmol/g Liver
Intact animals	3.57±0.12	1.78±0.01	3.26±0.13	1.04±0.01
NC animals	7.57±0.24#	4.12±0.12#	6.05±0.17#	3.24±0.02#
Fatty oil extract from the seeds of <i>Nigella damascena</i> L. (single administration)	6.78±0.15#	4.23±0.02#	4.56±0.31*#	3.25±0.42#
Fatty oil extract from the seeds of <i>Nigella damascena</i> L. (course administration)	5.72±0.52*#	3.06±0.11*#	4.72±0.37*#	2.05±0.22*#
“Omacor”	4.11±0.11*	2.85±0.17*#	3.42±0.43*	2.18±0.41*#

Note: # – statistically significant relative to the intact animals ($p < 0.001$);

* – statistically significant relative to the NC group of rats ($p < 0.001$)

A study of the experimental rats' blood with simulated pathology of CHF showed a pronounced disorder in the lipid spectrum (Table 4). That was reflected in an increase in the atherogenic coefficient (K_a) by 111.32% ($p < 0.05$), compared to the animal group not subjected to the experimental exposure. Dyslipidemia can be judged by the increased concentration of atherogenic lipoproteins – LDL – by 178.2%, and total cholesterol by 25.1% compared with the group of intact animals. A decrease in non-atherogenic lipoproteins by 19.11% relative to the intact group of rats was also observed.

It should be noted that in intact rats, the administration of the studied substance did not significantly affect the concentration of total cholesterol and lipoproteins.

Judging by the lipid profile (Table 4), it can be concluded that in case of a simulated pathology of CHF, a course administration of *Nigella damascena* L. at the dose of 2.3 ml/kg prevents the disturbance of lipid metabolism. The concentration of atherogenic lipoproteins (LDL) after the course administration of a fatty oil extract from the seeds of *Nigella damascena* L. has reduced

by 39.5% ($p < 0.05$) relative to the group of the NC animals. And the concentration of non-atherogenic lipoproteins, by contrast, increased by 23.5%, ($p < 0.05$) relative to the negative control group of rats. In the course administration of a fatty oil extract from the seeds of *Nigella damascena* L., the total cholesterol had also a tendency to decrease by 13.65% ($p < 0.05$). The atherogenic coefficient of blood plasma against the background of a course administration of a fatty oil extract from *Nigella damascena* L. decreased statistically significantly by 46.8% ($p < 0.05$) compared with the control group of animals. Against the background of the administration of “Omacor” in the animals compared with the control group, there was an increase in HDL by 32.5% ($p < 0.05$), as well as a decrease in TC, LDL and atherogenicity by 15.4% ($p < 0.05$); 34.7% ($p < 0.05$); 56.2% ($p < 0.05$), respectively. At the same time, no statistically significant differences between the groups of rats treated with “Omacor” and *Nigella damascena* L. during the course and single administrations under the conditions of CHF model have been established.

Table 4 – Effect of a fatty oil extract from the seeds of *Nigella damascena* L. at the dose of 2.3 ml/kg on lipid metabolism in rats with simulated CHF

Group	TC	HDL	LDL	VLDL	Ka
Intact	1.833±0.08	1.015±0.06	0.234±0.03	0.583±0.04	0.848±0.11
%	100	100	100	100	100
Control (pathology)	2.293±0.02*	0.821±0.03	0.651±0.05*	0.569±0.03*	1.792±0.12*
% to intact	+25.09	−19.11	+178.2	−2.4	+111.32
Fatty oil extract from the seeds of <i>Nigella damascena</i> L., 2.3 ml/kg, without pathology	1.762±0.021	0.989±0.027	0.146±0.053	0.582±0.031	0.782±0.03
% to intact	−3.9	+2.6	−37.61	−0.17	−7.8
Fatty oil extract from the seeds of <i>Nigella damascena</i> L., 2.3 ml/kg (single administration+ pathology)	2.021±0.02	1.001±0.02	0.341±0.12#	0.453±0.03	1.019±0.08
% to control	−12	+21.9	−47.6	−20.4	−41.97
Fatty oil extract from the seeds of <i>Nigella damascena</i> L., 2.3 ml/kg (course administration+ pathology)	1.980±0.110#	1.014±0.042#	0.394±0.112*#	0.572±0.010	0.953±0.06#
% to control	−13.65	+23.51	−39.47	−1.89	−43.1
“Omacor”	1.942±0.213#	1.088±0.129#	0.425±0.029*#	0.523±0.098	0.509 ±0.143#
% to control	−15.4	+32.5	−34.7	−8.1	−56.2

Note: * – to intact animals ($p < 0.05$)

– to the group of simulated pathology (control) ($p < 0.05$)

DISCUSSION

Thus, under the conditions of acute Tween lipidopathy, the most pronounced effect of lipid metabolism indices in the blood serum and liver was observed with a single administration of the studied extract of a fatty oil extract from the seeds of *Nigella damascena* L. It should be also noted that the extract of the fatty oil from the studied extract has an activating effect on the serum lipoprotein lipase in the acute Tween model of hyperlipidemia and without a simulated pathology, and in both – single and course – uses.

When simulating subchronic D₂-vitamin dyslipidemia, in the course administration of a fatty oil extract from the seeds of *Nigella Damascena* L., the positive dynamics of lipid metabolism, in the direction of lowering the level of cholesterol and triglycerides in the blood serum and liver, was observed compared with the negative control group.

In a simulated experimental pathology of CHF in rats, pathological changes in lipid metabolism were observed in increasing K_a concentration, which is comparable with the described manifestations in the clinic [21,22]. In the course and single administrations of a fatty oil extract from the seeds of *Nigella Damascena* L., the concentration of atherogenic lipoproteins significantly decreased and the concentration of HDL in the serum increased, which is also confirmed by literature data [23].

Hereby it should be notified that the effect of the administration of the studied extract was comparable to that of the reference drug – “Omacor”. The indicators of the animals treated with the fatty oil extract from the seeds of *Nigella damascena* L., did not significantly differ from the results of the group of the animals receiving “Omacor”, the reference drug. It has been proven that the hypotriglyceridemic effect observed in our experiments while the administration of the investigated fatty oil extract from the seeds of *Nigella damascena* L. to animals is associated with the activation of the enzyme metabolizing fatty acids and triglycerides

– LPL (lipoprotein lipase). The use of fatty oil extract from the seeds of *Nigella damascena* L. contributed to the restoration of lipid metabolism, expressed in the reduction of cholesterol and triglycerides in the blood serum and liver. A similar effect of the fatty oil extract is probably associated with its polyunsaturated fatty acids and timoquinone. The data on its lipid-correcting action are given in the literature [24].

CONCLUSION

It follows from the experiment that single and course administrations of a fatty oil extract from the seeds of *Nigella damascena* L. affect lipid metabolism. This is reflected in a decrease in cholesterol and triglycerides in the blood and liver of the animals under the conditions of Tween and vitamin hyperlipidemia.

It has also been established that, against the background of simulated CHF, during the course administration of a fatty oil extract from the seeds of *Nigella damascena* L., the lipid spectrum normalizes, the concentration of high-density lipoproteins increases relative to the control group, and the concentration of low-density (atherogenic) lipoproteins significantly decreases. Under the conditions of experimental CHF, the administration of a fatty oil extract from the seeds of *Nigella damascena* L. decreases the atherogenic coefficient of blood plasma relative to the control group of the animals. The studies of the activity of serum lipoprotein lipase in single and course administrations of the fatty oil extract from the seeds of *Nigella damascena* L. indicate the activating effect on the LPL enzyme.

The extract of the fatty oil from the seeds of *Nigella damascena* L. has a pronounced hypolipidemic effect in animals with experimental hyperlipidemia, manifested in a decrease in LDL, cholesterol, serum triglycerides, and also cholesterol and triglycerides in liver. This effect is not inferior to the similar effect of the official lipid-lowering drug “Omacor”.

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CONFLICT OF INTEREST

The author declare no conflict of interest.

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