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Effect of the inclusion of different doses of biologically active plant supplement into the combined feed for grower pigs

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Abstract

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The purpose of this experiment was to establish the effect of the lower and the higher level of the studied extract VemoHerb (VH), compared to the level of 150 g/t, which was used in the other experiments. In connection to this, an experiment was conducted with a total number of 24 grower pigs, divided into four groups – Group I (control), Group II – with a supplement of 75 g/t VH to the fodder, Group III + 150 g/t VH to the fodder, Group IV + 225 g/t VH to the fodder. The duration of the experiment was 42 days and covered the weight period from 30 to 60 kg live weight. The influence of the group the animals belong to depending on the dose of the studied supplement is a reliable variation source of the features of average daily growth ($P<0.05$) and the quantity of the received fodder ($P<0.01$). Compared to the control pigs, the animals from Groups III and IV have a practically equal growth intensity and use of the fodder, which shows that the increase of the dose of the used product does not lead to a significant increase of the productivity and the economic effectiveness; therefore, the dose used up to now for the inclusion of the product of 150 g/t is the most appropriate one.

Keywords: pigs; feed; plant extracts; economic effect; antibiotics

Introduction

The nutritive doses of antibiotics have been used in pig-breeding since the fifties of the 20th century, as their purpose is to improve the growth and the consumption of fodder, as well as to prevent the animals of subclinical forms of diseases. On one hand, the effectiveness of including antibiotics is not subject of any doubts due to the good economic results in the field; on the other hand, the danger of resistance of the bacteria to the antibiotics, the care for the human-being as a consumer of animal products, and the danger of residual quantities leading to allergic reactions, immune deficiency, etc. (Pugh, 1998; WHO, 1998; Bezoen et al., 1999; McMullin, 2000), is not to be underestimated.

This problem has become rather topical since the full ban of antibiotics as growth stimulators in pigs and birds, led to the demand for alternative supplements such as probiotics, prebiotics, plant extracts, etc. The practical results of the performed experiments with the application of herbs and medicinal plants in feeding farm animals is expressed, on one hand, in the improvement of the health condition, and, on the other, in the improvement of some production indicators – growth, consumption of the fodder, good slaughter indicators, etc. (Santoro et al., 2007; Ivanova-Peneva et al., 2010; Ivanova-Peneva and Kanev, 2014; Ivanova et al., 2016).

This gave us a reason to establish the effect of the lower and higher level of the studied biologically active plant supplement compared to the 150 g/t, which has already been applied in a number of experiments conducted by us (Zapry-

anova-Boeva, 2011), and which achieve good economic and physiological indicators with pigs.

Material and Methods

The purpose of the experiment was to establish the biological and economic effect of different doses of biologically active plant supplement. The trademark of the studied herb-based product is VemoHerb (VH) and contains a biologically active complex of dry extracts of chicory (*Cichoria intybus* L), sumac (*Cotinus coggygria* L.) and tansy (*Tanacetum vulgare*) plants, in a suitable combination.

The experiment was conducted at the experimental base of the Institute of Animal Science, Kostinbrod, with a total of 24 (12 castrated male and 12 female) grower pigs of the Danube White breed, divided into four groups: Group I – control, Group II – with a supplement of 75 g/t VemoHerb to the fodder, Group III – with a supplement of 150 g/t VemoHerb to the fodder, Group IV – with a supplement of 225 g/t VemoHerb to the fodder.

The animals were bred in individual boxes. Feeding was at will, with a standard combined feed for the category (Table 1) and they had free access to drinking water. The duration of the experiment was 42 days and covers the weight period from 30 to 60 kg of live weight.

The following indicators were controlled during the experiment: live weight of the pigs – at the beginning and at the end of the experiment; the quantity of the consumed fodder – daily, individually.

Table 1
Component composition and energy and nutrients content in 1 kg of compound feed for pigs

Components	%
Maize	32.00
Wheat	38.08
Soybean meal	12.00
Sunflower meal	7.00
Wheat bran	8.00
Dicalcium phosphate	1.00
Limestone	1.20
Salt	0.30
Premix	0.20
L-Lysine	0.22
Total	100.00
Combine feed contents	%
ME, MJ/kg	12.86
Crute protein,%	15.51
Lysine	0.82
Methionine+Cystine, g	0.57
Calcium, g	0.81
Phosphorus, g	0.62

The economic parameters used in the calculation of the revenue, expenses, and the notional profit include the technological indicators (the number of the pigs in a group, the duration of the period of study), the fattening qualities (average daily gain and consumption of fodder), the average price of the used types of fodder, the fodder supplements, the water, and the average purchase price of pork in Bulgaria as of November 2017.

In order to underline the economic effect of the studied biologically active complex VemoHerb, we used the name 'Notional profit'. The notional profit is the difference between the revenue and part of the expenses. At the calculation of expenses, the costs of the components in the mixes for the different categories and groups of animals are taken into account, as well as the expenses for water, at equal other conditions (expenses for labour, veterinary medical services, transport expenses, etc.).

In order to calculate the expenses on feed (BGN) and water (BGN) the data was used for the quantity of the used daily fodder (kg), the consumed regular amount of water (l), the average price of the used fodder and water (BGN), the number of pigs in a group, and the duration of the studied period (days).

The following formulas were used for calculation of the expenses on fodder and water:

$$\mathbf{FC = FP \times FID \times N \times T},$$

where FC – Feed cost (BGN), FP – Feed price (BGN), FID – Feed intake per day (kg), N – Number of pigs per group, T – Duration of the studied period (days).

$$\mathbf{WtC = WtP \times AWC \times N \times T},$$

where WtC – Water cost (BGN), WP – Water price (BGN), AWC – Average water consumption (l), N – Number of pigs per group, T – Duration of the studied period (days).

In order to calculate the notional profit, the amount of the expenses on water and the expenses on fodder are used, as they form the total amount of expenses.

The revenue is formed from the total gain for the period (kg), calculated by a formula and multiplied by the price we accept to be the average purchase price for 1 kg of live weight of the pigs for Bulgaria as of the moment of calculation.

$$\mathbf{TG = ADG \times N \times T},$$

where TG – Total gain for the period (kg), ADG – Average daily gain (kg), N – Number of pigs per group. T – Duration of the studied period (days).

At the end of the experiment, the obtained results were statistically processed with software product SPSS, v24, IBM

Results and Discussion

Plant and herbal extracts are a new direction in the search of an alternative for the nutritive antibiotics in feeding young animals. There are 0.5 million sorts of plants on the planet; however, only 10% of them are used by people and by some kinds of animals as food or for supporting the health condition (Borris, 1996). Many of the plant sorts containing different chemical substances like terpenes, essential oils, flavonoids, alkaloids, saponins, etc., playing an essential role in supporting human health, and after the EU banned the nutritive doses of antibiotics in fodder industry, the studies turn to their use in live-stock breeding.

The purpose of this experiment was to establish the effect of lower and higher level of the studied extract, compared to the level of 150 g/t, applied in the other experiments (Zapryanova-Boeva, 2011), which obtained good economic and physiological indicators with pigs. The direction of this study was also dictated by economic considerations.

The studied levels of the biologically active plant supplement were compared to the group without the inclusion of growth stimulator. Table 2 presents the average values of the reviewed plant indicators in pigs. As a whole, for the period of 42 days, pigs have good growth intensity, the average daily growth is 660 g/day, and the consumption of fodder for a growth of one kilo is 3.177 kg on average. The average daily combined fodder quantity the animals consumed was 2.078 kg.

The effect of the group the animals belong to depending on the dose of the studied supplement (Table 3) is reliable with the features of the average daily growth ($P<0.05$), and the quantity of the consumed fodder ($P<0.01$). No reliable difference concerning the studied indicators was found between male and female animals.

Figure 1 presents the dynamics of the growth indicators of pigs depending on the group they belong to (as a deviation from the average one, %). The growth intensity of control animals is 8% less than the average one, and with those from Group II, it is 4%. Pigs from Groups III and IV have an average daily growth of 5.2 and 5.3%, respectively, which is higher than the average value of this indicator ($P<0.05$).

Korniewicz et al. (2007) studied the plant extracts included in the fodder of different categories of pigs. The authors established that the studied product applied in the different doses, led to the increase of the average daily growth by up to 5%, and to the reduction of the consumption of fodder for a growth unit by up to 6.4% with the experimental pigs during the finishing period, compared to the control group.

According to the consumed fodder, the experimental animals from Group II are with average results compared to the whole extract. Control pigs have a reliably smaller value of the consumed fodder and they differ from the average value with 5.1%. The difference between Groups I and III and between Groups I and IV is 7% and 6%, respectively.

Table 2
Growth indicators of pigs (n = 24)

Traits	LS	±SE	CV, %
Live weight at the beginning of the trial, kg	29.982	0.659	10.5
Live weight at the end of the trial, kg	57.674	0.877	7.1
Average daily gain, kg	0.660	0.012	10.6
Feed intake, kg/day	2.078	0.014	3.9
Feed conversion ratio, kg	3.177	0.051	8.2

Table 3
The effect of the sex and the group on the growth indicators of pigs

	F- criterion and degree of reability		
Model	Model 1	Model 2	Model 3
Traits	Group	Sex	Sex*Group
Live weight at the beginning of the trial, kg	0.978	1.502	2.023
Live weight at the end of the trial, kg	0.737	0.059	1.701
Average daily gain, kg	3.098*	0.983	2.746*
Feed intake, kg/day	5.341**	0.14	5.668**
Feed conversion ratio, kg	2.08	1.689	1.552

*P < 0.05; ** P < 0.01

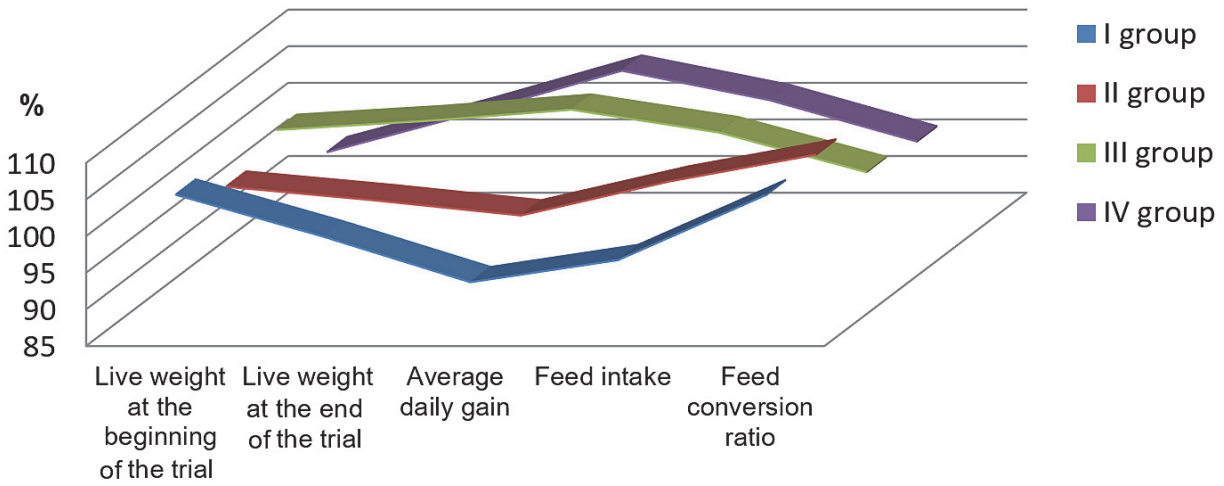

Fig. 1. Variability of growth indicators of pigs depending on the group (like deviation of mean, %)

Table 4
Economic analysis of the experiment with different doses of biologically active plant supplement

Economic traits	I group	II group	III group	IV group
Income, BGN	384.30	400.68	437.22	439.11
Expenditures, BGN	215.64	228.51	230.98	229.29
Notional profit, BGN	168.66	172.17	206.24	209.82
Expenditures per 1 kg of weight gain, BGN	1.40	1.43	1.32	1.31
Notional profit per 1 kg of weight gain, BGN	1.10	1.07	1.18	1.19

Source: own research

Compared to the Control group, the animals from Groups III and IV have practically identical growth intensity and fodder consumption, which shows that the increase of the dose of the used product does not lead to a significant increase of productivity; therefore, the used dose of inclusion of the product of 150 g/t is the most appropriate one.

In the attempts to establish the effect of the biologically active supplement Sangrovit® on the growth indicators of finisher pigs, Silva and Bridi (2009) also followed the economic effect of its application compared to the use of tiamulin. The authors established that the animals treated with the semi-synthetic antibiotic showed better average daily growth and final live weight ($p < 0.05$). Meanwhile, the experimental pigs whose mixture had supplement Sangrovit® have reliably greater slaughter weight, and, respectively, greater profit.

Along with reporting the biological effect of adding the biologically active plant supplement VemoHerb, it was also important to establish the extent to which the dose we accepted of 150 g/t was the most appropriate from economic point of view as well. The results from the economic analysis of the experiment we conducted are presented in Table 4.

Parallel to the growth intensity values, the profit in the Control group without growth stimulator is the lowest (384.30 BGN), as they increase gradually and reach to their highest level in Group IV including VemoHerb in a dose of 225 g/t fodder, as Group III is only 1.89 BGN less than this.

In the 50% lower inclusion of VemoHerb (Group II), compared to the level studied so far, of 150 g/t fodder (Group III), pigs have lower values of notional profit, which is 34.07 BGN (19.8%) less, higher expenditure of 0.11 BGN (7.7%) for 1 kg of growth, and 0.11 BGN (10.3%) lower notional profit for 1 kg of growth.

Compared to the pigs from the Control group, without the inclusion of growth stimulator, the animals of Groups III and IV have practically identical values of expenditure for 1 kg of growth – 1.32 BGN and 1.31 BGN, and a notional profit for one kg of growth of 1.18 BGN and 1.19 BGN, respectively, for Groups III and IV.

The growth intensity values and the consumption of fodder of pigs supported by the results of the economic analysis show that the dose we have accepted of 150 g/t fodder is the most appropriate one.

Conclusions

The influence of the group the animals belong to depending on the dose of the studied supplement is a reliable variation source of the features of average daily gain ($P < 0.05$) and the quantity of the received fodder ($P < 0.01$)

Compared to the control pigs, the animals from Groups III and IV have a practically equal growth intensity and use of the fodder

Supplementing VemoHerb to the feeding mixtures for grower pigs at the period from 30 to 60 kg live weight, under the conditions of the present experiment, led to a reduction in the cost per 1 kg of weight gain and to an increase of the conditional profit per 1 kg of weight gain in comparison with the control group.

The levels of the growth intensity and forage consumption in grower pigs, supported by the results of the economic analysis shows that the dose used up to now for the inclusion of the product of 150 g/t is the most appropriate one.

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