THE USAGE OF SECONDARY PRODUCTS OF SPICE INDUSTRY IN PIG NUTRITION

Mareš, P., Křížová, Š., Zeman, L., Večerek, M.

Mendel University of Agriculture and Forestry Brno, Czech Republic

Abstract

The usage of secondary products of spice industry was evaluated in frame of this work. These substrates can be used in animal nutrition to take benefits from plant secondary metabolites content. The work was involved in different types of by-products from allspice (*Pimenta dioica*), coriander (*Coriandrum sativum*) and cumin (*Carum carvi*). The work follows the paper about influencing of nutrients digestibility by these feed additives (Mareš et al., 2008) where any negative effect was not found. This study is concerning with growth experiment on piglets. By-products were included into experimental feed mixtures on level 0.5 %. Experiment duration was 28 days after weaning and 152 animals entry the trial after seven days of preparing period. The results show the improving of growth intensity in group with coriander spent (10 %) as well as in group with spent of allspice (4 %). The experimental treatments influenced as well the daily feed intake of animals.

Key Words. Pig, coriander, cumin, allspice, spent, secondary metabolites, growth intensity, feed intake, feed conversion**.**

A lot commercial feed additives for non-ruminants are already based on plant extracts. The secondary metabolites are monitored to improve the animal efficiency and health status. Dry plants, extracts or essential oils are used to bring these specified substances. The using is limited by price especially in Middle Europe region as the substrates are mostly imported. The using of by-products from spice industry has following advantages: low price and significant secondary metabolites content.

By-products coming from processing of fruits used as spice in human nutrition were used as feed additive in pig production during the experiment. The base sources were fruits of cumin (*Carum carvi*) and coriander (*Coriandrum sativum*). These plants belong to *Apiaceae* family. The specific secondary metabolites in these substrates are connected with positive effect in animal metabolism as is mentioned below. The same type of by-product from allspice (*Pimenta dioica*) that belongs to *Myrtaceae* family was used as the similar chemical content was analysed. The chemical that is common in these products (speaking about final by-product used in experiments) is limonene. In frame of secondary metabolites composition limonene is slightly supplemented by myrcene in allspice product and carvone and octadeceoic acid in cumin product; in coriander product the limonene is supplemented by higher content of alpha-pinene. Limonene (carven) is mono-terpene with pineapple or orange aroma depending on chemical isomery. The main occurrence of limonene is in citrus fruits but as this paper speaks about we can find it as well in other plants. Limonene support the activity of liver enzymes especially glutation S-tranferase that is tool of cancer development elimination. About anti-cancer activities speak authors e. g. Rabi and Bishayee (2009). Anti-oxidative activities of limonene describe Lado (2004) and others. Wagner and Elmadfa (2003) speak about carvone and its biofunctionality in positive sense (anti-carcinogenic, anti-oxidative, insecticide).

The aim of our study was to determinate the influence of by-product from spice industry on growth intensity and feed conversion of growing pigs.

Material and Methods

The growth experiment was held at University farm in Žabčice that is accredited for animal experimentations. The used technology enabled to stable experimental groups including control one in same micro-clime conditions. The experiment starts on 28th day of animal age, seven days after weaning in 21st day of animal age. The ratio between male (castrated) and female was 18:20 in each of groups. The average initial weight was 6.62 ± 1.06 kg. The experiment duration was 28 days. One hundred fifty two piglets were divided into 8 groups (4 groups x 2 repetitions) that were fed by iso-protein and iso-energy feed mixtures. Only difference between treatments was an additive: first control group mixture was supplied by 0.5 % of wheat bran; second experimental group was supplied by 0.5 % of coriander spent; third experimental group was supplied by 0.5 % of allspice; fourth experimental group was supplied by 0.5 % of cumin spent. We mark the experimental groups according the plant substrates as “control”, “coriander”, “allspice”, “cumin”; however the full plants was not supplied into feed mixture just spent from fruits of these plants. The feed analyses were provided before the experiment started. The analyses of dry matter, crude protein, crude fiber, crude fat, non-nitrogen extracts crude

ash in feed mixtures were provided according to Act No. 124/2001 on requirements for sampling and analyses processes (Czech legislation). All laboratory analyses were realized at Department of Animal Nutrition and Forage Production Mendel University of Agriculture and Forestry Brno.

The pens for 19 animals were equipped by perforated floor, two drinkers and feeder with 6 places. The feed and water was able to animals *ad libitum*. The experiment run in autumn months and all air temperature and humidity data was recorded in half-hour intervals automatically. The body weight was evaluated individually on the 1st, 14th and 28th day of experiment. Feed intake was monitored per pen for all experimental period. The feed conversion was calculated. The health status was monitored daily. Two repetitions of this experiment were made. Statistical evaluation of results was processed by one-factorial analyses of variance.

In these experiments was used same feed mixture based on wheat, barley, high quality soya extract meal (48 % of crude protein), fish meal (72 % of crude protein), mineral-vitamin additive, lysine additive, rapeseed fat and experimental treatment (0,5 %). The composition of mixtures is described in Table 1.

The nutrition value of experimental additives was not taken into account in calculation of nutritional value of mixtures that was same in all variants. And the character of this feed additive was most similar to wheat brand

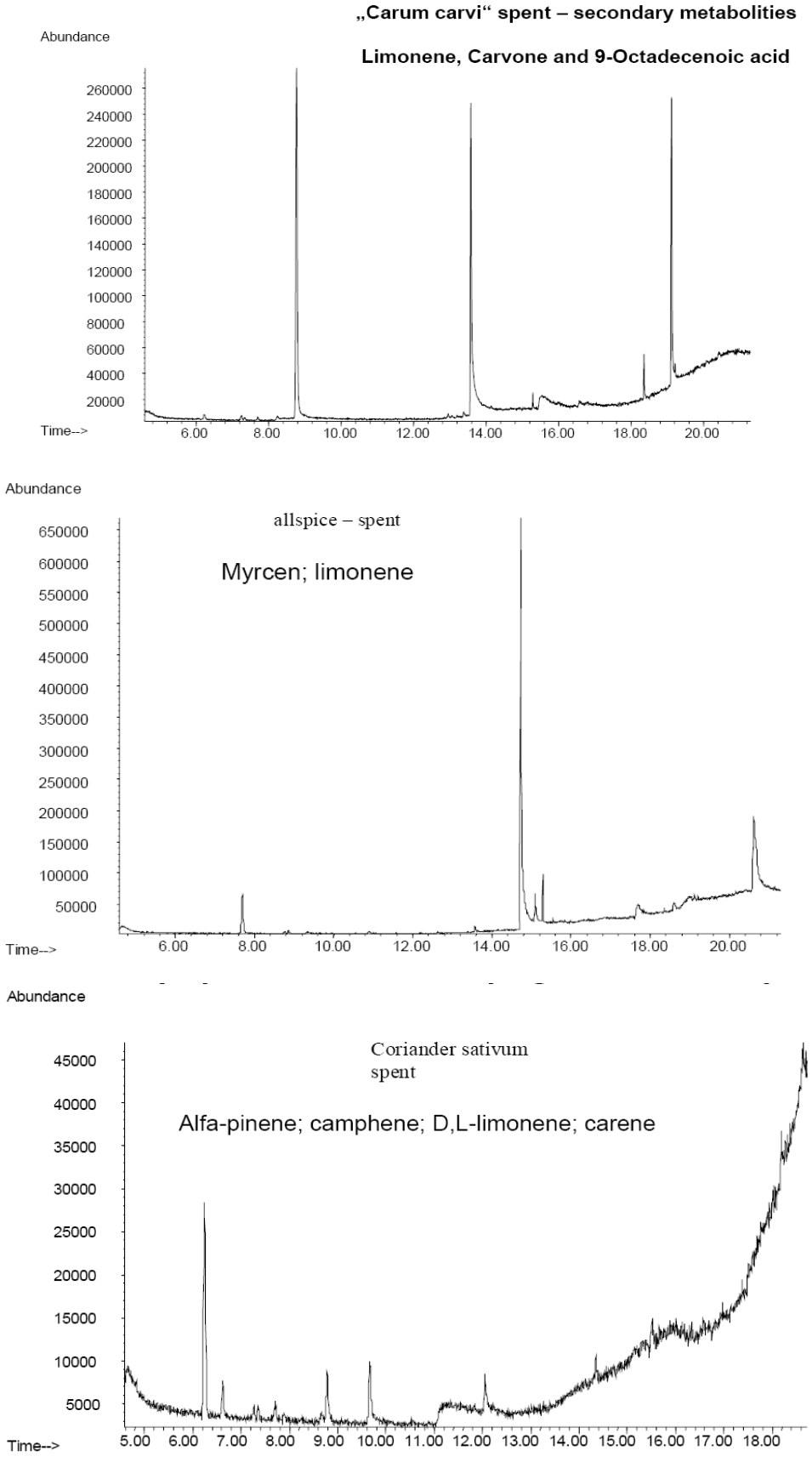
Table 1 Feed mixture composition

Component/Group	**„Control“**	**„Coriander“**	**„Allspice“**	**„Cumin“**
Wheat	48	48	48	48
Barley	21,4	21,4	21,4	21,4
Soya extract meal	17	17	17	17
Fish meal	4	4	4	4
Milk replacer	4	4	4	4
Rape seed oil	2	2	2	2
Limestone	1	1	1	1
Acidulant	0,6	0,6	0,6	0,6
Mono-calcium-phosphate	0,5	0,5	0,5	0,5
Salt (NaCl)	0,4	0,4	0,4	0,4
Lysine 99 %	0,3	0,3	0,3	0,3
Mineral – vitamine premix	0,25	0,25	0,25	0,25
DL-Methionine	0,05	0,05	0,05	0,05
Wheat brand	0,5			
Coriander spent		0,5		
Allspice spent			0,5	
Cumin spent				0,5
Total	**100**	**100**	**100**	**100**

Table 2. Average nutrient content in experimental mixtures

Nutrient	**Native mixture**	**Calculated 100 % DM**	**Calculated 88 % DM**
Dry matter (DM - g/kg)	921,6	1000,0	880,0
Crude protein (g/kg)	211,6	229,6	202,1
Crude fat (g/kg)	41,5	45,0	39,6
Gross energy (MJ/kg)	17,0	18,4	16,2
Crude fiber (g/kg)	21,5	23,4	20,6
Ash (g/kg)	47,5	51,5	45,3

Figure 1. Chromatograms of used additives showing main secondary metabolites contents



Results and Discussion

In experiment the growth intensity and feed conversion were monitored (Table 3, Table 4). The health status of animals was of good quality for all experimental time. No pig was medicated. One pig dead during the experiment in group "allspice"; therefore the total mortality was on level of 0.7 %. Comparing with control we can see increasing of average daily gain in group with "coriander" feed additive. As well other experimental treatment leads to the increasing of growth intensity without any statistical significance. The life body weight of animals on the end of experiment was higher of 7.2, resp. 2.2 and 0.6 % comparing with control group which has average final weight on level of 16.74 ± 3.91 kg. The average daily gain raised from 0.362 ±0.113 g ("control") to 0.368 ± 0.109 kg and 0.375 ± 0.097 kg in "cumin" and "allspice" group; the highest average daily gain was in group with coriander spent that reach the level 0.401 ± 0.101 kg. The variability between animals was quite high and the differences were not significant. The feed mixture utilization has similar tendency.

The average daily feed intake was similar between experimental groups and we can see intake of animals in control group on level 0.902 ± 0.085 kg / day / piglet. The animals in control groups accept of 918 ± 69; 916 ± 121 and 891 ± 96 g of dry feed mixture daily. It means in percentage 101.8, 101,6 and 98,8 % compared with "control". In relation with differences in animal growth intensity the feed conversion improved with addition of experimental spent. From level of 2,49 kg of feed mixture We can see improving of feed utilization mainly in second experimental group (feed conversion 2.29 kg feed/kg gain) in relation with the conversion that was found out in control group (2.49 kg feed/kg gain).

The positive effect of experimental treatment can be explained with the help of few papers that are connected with herbs extract trials. For example Jabeen et al. (2009) speaks about gut stimulation and hypotensive effect of coriander extract on guinea-pig ileum and rabbit jejunum. Finally it can lead to elimination of diarrhea etc. Sharma et al. (2009) evaluate the effect of coriander extracts against the oxidative stress – this situation is described on model example with lead poisoning. Anti-oxidative properties of coriander describe as well Nickavar and Abolhasani (2009). The anti-oxidative preservation of allspice (Pimenta dioica) sources is main point of papers of Miyajima et al., (2004); Ramos et al. (2003). The influencing of caraway substrates on Escherichia coli promotion found out Fazlara et al. (2008).

Short overview about positive properties of new plant sources show that there is few way how can plant additives affect the animal metabolism by positive sense. We cannot say the only one chemical bring the positive value or exactly this metabolic pathway is affected. The synergic effect in stomach processing or in internal metabolism is talked.

Table 3 Growth intensity of experimental animals

Group	Initial weight (kg)	Final weight (kg)	Average daily gain (kg/ animal/day)
"Control"	6,61 ± 1,08	16,74 ± 3,91	0,362 ± 0,113
„Coriander"	6,72 ± 0,93	17,95 ± 3,38	0,401 ± 0,101
„Allspice"	6,60 ± 1,05	17,11 ± 3,30	0,375 ± 0,097
„Cumin"	6,55 ± 1,17	16,85 ± 3,99	0,368 ± 0,109

Table 4 Feed intake and conversion during experimental period

Group	Average daily feed intake (kg/pc/day)	Feed conversion (kg feed mixture /kg gain)	1/ feed conversion (kg gain / kg feed mixture)
"Control"	0,902 ± 0,085	2,49 ± 0,40	0,40 ± 0,065
„Coriander"	0,918 ± 0,069	2,29 ± 0,06	0,44 ± 0,011
„Allspice"	0,916 ± 0,121	2,44 ± 0,39	0,41 ± 0,066
„Cumin"	0,891 ± 0,096	2,42 ± 0,37	0,41 ± 0,064

Conclusion

The work brought some information about affecting of three similar feed additives on piglets efficiency. We can see improving of daily gain or feed conversion after experimental treatment. It leads to investigation the plant sources from selected spice (coriander, cumin, allspice) can be used in pig production as growth promoters. In this point of view we have to point to coriander type spent, that shows the best properties from used treatments. The research needs will include further investigation processes with other livestock categories.

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