G. A. Nozdrin et al /J. Pharm. Sci. & Res. Vol. 10(10), 2018, 2537-2542

ISSN:0975-1459
Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

New Preparation Based on *Duddingtonia Flagrans* as an Alternative Trigger for Growth Stimulating Factors in the Organisms of Broilers

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Abstract

This research was focused on studying the influence of new microbial preparation Vetom 21.77 on chickens' growth and development. 105 5-day-old broiler chickens of cross Hubbard ISA F 15 with the weight of (102.5±1.0) g were used in the research. The preparation was administered to the experimental groups by ingestion once a day at the dosages of 2, 5, 50, and 300 µl/kg for 90 days. Chickens in the reference group did not receive the preparation. Chickens' reaction to the preparation was noted after 30 minutes, and after every 24 hours afterwards. The assessment criteria were the physiological stage of the chickens, reservation rate, weight changes, average daily and absolute weight gain, feed conversion, and the morphometric analysis of internal organs; in addition, the European Efficiency Index (EEI) was calculated. Throughout the research, the physiological state of the experimental chickens did not change, and their 100% preservation rate was determined. At the end of the research, the absolute and the average daily live weight gain in the broilers from experimental groups 1 through 4 exceeded the weight gain in the reference group by 0.7, 3.8, 5.2, and 9.2%, respectively. The feed conversion rate at the end of the experimental period was lower than that in the reference by 0.8, 3.3 4.2, and 9.2%, respectively. By the EEI indicator, the experimental broilers in groups 1 through 4 were superior to their counterparts from the reference group by 1.7, 6.8, 8.8, and 21.1%, respectively.

Keywords: absolute gain, average daily gain, *D. flagrans*, European efficiency index, feed conversion, growth rate, morphometric analysis, Vetom 21.77.

INTRODUCTION

Over the last decades, researchers have tended to studying cost-effective natural analogs of antibiotic growth stimulants, in particular, for poultry. One of the mechanisms of increasing poultry productivity is improving the state of the gastrointestinal tract by suppressing nonindigenous microorganisms, and reducing the number of helminths. In addition to synthetic preparations, some vegetable supplements can positively influence the state of the digestive tract of the broilers [1, 2]. It is quite natural that certain studies speak of a proven increase in the productivity of broilers through the use of vegetable components [3-7]. For example, according to the results of the comparative research performed by Sarica et al. [8], the introduction of additives of plant origin into the basic diet of broilers resulted in the weight gain that was not statistically different from that in the group where antibiotic had been used. In other words deficiency of these additives was at least not inferior to that of the antibiotic preparation.

Scientific literature is constantly updated with evidences of efficiency of predacious fungi as a means of dehelmintization. A recent study of Campos et al. [9] has shown the predatory activity of isolates *Arthrobotrys*, *Nematoctonus robustus*, *Monacrosporium*, and *Duddingtonia flagrans* against *Strongyloides papillosus*. Unfortunately, most studies with the use of the studied apathogenic fungus were performed on mammals, and the possible effect of fungi on the organism of poultry has not been studied sufficiently, which determines the ***relevance*** of this work. The new microbial preparation Vetom 21.77 (Research Center, the Novosibirsk region, Russian Federation) contains spore-and-mycelial biomass of fungi.

Microbial preparations have been used earlier in the studies aimed at assessing the growth-stimulating action: Iwańczuk-Czernik et al. [10] obtained positive results in testing preparation Biosan-GS on broilers; the research group headed by G. Nozdrin [11] proved the efficiency of microbial product BS 225 for increasing the absolute weight of Siberian sturgeons.

This research is aimed at assessing the effect of 90-day long administration of four daily dosages (2, 5, 50, and 300 µl/kg of weight) of the studied preparation on the key indicators of Hubbard F15 broilers' growth rate.

MATERIALS AND METHODS

Preclinical testing of the preparation was performed at the Scientific Research Veterinary Laboratory of the Agrotechnopark at the State University n.a. Shakarim (Semey, Kazakhstan). The targets of the research were 5-day-old broilers of cross Hubbard ISA F15. The subject of the research was the new microbial preparation Vetom 21.77 based on nematophagous fungi *D. flagrans*, and intensity of broilers' growth under the action of this preparation.

The effect of the preparation on growth intensity was studied based on the method OECD Test No. 409 (GOST R 56697-2015) (https://www.oecd-ilibrary.org/environment/test-no-409-repeated-dose-90-day-oral-toxicity-study-in-non-rodents_9789264070721-en) [12].

105 clinically healthy broilers of cross Hubbard ISA F15 in the age of 5 days with the weight of (102.5±1.0) g were selected by the principle of analog pairs in the period of 5-day adaptation after quarantine.

The feeding and keeping conditions were the same for the broilers in all groups. The chickens were kept according to the hygienic norms. Within the experimental period, the broilers were kept on the floor on deep nonreplaceable bedding. As the main diet, the chickens received nutrient-balanced complete granulated feeds «Start» (in the age of 0-14 days), «Rost» (15-34 days), and «Finish» (35 days and older) for all stages of broiler breeding in accordance with the standards recommended for highly productive foreign crosses.

For the objectives of the study, 5 groups were formed – the reference group and 4 experimental groups, 20 chickens in each (Fig. 1). In the reference group, chickens that received the above mentioned feeds were used. Chickens in experimental groups 1 through 4, along with the feeds, received Vetom 21.77 at the dosages of 2, 5, 50, and 300 µl/kg of weight, respectively. The chickens were weighed before the start of the experiment, after 24 hours, and then according to the above-mentioned method every week for 3 months. The physiological state of the chickens and their preservation where monitored every week.

Within the framework of this research, the following indicators were recorded: the number of chickens at the beginning and at the end of the experiment; mortality, %; preservation rate, %; live weight, g; absolute live weight gain, g; average daily gain

of live weight, g; relative gain of live weight according to S. Brody, %; feed conversion rate, g; and carcass yield, %. The results of check slaughtering of the chickens, and calculation of the EEI, which had been widely used in the international practice of meat production, were also considered.

EEI was calculated according to the following formula:

$$EEI = \frac{Preservation\ rate\ (\%) \times live\ weight\ of\ one\ chicken\ (kg)}{Slaughtering\ age\ (days.) \times feed\ conversion\ (kg)} \times 100$$

Morphometric studies of internal organs were performed in accordance with GOST R 53157-2008 (http://www.gostrf.com/normadata/1/4293830/4293830278.pdf), GOST R 31657-2012 "Giblet of a bird. Specifications" (http://www.gostrf.com/normadata/1/4293787/4293787273.pdf). For the purpose of morphometric analysis, 5 chickens from each group were subjected to humane euthanasia and dissection according to the above method below before the experiment, and 42 and 90 days after the beginning of the experiment.

The broilers were slaughtered according to GOST 52837-2007 "Slaughter poultry. Specifications" (http://www.gostrf.com/normadata/1/4293835/4293835128.pdf). By the results of slaughtering, anatomic dissection was performed, and the state of internal organs was assessed. The following was determined: the weight of the eviscerated carcass, g; the weight of internal organs (heart, lungs, liver, spleen, kidneys, intestines, stomach, and pancreas); the weight shares of these internal organs (MK, %), and the slaughter yield in % were calculated.

The experimental data obtained during the research were processed using software 3.1.14 Stats Direct (Stats Direct Ltd, UK). The samples were compared using the Kruskal-Wallis test, which was a modification of the Mann-Whitney test for multiple pairwise comparison of samples. The differences were considered statistically significant with P<0.05.

RESULTS

During the observation period (90 days), morbidity and mortality of the experimental chickens were not registered.

The physiological state of the chickens in the reference and the experimental groups throughout the entire research did not have reliable differences: chickens remained clinically healthy throughout the experiment.

Information about the effect of microbiological preparation Vetom 21.77 on the live weight of experimental and reference broilers is shown in Table 1.

From the data in the Table it follows that statistically significant increase in the absolute weight was registered in the chickens in experimental group 2 by 4.1% (P <0.01) on day 28, and 2.5% (P <0.01) on day 35, by 2.5% on day 77 (P <0.05), by 2.4% (P <0.01) on day 84, and by 3.7% (P <0.0001) on day 90 of the experiment.

Chickens in experimental group 3 were ahead of their counterparts in the reference groups by 3.8% (P <0.05) on day 7, by 4% (P <0.05) on day 14, by 8.9% (P <0.001) on day 21, by 7.5% (P <0.0001) on day 28, by 5.3% (P <0.001) on day 35, by 6.2% on day 49 (P <0.0001), by 5.4% (P <0.05) on day 56; by 4.8% (P <0.01) on day 63, by 3.1% (P <0.01) on day 77, by 4.3% (P <0.01) on day 84, and by 5.1% (P <0.0001) on day 90. On day 42 of the research, the group was ahead of the counterparts from the reference group by 7.9%, but there were already no statistically significant differences.

In experimental group 4, the absolute weight was statistically much higher than in the reference group (P <0.0001) from day 7 (8.4%) until the end of the experimental period. With that, on days 42 and 56 of the experiment, they were ahead of their counterparts from the reference group by 12.8% (P <0.001), and by 8.9% on day 70 (P <0.001).

The absolute and average daily live weight gains by the broilers in experimental groups 1–4 on day 42 of the research were higher than in the reference group by 5.2, 6.7, 8.3 and 13.4% (P <0.001), respectively (Table 2). On day 90 of the research, the indicators in the experimental groups were superior to the weight gain (P <0.0001) in the reference group by 0.7, 3.8, 5.2, and 9.2%, respectively.

Relative weight gain acc. to S. Brody on day 42 of the research was higher in experimental groups 1–4 than those in the reference group by 0.4, 0.6, 0.7 and 1.1% (P <0.01), respectively. On day 90 of the research, the values changed insignificantly: in the reference group, it was higher than that in the experimental group 1 by 0.1%, in experimental group 2, it was higher than that in the reference group by 0.1% (P <0.05), in experimental group 3 – by 0.2% (P <0.001), in experimental group 4, it was higher than that in the reference group by 0.4% (P <0.0001).

Table 1 Absolute weight of experimental birds (g, M±m)

Group name	Reference	Experimental 1	Experimental 2	Experimental 3	Experimental 4
Number of chickens in the group	n = 20	n = 20	n = 20	n = 20	n = 20
Dosage of the preparation (µl/kg)	0	2	5	50	300
Results, weighing					
Before the research	101.5 ±0.34	103.6 ±0.34	102.65 ±0.44	102.5 ±0.28	102 ±0.4
After 24 hours	125.55 ±1.88	126.95 ±1.56	127.25 ±0.8	127.65 ±0.91	127.95 ±0.88
On day 7	356.75 ±3.5	353.7 ±2.73	362.4 ±2.31	370.45 ±0.9*	386.7 ±0.88****
On day 14	697.25 ±8.12	698.05 ±12.48	708.80 ±5.77	725.3 ±2.39*	773.55 ±9.45****
On day 21	1,232.8 ±11.74	1,248.75 ±11.05	1,262.2 ±17.21	1,342.5 ±13.9***	1,399.95 ±1.23****
On day 28	1,809.4 ±10.21	1,794.95 ±10.75	1,883.55 ±12.32**	1,946 ±4.76****	2,070.15 ±11.65****
On day 35	2,152.15 ±12.35	2,186.3 ±13.66	2,206.15 ±5.47**	2,267.05 ±17.1***	2,399.95 ±12.56****
On day 42	2,364.5 ±13.22	2,483.2 ±13.44	2,517.4 ±18.96	2,552.30 ±20.8	2,667.5 ±23.74***
On day 49	2,711.4 ±25.96	2,699.67 ±19.1	2,782.07 ±28.69	2,879.67 ±13.95****	3,012.47 ±12.64****
On day 56	3,193.27 ±24.92	3,152.27 ±14.18	3,236.87 ±12.69	3,364.53 ±12.02*	3,601.93 ±14.31***
On day 63	3,466.93 ±28.83	3,463.6 ±28.79	3,454.4 ±21.04	3,632.8 ±21.44**	3,838 ±11.99****
On day 70	3,860.20 ±29.43	3,816.47 ±23.61	3,940.73 ±35.9	3,987.4 ±10.92	4,203.87 ±11.43***
On day 77	4,036.2 ±28.53	4,029 ±20.85	4,136.53 ±11.6*	4,161.67 ±10.62**	4,394.2 ±12.42****
On day 84	4,222.8 ±26.96	4,238.07 ±21.96	4,325.67 ±11.49**	4,404.47 ±13.51**	4,610.53 ±15.58****
On day 90	4,417.07 ±19.24	4,451.07 ±16.95	4,582.6 ±13.42****	4,643.47 ±13.82****	4,814.87 ±19.93****

*Note: * – the differences are veracious with the significance level of P <0.05; * * P <0.01; *** – P <0.001; **** – P <0.0001*

Table 2 The absolute average daily and relative weight gains of experimental chickens (g, %, M±M)

Group name	Reference	Experimental 1	Experimental 2	Experimental 3	Experimental 4
Number of chickens in the group	n = 20	n = 20	n = 20	n = 20	n = 20
Preparation dosage (µl/kg)	0	2	5	50	300
Absolute weight gain, g					
On day 7	255.25 ±3.57	250.10 ±2.75	259.75 ±2.35	267.95 ±0.95	284.70 ±1.06****
On day 14	595.75 ±8.11	594.45 ±12.54	606.15 ±5.64	622.80 ±2.44*	671.55 ±9.43****
On day 21	1,131.30 ±11.78	1,145.15 ±11.12	1,159.55 ±17.38	1,240.00 ±13.90***	1,297.95 ±1.27****
On day 28	1,707.90 ±10.10	1,691.35 ±10.77	1,780.90 ±12.25**	1,843.50 ±4.87****	1,968.15 ±11.74****
On day 35	2,050.65 ±12.34	2,082.70 ±13.78	2,103.50 ±5.45**	2,164.55 ±17.09***	2,297.95 ±12.65****
On day 42	2263.00 ±20.22	2379.60 ±13.49	2414.75 ±18.96	2449.80 ±20.83	2565.50 ±23.72***
On day 49	2,609.93 ±26.09	2,596.20 ±18.99	2,679.53 ±28.49	2,777.07 ±13.89****	3,000.60 ±12.78****
On day 56	3,091.80 ±24.76	3,048.80 ±24.23	3,134.33 ±12.27	3,261.93 ±11.87*	3,500.07 ±14.24***
On day 63	3,365.47 ±28.74	3,360.13 ±28.73	3,351.87 ±23.76	3,530.20 ±21.39**	3,736.13 ±12.27****
On day 70	3,758.73 ±29.64	3,713.00 ±23.75	3,838.20 ±25.91	3,884.80 ±10.78	4,102.00 ±11.36***
On day 77	3,934.73 ±28.69	3,925.53 ±20.81	4,034.00 ±11.73*	4,059.07 ±10.62**	4,292.33 ±12.36****
On day 84	4,121.33 ±26.94	4,134.60 ±21.94	4,223.13 ±11.60**	4,301.87 ±13.53**	4,508.67 ±15.68****
On day 90	4,315.60 ±19.15	4,347.60 ±16.86	4,480.07 ±13.46****	4,540.87 ±13.84****	4,713.00 ±19.76****
Average daily weight gain, g					
On day 7	23.20 ±0.32	22.74 ±0.25	23.61 ±0.21	24.36 ±0.09	25.88 ±0.10****
On day 14	33.10 ±0.45	33.03 ±0.70	33.68 ±0.31	34.60 ±0.14*	37.31 ±0.52****
On day 21	45.25 ±0.47	45.81 ±0.44	46.38 ±0.70	49.60 ±0.56***	51.92 ±0.05****
On day 28	53.37 ±0.32	52.85 ±0.34	55.65 ±0.38**	57.61 ±0.15****	61.50 ±0.37****
On day 35	52.58 ±0.32	53.40 ±0.35	53.94 ±0.14**	55.50 ±0.44***	58.92 ±0.32****
On day 42	49.2 ±1.53	51.73 ±0.29	52.49 ±0.41	53.26 ±0.45	55.77 ±0.52***
On day 49	49.24 ±0.49	48.98 ±0.36	50.56 ±1.29	52.40 ±0.26****	56.62 ±0.24****
On day 56	51.53 ±0.91	50.81 ±1.24	52.24 ±0.20	54.37 ±0.20*	58.33 ±0.24***
On day 63	50.23 ±0.43	50.15 ±0.43	50.03 ±1.55	52.69 ±0.32**	55.76 ±0.18****
On day 70	50.79 ±0.94	50.18 ±1.0	51.87 ±0.49	52.50 ±0.15	55.43 ±0.15***
On day 77	48.58 ±0.35	48.46 ±0.26	49.80 ±0.14*	50.11 ±0.13**	52.99 ±0.15****
On day 84	46.83 ±0.31	46.98 ±0.25	47.99 ±0.13**	48.88 ±0.15**	51.23 ±0.18****
On day 90	45.43 ±0.20	45.76 ±0.18	47.16 ±0.14****	47.80 ±0.15****	49.61 ±0.21****
Relative weight gain acc. to S. Brody, %					
On day 7	27.83 ±0.19	27.33 ±0.15	27.92 ±0.13	28.33 ±0.06	29.13 ±0.08****
On day 14	37.27 ±0.14	37.01 ±0.23	37.34 ±0.09	37.62 ±0.05	38.32 ±0.14***
On day 21	42.38 ±0.07	42.33 ±0.07	42.45 ±0.11	42.89 ±0.07***	43.21 ±0.03****
On day 28	44.69 ±0.03	44.54 ±0.04*	44.83 ±0.04*	45.00 ±0.02****	45.30 ±0.03****
On day 35	45.49 ±0.03	45.47 ±0.03	45.55 ±0.02	45.67 ±0.03**	45.92 ±0.03****
On day 42	45.81 ±0.14	45.99 ±0.03	46.08 ±0.03	46.13 ±0.03	46.31 ±0.03**
On day 49	46.39 ±0.04	46.31 ±0.03	46.42 ±0.08	46.56 ±0.02**	46.82 ±0.02****
On day 56	46.91 ±0.05	46.79 ±0.09	46.93 ±0.01	47.04 ±0.01	47.25 ±0.02****
On day 63	47.15 ±0.02	47.10 ±0.02	47.09 ±0.08	47.25 ±0.02*	47.41 ±0.02****
On day 70	47.43 ±0.06	47.35 ±0.05	47.46 ±0.03	47.49 ±0.01	47.63 ±0.01**
On day 77	47.55 ±0.02	47.50 ±0.02	47.58 ±0.02	47.59 ±0.01	47.73 ±0.01****
On day 84	47.65 ±0.02	47.62 ±0.01	47.68 ±0.01	47.72 ±0.01*	47.84 ±0.1****
On day 90	47.75 ±0.01	47.73 ±0.01	47.81 ±0.01*	47.84 ±0.01***	47.93 ±0.01****
Feed conversion rate, g					
On day 42	48.94 ±0.38	48.94 ±0.3	46.85 ±0.36	45.71 ±0.07*	43.4 ±0.39*
On day 90	39.75 ±0.16	39.43 ±0.16	38.46 ±0.22	38.09 ±0.03*	36.1 ±0.04*
EEI					
On day 42	111.1 ±1.64	111.2 ±1.34	121.0 ±1.85	126.9 ±0.38	140.7 ±2.51
On day 90	119.2 ±0.96	121.2 ±0.96	127.3 ±1.4	129.8 ±0.23	144.3 ±0.35

*Note: * – the differences are veracious with the significance level of P <0.05; * * P <0.01; *** – P <0.001; **** – P <0.0001*

The feed conversion rates on day 42 of the research in the reference group and in experimental group 1 were higher than the values in experimental groups 2–4 by 4.3, 6.6 (P <0.05), and 11.3% (P <0.05), respectively. On day 90, the feed conversion rate in experimental group 1 was lower than in the reference group by 0.8%; in experimental group 2 - by 3.3%; in experimental group 3 – by 4.2% (P <0.05); in experimental group 4 – by 9.2% (P <0.05).

For calculating the EEI, the following data were used: 100% preservation of the chickens in all groups, the age of the chickens at the time of slaughtering - 42 and 90 days, the average live weight at the time of slaughter on day 42: 2.5 kg in the

reference group and experimental group 1, 2.61 kg in experimental group 2, 2.67 kg in experimental group 3, and 2.81 kg in experimental group 4; on day 90: 4.45 kg, 4.49 kg, 4.6 kg, 4,65 kg, and 4.9 kg, respectively; the average feed conversion rate: on day 42 - 0.05 kg, on day 90 – 0.04 kg for chickens in all groups.

The EEI value on day 42 of the research in experimental groups 1–4 exceeded that in the reference group by 0.1, 9, 14,3, and 26.7%, respectively; on day 90 – by 1.7, 6.8, 8.8, and 21.1%, respectively; however, the data did not reach statistical significance relative to the reference group.

After 42 and 90 days, according to the above-mentioned method, the chickens were slaughtered and weighed. For this purpose, 5 broiler chickens with the same live weight (M ± 5.0%) were taken from each group. The slaughtering data are shown in Table 3.

Table 3 The results of check-out slaughtering of broiler chickens (M±m)

Indicator / Group name	Preslaughter weight, g	Weight of eviscerated carcass, g	Slaughter yield, %
On day 42 of the study			
Reference	2,499.0±18.0	1,954.3±11.3	78.2±0.3
Experimental 1	2,501.4±14.5	2,029.2±12.2	81.1±0.2
Experimental 2	2,607.4±19.1	2,163.9±24.7	83.0±0.7
Experimental 3	2,668.6±4.0	2,242.4±13.8	84.0±0.4
Experimental 4	2,806.2±24.7	2,359.6±15.2	84.1±0.6
On day 90 of the study			
Reference	4,454.4±17.8	3,289.5±10.9	73.9±0.2
Experimental 1	4,492.6±17.5	3,417.9±12.1	76.1±0.1
Experimental 2	4,602.8±25.1	3,567.7±14.7	77.5±0.5
Experimental 3	4,645.8±4.2	3,695.7±17.3	79.6±0.4
Experimental 4	4,896.6±6.1	3,938.5±13.0	80.4±0.3

Note: the differences between the reference and the experimental groups were statistically insignificant

Table 4 Absolute weight of the organs of experimental chickens on day 42 of the research (n=25, M±m)

Groups	Reference		Experimental 1		Experimental 2		Experimental 3		Experimental 4	
Preparation dosage (µl/kg)	0		2		5		50		300	
Indicators	Weight of organ (g)	MK (%)	Weight of organ (g)	MK (%)	Weight of organ (g)	MK (%)	Weight of organ (g)	MK (%)	Weight of organ (g)	MK (%)
Body weight	2,499±17.98	–	2,501.4±14.5	–	2,607.4±19.07	–	2,668.6±3.97	–	2,806.2±24.68***	–
Heart	9.268±0.08	0.371±0	9.263±0.07	0.37±0	9.679±0.08	0.371±0	9.887±0.03	0.37±0	10.33±0.12	0.368±0
Lungs	9.187±0.07	0.368±0	9.272±0.07	0.371±0	9.688±0.08	0.372±0	9.831±0.07	0.368±0	10.41±0.09	0.371±0
Liver	37.02±0.32	1.481±0	37.05±0.27	1.481±0	38.71±0.31	1.485±0	39.61±0.12	1.484±0	41.59±0.37	1.482±0
Spleen	1.981±0.02	0.079±0	1.983±0.01	0.079±0	2.072±0.02	0.079±0	2.054±0.03	0.077±0	2.191±0.05	0.078±0
Kidneys	13.89±0.12	0.556±0	13.9±0.1	0.556±0	14.53±0.12	0.557±0	14.78±0.1	0.554±0	15.53±0.17	0.554±0
Stomach	51.84±0.44	2.074±0.01	51.88±0.38	2.042±0	54.21±0.44	2.079±0	55.38±0.16	2.075±0	58.24±0.52	2.076±0
Intestines	25.2±0.28	1.008±0.01	25.05±0.19	1.001±0	26.18±0.21	1.004±0	26.72±0.1	1.001±0	28.12±0.25	1.002±0
Pancreas	4.95±0.06	0.198±0	4.909±0.04	0.196±0	5.13±0.04	0.197±0	5.241±0.02	0.196±0	5.511±0.05	0.196±0

*Note: *** – the differences are veracious with the significance level of P <0.001*

Table 5 Absolute weight of the organs of experimental chickens on day 90 of the research (n=25, M±m)

Groups	Reference		Experimental 1		Experimental 2		Experimental 3		Experimental 4	
Preparation dosage (µl/kg)	0		2		5		50		300	
Indicators	Weight of organ (g)	MK (%)	Weight of organ (g)	MK (%)	Weight of organ (g)	MK (%)	Weight of organ (g)	MK (%)	Weight of organ (g)	MK (%)
Body weight	4,454.4±17.8	–	4,492.6±17.48	–	4,602.8±25.05****	–	4,645.8±4.19****	–	4,896.6±6.08****	–
Heart	16.61±0.02	0.373±0	16.67±0.06	0.371±0	17.14±0.08	0.372±0	17.14±0.02	0.369±0	18.04±0.04	0.368±0
Lungs	16.558±0.05	0.372±0	16.69±0.06	0.371±0	17.09±0.12	0.371±0	17.16±0.02	0.369±0	18.08±0.03	0.369±0
Liver	66.16±0.19	1.485±0	66.68±0.25	1.484±0	68.56±0.32	1.49±0	68.57±0.1	1.476±0	72.13±0.12	1.473±0
Spleen	3.587±0.04	0.081±0	3.568±0.01	0.079±0	3.669±0.02	0.08±0	3.669±0.01	0.079±0	3.865±0.01	0.079±0
Kidneys	24.82±0.07	0.557±0	25.02±0.09	0.557±0	25.72±0.12	0.559±0	25.73±0.04	0.554±0	27.1±0.05	0.553±0
Stomach	92.64±0.27	2.08±0	93.37±0.35	2.078±0	95.96±0.47	2.085±0	96.01±0.14	2.067±0	101.14±0.18	2.065±0
Intestines	44.74±0.13	1.004±0	45.09±0.17	1.004±0	46.16±0.35	1.003±0.01	46.36±0.07	0.998±0	48.84±0.09	0.997±0
Pancreas	8.767±0.03	0.197±0	8.835±0.03	0.197±0	9.084±0.04	0.197±0	9.085±0.01	0.196±0	9.57±0.02	0.195±0

*Note: **** – the differences are veracious with the significance level of P <0.0001*

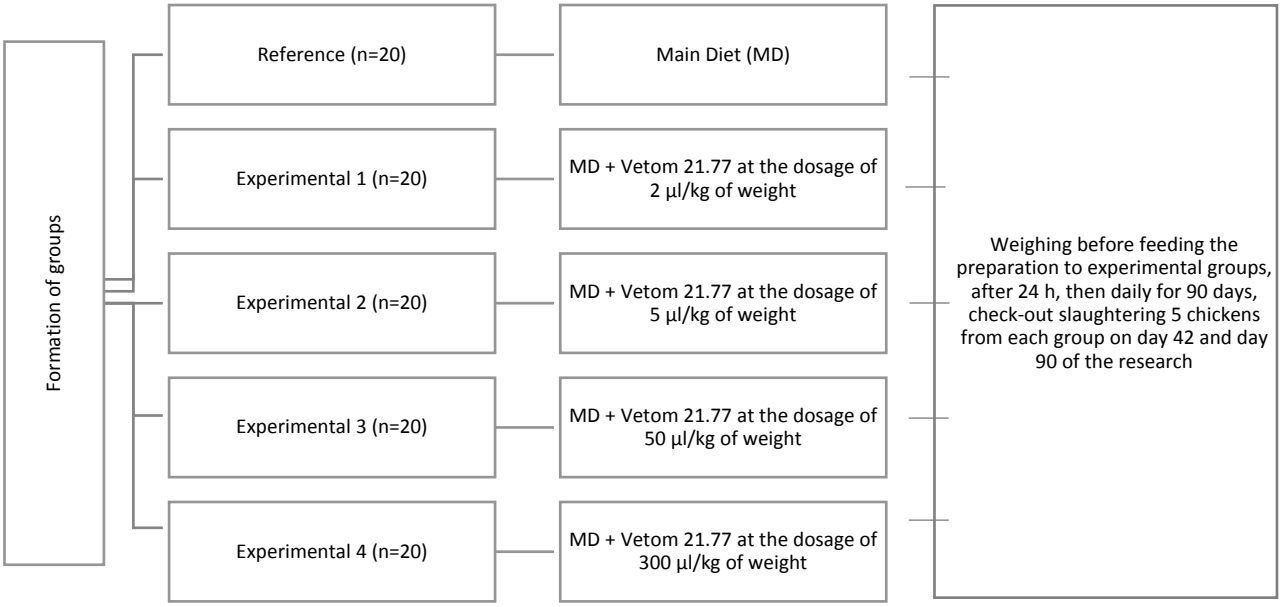

Fig. 1. Scheme of the research

Analysis of the data in Table 3 shows an increase in the slaughter yield of broilers in all experimental groups relative to the reference group throughout the research.

After 42 days, the slaughter yield in experimental group 1 was higher than that in the reference group by 3.7%, in experimental group 2 – by 6.1%, in experimental group 3 – by 7.4%, in experimental group 4 – by 7.5%, after 90 days - by 3, 5, 7.7, and 8.9%, respectively.

During the morphometric analysis of internal organs (Tables 3-5), anatomical dissection was performed, and internal organs were assessed.

In all cases of slaughtering (on day 42 and 90), the studied organs (heart, lungs, kidneys, liver, spleen, intestines, stomach, pancreas) of the chickens in the reference and experimental groups had no significant differences and pathological deviations in terms of appearance and structure. The mass coefficients of the organs had statistically insignificant differences, and were within the physiological norms for an individual organ, which confirmed the fact that the preparation had no nephrotoxic, hepatotoxic, and other undesirable effects.

CONCLUSION

In the opinion of the authors, the results of studies with the use of *D. flagrans* contained in available scientific literature do not allow objective evaluation of the growth stimulating potential of the microorganisms contained in this apathogenic fungus, due to the contrast of the data presented.

According to Chandrawathani, et al. [13], adding spores of *D. flagrans* into the basic fodder for sheep resulted in statistically significant (P=0.054) changes in the live weight of the animals. The results of the study performed by Epe et al. [14], where spores of *D. flagrans* were fed to goats and lambs, show that at some stages of the experiment, statistically significant ($P < 0.05$) live weight gain was observed, compared to the reference values. In the 4-month-long study by Dias et al. [15] with cattle that received pellets with *D. flagrans*, statistically significant ($P < 0.01$) live weight gain in the animals was achieved, compared to the reference group. The above results were consistent with the results of this study.

Dimander et al. [16], who also studied the influence of this fungus on the organism of cattle, reported a high level of statistical significance ($P < 0.0001$) of the increased weight gain in the group of experimental animals, compared to the analogs in the reference group. Similar results were also obtained in this study.

From the publication of Knox and Faedo [17] that was also devoted to studying the action of *D. flagrans* on the organism of sheep, it followed that almost throughout the entire duration of the experiment, in the group of animals that had received chlamydospores of the studied fungus, the cumulative weight gain clearly exceeded the reference values, although statistically significant differences between the groups were not achieved. In the study of the authors, the differences between the values in the reference and the experimental groups did not always reach statistical significance.

The growth-stimulating effect in case of using strains of *D. flagrans* seems to be mainly due to the integrated influence of the preparation on the organism, improving the processes of nutrients digestion, which results in lower feed conversion rate.

The obtained results show that Vetom 21.77 used at the dosages of 2, 5, 50, and 300 µl/kg did not adversely affect the physiological state and the morphometric indicators of the studied organs. Intensity of growth and development of the chickens in the experimental groups was much higher than in the reference group. The absolute weight of the studied internal organs of chickens in the studied groups did not have significant differences. During the experiment, no diseases and mortality of experimental chickens were registered. In the studied dosages, the preparation did not have any negative impact on the organism of chickens.

REFERENCES

1. Viveros, A., Chamorro, S., Pizarro, M., Arija, I., Centeno, C., Brenes, A., Effects of dietary polyphenol-rich grape products on intestinal microflora and gut morphology in broiler chicks, *Poultry Science* 2011, *90(3)*, 566-578.
2. Mathlouthi, N., Bouzaienne, T., Oueslati, I., Recoquillay, F., Hamdi, M., Urdaci, M., Bergaoui, R., Use of rosemary, oregano, and a commercial blend of essential oils in broiler chickens: in vitro antimicrobial activities and effects on growth performance, *Journal of Animal Science* 2010, *90(3)*, 813-823.

3. Lewis, M. R., Rose, S. P., Mackenzie, A. M., Tucker, L. A., Effects of dietary inclusion of plant extracts on the growth performance of male broiler chickens, *British Poultry Science* 2003, *44(S1)*, 43-44.
4. Hernandez, F., Madrid, J., Garcia, V., Orengo, J., Megias, M. D., Influence of two plant extracts on broilers performance, digestibility, and digestive organ size, *Poultry Science* 2004, *83(2)*, 169-174.
5. Cross, D. E., McDevitt, R. M., Hillman, K., Acamovic, T., The effect of herbs and their associated essential oils on performance, dietary digestibility and gut microflora in chickens from 7 to 28 days of age, *British Poultry Science* 2007, *48(4)*, 496-506.
6. Al-Kassie, G. A., Influence of two plant extracts derived from thyme and cinnamon on broiler performance, *Pakistan Veterinary Journal* 2009, *29(4)*, 169-173.
7. Kiczorowska, B., Samolińska, W., Al-Yasiry, A. R. M., Kowalczyk-Pecka, D., Effect of Boswellia serrata dietary supplementation on growth performance, gastrointestinal microflora and morphology of broilers, *Annals of Animal Science* 2016, *16(3)*, 835-849.
8. Sarica, S., Ciftci, A., Demir, E., Kilinc, K., Yildirim, Y., Use of an antibiotic growth promoter and two herbal natural feed additives with and without exogenous enzymes in wheat based broiler diets, *South African Journal of Animal Science* 2005, *35(1)*, 61-72.
9. Campos, A. K., Valadão, M. C., Carvalho, L. M., de Araújo, J. V., Guimarães, M. P., In vitro nematophagous activity of predatory fungi on infective larvae of Strongyloides papillosus, *Acta Veterinaria Brasilica* 2017, *11(4)*, 213-218.
10. Iwańczuk-Czernik, K., Witkowska, D., Sowińska, J., Wójcik, A., Mituniewicz, T., The Effect of A Microbiological and A Disinfecting Preparation on the Physical and Chemical Properties of Litter and the Results of Broiler Chicken Breeding, *Polish Journal of Natural Science* 2007, *22*, 395-406.
11. Nozdrin, G., Moruzi, I., Pishchenko, Y., Ivanova, A., Nurutdinova, S., Startseva, Y., Exterior Features of Siberian Sturgeon Underyearlings when Applying Bs 225 Microbiological Preparation, *Indian Journal of Science and Technology* 2015, *8(34)*.
12. OECD, Test No. 409: Repeated Dose 90-Day Oral Toxicity Study in Non-Rodents, OECD Publishing, Paris 1998.
13. Chandrawathani, P., Jamnah, O., Adnan, M., Waller, P. J., Larsen, M., Gillespie, A. T., Field studies on the biological control of nematode parasites of sheep in the tropics, using the microfungus Duddingtonia flagrans, *Veterinary Parasitology* 2004, *120(3)*, 177-187.
14. Epe, C., Holst, C., Koopmann, R., Schnieder, T., Larsen, M., von Samson-Himmelstjerna, G., Experiences with Duddingtonia flagrans administration to parasitized small ruminants, *Veterinary Parasitology* 2009, *159(1)*, 86-90.
15. Dias, A. S., Araújo, J. V., Campos, A. K., Braga, F. R., Fonseca, T. A., Application of a formulation of the nematophagous fungus Duddingtoniaflagrans in the control of cattle gastrointestinal nematodiosis, *World Journal of Microbiology and Biotechnology* 2007, *23(9)*, 1245.
16. Dimander, S. O., Höglund, J., Uggla, A., Spörndly, E., Waller, P. J., Evaluation of gastro-intestinal nematode parasite control strategies for first-season grazing cattle in Sweden, *Veterinary Parasitology* 2003, *111(2-3)*, 193-209.
17. Knox, M. R., Faedo, M., Biological control of field infections of nematode parasites of young sheep with Duddingtonia flagrans and effects of spore intake on efficacy, *Veterinary Parasitology* 2001, *101(2)*, 155-160.