



НІБУЛОН, вул. Велика Морська, 63, Миколаїв, 54001, Україна  
Телефон: +38 (0512) 37 23 44, +38 (0512) 58 04 04. <https://www.nibulon.com>

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A. Lapinska, PhD. Sc., Associate Professor, E-mail: [alocnka.onaft@gmail.com](mailto:alocnka.onaft@gmail.com)

Scopus ID 57223318327, ORCID 0000-0003-4217-2516, Researcher ID: B-6483-2016

Department of Technology of Mixed Feeds and Biofuel

Odessa National Academy of Food Technologies, 112, Kanatna Str., 65039, Odessa, Ukraine, +38487124113

## THE ANTIDISBIOTIC EFFECT OF OIL CAKE FROM HIGH OLEIC SUNFLOWER SEEDS IN RATS WITH EXPERIMENTAL DYSBIOISIS

### Abstract

The work shows the relevance of the use in feeds production of means for correcting the microbiome. It is shown that the use of probiotic and prebiotic preparations increases the zootechnical efficiency of feed products, contributes to an increase in the amount of livestock and poultry products and forms its quality and safety. The expediency of using oil cake from high oleic sunflower seeds in the production of feed products has been substantiated from the point of view of ensuring the nutritional value of products and a positive effect on the norm of the flora of farm animals and poultry.

Experimental dysbiosis in rats was reproduced with lincomycin. Oilcakes from linoleic and high oleic sunflower seeds were added to the diet in an amount of 10%. The experiment lasted 18 days. The activity of urease, lysozyme, elastase was determined in the mucous membranes of the digestive tract (oral, small and large intestine), and the degree of dysbiosis was calculated.

The therapeutic and prophylactic effect of oil cake from high oleic sunflower seeds on the development of inflammatory and dystrophic processes in the digestive system of rats under experimental dysbiosis was established. Studies have established an increase in the activity of elastase, urease, a decrease in the activity of lysozyme in rats with experimental dysbiosis. It was found that the consumption of high-oleic sunflower oil cake has a significantly greater therapeutic and prophylactic effect in comparison with the linole-type sunflower oil cake, since it reduces the level of elastase by 23-45%, urease by 13.5-58% in the mucous membranes of the digestive tract. An increase of 25-94% in the activity of lysozyme in animals with experimental dysbiosis was established when using oil cake from high oleic sunflower. It was found that the consumption of oil cake from high oleic sunflower seeds reduces the degree of dysbiosis in all tissues, especially in the small intestine (5 times).

It was found that with dysbiosis in the digestive system, inflammatory-dystrophic processes develop as a result of a decrease in the level of nonspecific immunity. It was found that the consumption of oil cake from the seeds of high oleic sunflower has an anti-disbiotic effect and, as a consequence, mucosoprotective effect.

**Key words:** feeds, cake, high-oleic sunflower, digestive system, dysbiosis, inflammatory processes.



## Introduction

Numerous studies have established that probiotic and prebiotic preparations improve intestinal function and normalize the digestion of feed in farm animals and poultry, increasing the zootechnical efficiency of diets. Colonization of the gastrointestinal tract with beneficial microflora helps to reduce the negative impact of pathogenic or opportunistic microorganisms, maintain optimal acidity of the environment, prevent dysbiosis, stimulate local and general immunity factors, reduce the amount of antibiotics and drugs used in animal husbandry and [1].

Topical issues in feed production are the substantiation of the composition and formulation of products, taking into account its effect on the normal flora of farm animals and poultry.

With the press method of processing sunflower seeds, almost 60% of cake is formed with a content of 9 to 15 % fat and more than 30% protein. The use of cake in the composition of mixed fodders significantly increases the content of protein and fat.

Recently, they began to grow high oleic varieties and hybrids of sunflower [2, 3], containing in the fat composition a large amount (80 ... 90 %) of valuable oleic acid (C18: 1,  $\omega$  -9), a low amount (less than 10 %) of linoleic acid (C18: 2,  $\omega$  -6) and a small amount (up to 5%) of palmitic acid (C16: 0), harmful to the body [4]. It was found that high-oleic sunflower hybrids contain more protein than high-salt varieties [5].

**The aim of this work** was to determine the effect of oil cake from high oleic sunflower seeds on the development of dysbiosis in the digestive system of rats. For comparison, a cake from the seeds of a common sunflower of the linoleic type was used.

## Materials and methods of research.

In the work, 20 Wistar rats (males, 2-2.5 months, live weight  $193 \pm 13$  g) were used, which were divided into 4 levels of the group: 1st control, which received a standard diet [6]; Groups 2, 3, 4 received the antibiotic lincomycin at a dose of 70 mg / kg with drinking water for the first 5 days to reproduce the experimental dysbiosis [7]. Rats of the 3rd group received 10 % of linoleic-type sunflower oil cake with food (replacement of 10 % wheat grain), and rats of the 4th group received 10 % high-oleic sunflower oil cake with food (replacement of 10 % wheat grain).

The fat content in macus from sunflower seeds of the linoleic type was 9.1 %, the content of linoleic acid was 54.5% of the total fatty acids. The fat content of the macaus of the high oleic sunflower was 8.9 %, the oleic acid content was 84.6%. The analysis of the fatty acid composition of the oil cake was carried out in accordance with [8].

The duration of feeding was 18 days.

The animals were euthanized on the 19th day of the experiment under thiopental anesthesia (20 mg / kg) by total bleeding from the heart. The liver and mucous membranes of the cheeks (oral cavity (OOM)), small and large intestines were isolated, after washing them with cold 0.9 % NaCl solution.

In tissue homogenates, the activity of the proteolytic enzyme elastase [9], the activity of the bacterial enzyme urease [9], the activity of the antimicrobial enzyme lysozyme [9] were determined, and the degree of dysbiosis was calculated according to A.P. Levitsky [9].

The experimental results were subjected to standard statistical processing [10].

## Results and discussion.

Table 1 presents the results of determining the activity of elastase in the mucous membranes of the digestive system of rats, which is a marker of inflammatory-dystrophic processes [9] and the activity of the bacterial enzyme urease.

As can be seen from the data, in all studied tissues of rats with dysbiosis, the level of elastase increases: in the oral mucosa by 20 %, in the small intestine by 57 %, in the large intestine by 70 %.

In rats that consumed linoleic sunflower cake, elastase activity decreased slightly in the mucous membranes of the mouth and small intestine (only by 3-5 %) and significantly (by 31 %) in the mucous membrane of the large intestine.

In rats that consumed oil cakes from high oleic sunflower seeds, the activity of elastase in the OAS decreases by 23 %, and in the mucous membrane of the small intestine by 45 %, in the mucous membrane of the large intestine, a decrease of 5%.

From the data obtained on the activity of urease in the studied tissues, it can be seen that the level of this enzyme in rats with dysbiosis increases in the OAS by 168 %, in the mucous membrane of the small intestine by 280 % and in the mucous membrane of the large intestine by 197 %.

Consumption of oil cake from linoleic sunflower seeds somewhat reduces the level of urease, however,  $P > 0.05$ . Only the addition of oil cake from high oleic sunflower to the diet significantly reduced the activity of urease: in the OAS by 41 %, in the small intestine by 58 %, in the large intestine the level of this enzyme decreased by 13.5 %.

Table 2 shows the results of determining the activity of the antimicrobial enzyme lysozyme in the tissues of rats with experimental dysbiosis. It can be seen that in all tissues the level of lysozyme decreases, especially in the colon - by 51%.

Consumption of oil cake from ordinary sunflower (linoleic type) had little effect on the level of lysozyme, while the addition of oil cake from high oleic sunflower to the diet significantly increases the activity of lysozyme: in the small intestine by 94 %, in the large intestine.

From the results of determining the degree of dysbiosis in the digestive system of rats, it can be seen that the degree of dysbiosis in the OAS increases by almost 3 times, and in the intestine by 5-6 times, provided that the antibiotic lincomycin is used.

As can be seen from the data obtained (Table 2.), the consumption of oil cake from sunflower seeds of the linoleic type reduces the degree of dysbiosis, but it is reliable only in the OSS. Consumption of oil cake from high oleic sunflower seeds reduces the degree of dysbio-



sis in all tissues, especially in the small intestine (5 times).

Thus, the data obtained have shown that in animals with dysbiosis, damage to the digestive system is observed (inflammatory-dystrophic processes). This is

evidenced by an increase in the activity of the biochemical marker of inflammation, the enzyme elastase. An increase in bacterial seeding of the mucous membrane of the digestive tract is evidenced by an increase in the activity of urease.

**Table 1- The effect of sunflower seed cake on the activity of elastase and urease in the digestive system of rats with experimental dysbiosis**

№	Group	Elastase			Urease		
		Oral mucosa, $\mu$ kat /kg	mucous membrane of the small intestine, $\mu$ kat /kg	mucous membrane of the colon, $\mu$ kat /kg	Oral mucosa, $\mu$ kat /kg	mucous membrane of the small intestine, $\mu$ kat /kg	mucous membrane of the colon, $\mu$ kat /kg
1	Control	54.6±6.1	1.04±0.06	44.3±3.3	0.13±0.03	1.28±0.31	1.28±0.16
2	Experimental dysbiosis (ED)	65.7±5.3 P>0.05	1.63±0.05 P<0.01	76.3±2.2 P<0.01	0.34±0.004 P<0.05	5.14±1.85 P<0.05	3,8±0.57 P<0.05
3	ED + sunflower seed cake linoleic type	63.3±10.84 P>0.3 P1>0.5	1.55±0.08 P<0.01 P1>0.3	52.8±9,1 P>0.05 P1<0.05	0.25±0.04 P>0.05 P1>0.05	4.99±0.59 P<0.05 P1>0.3	3.3±0.57 P>0.05 P1>0.3
4	ED+ high oleic sunflower seed cake	48.7±6.9 P>0.3 P1>0.05 P2>0.05	0.85±0.03 P<0.05 P1<0.001 P2>0.001	48.0±3.3 P>0.3 P1<0.01 P2>0.35	0.20±0.04 P>0.05 P1<0.05 P2>0.3	1.92±0.75 P<0.05 P1<0.05 P2>0.05	3.28±0.31 P<0.05 P1>0.3 P2>0.5

Note: P - in comparison with group 1  
P1 - in comparison with group 2  
P2 - in comparison with group 3

**Table 2 - Influence of oil cake from sunflower seeds on the activity of lysozyme and the degree of dysbiosis in the digestive system of rats**

№	Group	Lysozyme, units / kg			Degree of dysbiosis, units		
		Oral mucosa, $\mu$ kat /kg	mucous membrane of the small intestine, $\mu$ kat /kg	mucous membrane of the colon, $\mu$ kat /kg	Oral mucosa, $\mu$ kat /kg	mucous membrane of the small intestine, $\mu$ kat /kg	mucous membrane of the colon, $\mu$ kat /kg
1	Control	189±16	275±35	522±28	1.00±0.12	1.00±0.27	1.00±0.15
2	Experimental dysbiosis (ED)	178±8 P>0.1	191±32 P>0.05	297±5 P<0.01	2.87±0.39 P<0.01	5.39±0.88 P<0.001	5.57±0.84 P<0.01
3	ED + sunflower seed cake linoleic type	166±19 P>0.3 P1>0.3	213±17 P>0.05 P1>0.3	290±20 P<0.01 P1>0.05	1.75±0.23 P<0.05 P1<0.05	4.69±0.91 P<0.001 P1>0.3	4.96±0.77 P<0.01 P1>0.3
4	ED+ high oleic sunflower seed cake	194±10 P>0.3 P1>0.05 P2>0.05	414±14 P<0.01 P1<0.01 P2<0.01	364±20 P<0.01 P1<0.01 P2<0.05	1.9±0.27 P>0.05 P1<0.05 P2>0.3	0.93±0.28 P<0.05 P1<0.01 P2<0.01	3.66±0.59 P<0.05 P1>0.05 P2>0.05

Note: P - compared with group 1  
P1 - compared with group 2  
P2 - compared with group 3

The reason for the development of pathological phenomena in the digestive system may be a significant decrease in the level of nonspecific immunity, an indicator of which is the enzyme lysozyme. As our research has shown, the consumption of high oleic sunflower meal can significantly affect the state of the digestive system in conditions of dysbiosis. Normalization is due to an increase in the activity of lysozyme and a decrease in the level of inflammatory-dystrophic processes.

The benefits of oil cake from high oleic sunflower seeds are most likely due to the presence of a

large amount of oleic acid, which is an antioxidant [11] and stimulates endogenous biosynthesis of  $\omega$ 3 PUFA (polyunsaturated fatty acids) [12], as a result of which inflammatory processes are inhibited in the body. regeneration [13, 14]. The established ability of high oleic sunflower cake to neutralize the negative manifestations of the antibiotic and restore homeostasis in the "microbe - human" system allows us to recommend its use as a component of feed products not only as a source of protein, but as a component with functional properties, in particular antidiabetic.



Further research is advisable to establish the biological value, functional properties of oil cake from high oleic sunflower and substantiate the methods of effective use in the production of feed products.

### Conclusions.

1. In conditions of dysbiosis, inflammatory and dystrophic processes develop in the digestive system.

2. The use of drugs that normalize the intestinal microbe of farm animals and poultry in the production of feed products can significantly increase its zootechnical efficiency, contributing to an increase in the amount of products obtained and the quality and safety of the latter.

3. Consumption of oil cake from high oleic sunflower seeds has an antidiabetic effect and, as a result, mucosoprotective effect.

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А.П. Лапінська, канд. техн. наук, доцент, E-mail: alocnka.onaft@gmail.com

Кафедра технології комбікормів і біопалива, Tel. +38048 7124013

Одеська національна академія харчових технологій, вул. Канатна, 112, Одеса, Україна, 65039

## АНТИДИСБІОТИЧНА ДІЯ МАКУХИ З НАСІННЯ ВИСОКООЛЕЇНОВОГО СОНЯШНИКА У ЩУРІВ З ЕКСПЕРИМЕНТАЛЬНИМ ДИСБІОЗОМ

### Анотація

В роботі показано, актуальність застосування в кормовирбництві засобів для корекції мікробіому. Показано, що застосування пробіотичних та пребіотичних препаратів підвищує зоотехнічну ефективність комбікормової продукції, сприяє збільшенню кількості продукції тваринництва та птахівництва та формує її якість та безпеку. Обґрунтовано доцільність застосування макухи з насіння високоолеїнового соняшника при виробництві комбікормової продукції, з точки зору забезпечення поживної цінності продукції та позитивного впливу на нормофлору сільськогосподарських тварин та птиці.

Експериментальний дисбіоз у щурів відтворювали за допомогою лінкоміцину. Макуху з насіння соняшника лінолевого типу та високоолеїнового додавали до раціону в кількості 10%. Тривалість експерименту становила 18 днів. В слизових оболонках травного тракту (СОПР, тонка та товста кишка) визначали активність уреаз, лізоциму, еластази, розраховували ступінь дисбіозу.



Встановлено лікувально-профілактичну дію макухи з насіння високоолеїнового соняшника на розвиток запально-дистрофічних процесів в травній системі щурів за умов експериментального дисбіозу. Дослідженнями встановлено зростання активності еластази, уреазу, зниження активності лізоциму у щурів із експериментальним дисбіозом. Встановлено, що споживання макухи високоолеїнового соняшника має значно більшу лікувально-профілактичну дію у порівнянні з макухою соняшника лінолевого типу, оскільки дозволяє знизити рівень еластази на 23-45%, уреазу на 13,5-58% в слизових оболонках травного тракту. Встановлено збільшення на 25-94% активності лізоциму у тварин з експериментальним дисбіозом за умови споживання макухи з високоолеїнового соняшника. Встановлено що споживання макухи з насіння високоолеїнового соняшника знижує ступінь дисбіозу в усіх тканинах, особливо у тонкій кишці (в 5 разів).

Встановлено, що за умов дисбіозу в травній системі розвиваються запально-дистрофічні процеси, як результат зниження рівня неспецифічного імунітету. Встановлено, що споживання макухи з насіння високоолеїнового соняшника здійснює антидисбіотичну дію і, як наслідок, мукозопротекторну дію.

**Ключові слова:** корми, макуха, високоолеїновий соняшник, травна система, дисбіоз, запальні процеси.

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