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POSSIBILITIES FOR USING PLANT EXTRACTS IN THE COMBINED FORAGE FOR THE SUCKING AND WEANED PIGS

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Abstract

The purpose of the research was to establish the possibilities for using plant extracts as an alternative of the nutritional antibiotics for growing pigs. Under the conditions of the performed experiment we established that the average live weight at birth was 1,512.4±24.6 g. The average weight of the experiment pigs was 1,459.6±42.9 g at birth, which is almost 80 g less, compared to the control animals. At the end of the sucking period, a higher average live weight by 2.2% is registered for the experiment animals, despite the unreliable differences in the groups. Putting in the biologically active plant supplement increases the average daily gain of the pigs by 4.8% in comparison with the control animals, and the overall gain by 4.6%. The inclusion of the biologically active complex of dry extracts from the plants Cichoria intybus L, Cotinus coggygria L. and Tanacetum vulgare in the mixes of the growing pigs leads to significant decrease of the number of the unwanted microorganisms in the digestive system of the animals – aerobic mesophiles, coliforms, staphylococci and micrococci, and enterococci, etc.

Key words*: antibiotics, faecal samples, microbiological analisys, plant extracts, sucking pigs.*

INTRODUCTION

After the complete ban of the subtherapeutic doses of antibiotics by the EU, a lot of controversial opinions appeared, originating from the sudden change in the productive indicators of the animals, the occurrence of persistent diarrhoea in the young animals, the economic losses in the industry.

A lot of antibiotics supporters appeared, due to an increase in the morbidity rate of the pigs, respectively an increase in their therapeutic use, as well as a productivity decrease of the different animal categories, especially with the weaned pigs (Casewell et al., 2003; Phillips et al., 2004; Vigre et al., 2008).

Plant and herbal extracts are a new direction in the search for a new alternative of nutritional antibiotics for the nutrition of young animals.

The use of herbs and their healing effect have been known since ancient times. According to Trifunschi et al. (2017), medicinal plants like *Viscum album* L. and *Allium sativum* L. are an appropriate alternative for the medication of different diseases. New methods are being investigated to highlight bioactive compounds from these authors.

In our country there are unique and valuable herbal plants, which allows the production of forage supplements for the needs of stockbreeding, and which can successfully replace the subtherapeutic doses of antibiotics, used as growth stimulators for years.

Studying various herbal mixtures in appropriate concentrations and doses would find practical application in solving some health problems when the pigs are being weaned (Ivanova-Peneva and Kanev, 2014).

All this gave us a reason to establish the effect of the biologically active plant product VemoHerb on the growth indicators of the sucking pigs and its significance for the improvement of the microbiological status of faecal samples of growing animals.

MATERIALS AND METHODS

In order to establish the effect of plant extracts on the growth indicators and the health status of the pigs, two experiments were conducted under production conditions in a pig located near the town of Plovdiv, Bulgaria (42.35°; 24.733°). During the first experiment, a total of 91 sucking pigs were used, originating from the farrows of

10 mothers (Large White x Landrace), divided in two groups of 5 mothers – control one (n=44 sucking pigs) and experiment one (n=47 sucking pigs). The mammals from the first group received standard combined forage without plant extract supplement or a nutritional antibiotic, while a herbal extract with the trade name VemoHerb was added to the combined forage of the experiment group, which contains a combination of dry extracts from chicory (*Cichoria intybus* L.), tansy (*Tanacetum vulgare*), and sumac (*Cotinus coggygria* L.) in a dose of 150g/t of fodder. The VemoHerb supplement is standardized using analytical indices, which are included in the company quality specification of the product (Valchev et al., 2009; Zapryanova-Boeva, 2011). The mother pigs were fed with standard combined forage for the category.

The second experiment was conducted with growing pigs in the period with weight from 6 to 20 kg. The nutritional antibiotic – Flavomycin was used as basis of comparison for the control animals, in a dose of 5 g/t fodder, and the experiment animals received combined fodder with the addition of VemoHerb in a dose of 150 g/t.

The animals from both experiments were bred in boxes on the floor, the feeding was without restraint with fodders with balanced nutritional ingredients in accordance with the category of the animals. The pigs from the first experience were fed from the fifth day after their birth, as the sucking period continued 29.4±0.5 days.

All animals had free access to drinking water.

During the first experiment with sucking pigs, the following indicators were controlled: live weight at birth and at weaning, individually; composition of the combined fodders – per components and end product, health status of the animals – daily.

In addition to control of the growth (Zapryanova-Boeva, 2011), at the beginning and the end of the second experiment microbiological analyses were performed of faecal samples for content of pathogenic and conditionally pathogenic microorganisms in a gram of sample. Samples from the excrements of the pigs were taken from each box, in sterile test tubes, which were sent for analysis in microbiological laboratory on the same day.

The trials are a part of a series of experiments which help to establish the effect of the tested biologically active plant supplement as a growth stimulator for growing pigs and the possibility to replace the nutritional antibiotics in pig breeding.

The received results were processed statistically with software product SPSS, v24, IBM.

RESULTS AND DISCUSSIONS

The data from the growth performance of sucking pigs from the first conducted experiment is shown in Table 1.

The average live weight at birth was 1,512.4±24.6 g, which is within the normal range for this indicator, which appears as an important factor, determining the survival rate and productivity of the pigs through their sucking period (Milligan et al., 2002).

The average weight at birth of the experiment pigs was 1,459.6±42.9 g, which is almost 80 grams less in comparison with the weight of the control animals.

At the end of the sucking period, a live weight which is 2.2% higher on average is registered with the experiment animals, despite the unreliable differences between the groups.

On the basis of a relatively low growth intensity, generally for the animals of this category, the addition of the biologically active plant supplement VemoHerb increases the average daily growth of the experiment pigs by 4.8% in comparison with the control animals, and the overall growth is by 4.6% (Table 1).

Table 1. Growth performance of suckling piglets

Traits	I group		II group		Average	
	LS	±SE	LS	±SE	LS	±SE
Piglet body weight at birth, g	1,545.7	44.4	1,469.6	42.9	1,512.4	24.6
Piglet body weight at weaning, g	6,172.4	198.9	6,307.0	192.5	6,261.5	131.4
Gain						
- Total gain, g	4,626.7	177.7	4,837.5	171.9	4,749.1	117.5
- Average daily gain, g	157.2	6.0	164.7	5.8	161.52	3.9

The research regarding the influence of herbs on the productive indicators of sucking pigs in scientific literature are too multi-directional. Ivanova-Peneva and Kanev (2014) established that better weight development of the pigs from the control group ($p<0.05$) compared to the group with oregano supplement.

Another study of the same category of animals, conducted under similar regimen, Ivanova-Peneva et al. (2010) establish that the use of the same herbs, *Origanum vulgare* and *Potentilla erecta Raus*, in the combined forage for sucking pigs, improves the growth of sucking pigs with 11% ($p<0.01$) for the suckling period (1-34 days), as well as the live weight at the weaning. According to these authors, the lack of enough literature on the issue of the influence of plant extracts on the production indicators of sucking pigs makes it difficult to interpret the acquired results. Meanwhile, data for the application of herbs in growing and fattened pigs is not missing (Toncheva et al., 2004; Valchev et al., 2005; Oetting et al., 2006; Zapryanova-Boeva, 2011), etc.

The factors we studied show that only the mother has a reliable effect on the controlled traits (Table 2). According to Ivanova-Peneva and Kanev (2014), the reliable effect of the box is probably due to the milkiness of the mother, and it is extremely difficult to achieve the equalization in milkiness.

Table 2. The effect of the sex, group and the mother on the growth indicators of sucking piglets

Model	**F- criterion and degree of reability**			
	Traits			
	Piglet body weight at birth	Piglet body weight at weaning	Total gain	Average daily gain
Sex	0.33	0.566	0.876	0.764
Group	1.517	0.237	0.726	0.792
Mother	6.945***	2.033*	2.066*	2.010*
***** P<0.001, *P<0.05**				

The data of growth indicators of pigs from the second conducted experiment is presented in our previous studies (Valchev et al., 2003; Zapryanova-Boeva, 2011), where we establish 18.8% higher average daily growth of the experimental animals compared to the control ones ($p<0.01$). The results for the use of the forage are similar, as adding plant extracts leads to reliably better ($p<0.05$) conversion of fodder in the experimental group compared to the control pigs.

The influence of herb extracts on the gastrointestinal microflora was studied by Castillo et al. (2006), in a comparative experiment with early weaned pigs under the following regimen: I control group; II group with supplement of 0.04% of Avilamycin; III group – 0.3% of sodium butyrate, and IV group – 0.05% mixture of Origanum spp., Cinnamonum spp and *Capsicum annuum* extracts. At the end of the experiment, post mortem samples were taken from the contents of the digestive tract in order to define the total number of micro-organisms, as well as the contents of lactobacilli and enteric bacteria in the jejunum and cecum of the pigs. The authors come to the conclusion that the total number of microorganisms in the separate parts of the tract does not change in dependence on the experimental supplements, but they detect increase ($P=0.003$) in the ratio of lactobacilli: enteric bacteria in the cecum of the animals from the group which took herb extracts.

The anti-bacterial activity of essential oils and herb extract were studied by Hammer et al., 1999; Gislene et al., 2000; Burt and Reinders, 2003; Kim and Shin, 2004; Si et al., 2006; Fisgin et al., 2009).

Santoro et al. (2007) studied the effect of essential oils mixture (*Origanum vulgare* – oregano and *Thymus vulgare* - thyme) on the growth and development of *Tripanosoma cruzi*. The results of the observation show that the essential oils from oregano and thyme inhibit the development of trypanosomes for 24 hours at IC50.

Similar results for the inhibitor effect of essential oils on different intestinal parasites were established by Nostro et al. (2004), Moon et al. (2006), etc.

In order to establish the influence of the studied product on the intestinal microflora,

microbiological analyses of faecal samples were taken for contents examination of pathogenic and conditionally pathogenic microorganisms in a gram of sample in them (Table 3).

Table 3. Microbiological analysis of faecal samples, number per gramme

	Average	Min	Max
Aerobic mesophilis	4,390,825x10^3	433x10^5	68x10^8
Coli forms	17,111x10^5	4x10^5	46x10^8
Staphylococci and micrococci	5,755x10^3	4x10^5	123x10^5
Enterococci	251,165x10^2	166x10^3	633x10^5
Proteus	1,590,750	333x10^3	35x10^5
Fungi and yeast	72,065x10^2	166x10^3	186x10^5
Sulfitreducing clostridia	1,725	0	5,000
Salmonellas	ND	ND	ND
Bacteria anaerobic	ND	ND	ND
Listeria monocitogenes	ND	ND	ND

ND- not detectable

Figure 1 presents clear data for the categorical reduction of unwelcome microorganisms at the end of the experiment with the group of VemoHerb supplement. The reduced number of *Aerobic mesophiles* of the control animals is within 20%, and with the experiment pigs – five times more.

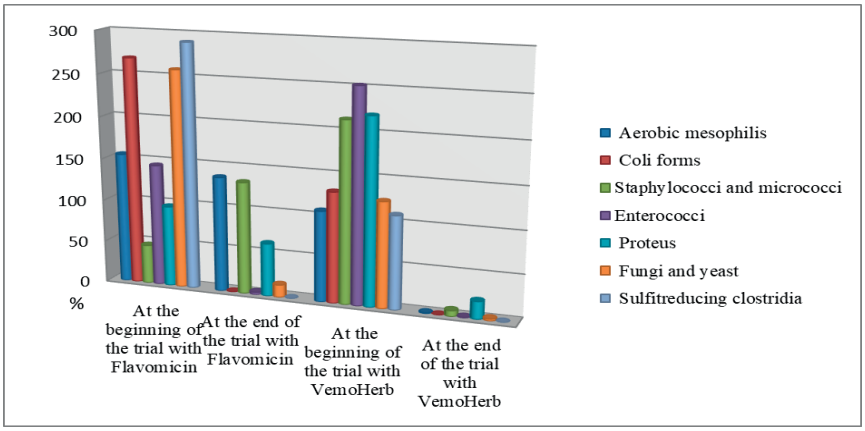

Figure 1. Content of pathogenic and conditionally pathogenic microorganisms in faecal samples (like deviation of mean)

The supplement of nutritional antibiotic and plant extract has an equal effect on the reduction of the population of Coli forms and Enterococci in the faecal samples of pigs. At the end of the experimental period, the number of Staphylococci and micrococci in the group with a supplement of the tested herbal product is around 93% smaller, compared to the average value of this indicator. With Proteus, a decrease is registered from 37 to 79%, respectively with the control and the experiment group.

In comparison with the control samples at the end of the experiment, the Fungi and Yeast group with supplement from plant extract reach 2% from the average for the indicator, which is 13% less than that of the animals, which have been given nutritional antibiotic.

CONCLUSIONS

Under the conditions of the performed experiment we established that the average live weight at birth was 1,512.4±24.6 g. The average weight of the experiment pigs was 1,459.6±42.9g at birth, which is almost 80 g less, compared to the control animals.

At the end of the sucking period, a higher average live weight by 2.2% is registered for the experiment animals, despite the unreliable differences in the groups.

Putting in the biologically active plant supplement increases the average daily gain of the pigs by 4.8% in comparison with the control animals, and the overall gain by 4.6%.

The inclusion of the biologically active complex of dry extracts from the plants *Cichoria intybus* L, *Cotinus coggygria* L. and *Tanacetum vulgare* in the mixes of the growing pigs leads to significant decrease of the number of the unwanted microorganisms in the digestive system of the animals – aerobic mesophiles, coliforms, staphylococci and micrococci, and enterococci, etc.

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