Influence of biologically active and phytogenic feed supplements on the productiveness in growing and fattening pigs

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Abstract

Phytogenic feed supplements are plant products used in animal nutrition in order to improve productivity. This class of feed has recently gained interest, especially since the EU ban on antibiotic feed supplements in 2006. Phytogenics is a fairly new class of feed supplements, with limited research on their effects and application, as well as studies on their botanical origin, processing and composition. The literature analysis indicated that herbal and plant extracts are one of the alternatives for growth promoters as their dosage, type and combinations of application will continue to be a subject of study for nutritional science.

This article considers researches on the influence of herbs and herbal extracts, activated charcoal and *Spirulina plantesis* in combined feeds, the productiveness and health of growing and fattening pigs.

Key words: nutrition, biologically active supplements, pigs, health, productiveness

The developmental directions of pig nutrition science in recent years are related to the use of biologically active and phytogenic feed supplements, which provide improvement of the microflora of digestion and absorption of nutrients and maintaining the health status of animals.

Phytogenic feed supplements are plant products used in animal nutrition in order to improve productivity. This class of feed has recently gained interest, especially since the EU ban on antibiotic feed supplements in 2006. Phytogenics is a fairly new class of feed supplements, which do not include organic acids or probiotics that have been widely studied in animal nutrition. Studies about phytogenic supplements, their effects and application are limited, as well as studies on their botanical origin, processing and composition (Windisch et al., 2007).

Studies by a number of authors (Namkung et al., 2004, Demir et al., 2005, Jamroz et al., 2006, Nofrarias et al., 2006, Cho et al., 2006, Stoni et al., 2006, Oetting et al., 2006) have been aimed at establishing morphological changes in the gastrointestinal tissues in pigs and birds due to the use of phytogenic feed supplements. Studies show both an increase and no change or decrease in the length of the intestinal villi in pigs and birds. The authors substantiated the claims by supporting the hypothesis that these supplements may stabilize nutrition.

In their review, Windisch et al. (2007) described possible antioxidant, antimicrobial and growth effects, as well as the effects in animals from the use of phytogenic supplements associated with improved consumption of compound feeds. Some researchers have shown the poten-

tial of phytogenic supplements to reduce intestinal pathogenic pressure, in terms of antimicrobial activity. According to some studies, they have the ability to modulate microbial colonies, fermentation and nutrient digestibility. Some isolated observations appear to support improvement in digestive enzyme activity and absorption capacity through the use of phytogenic compounds.

The ban on antibiotic application (2006) as growth stimulants has led to the search for alternative biological supplements that ensure the preservation and health of animals, as well as their productivity (Ivanova et al., 2010; Ivanova-Peneva et al., 2006; Borovan, 2004; Huang et al., 2011). Plant extracts have been used in animal nutrition especially because of their antimicrobial (Namkung et al., 2004, Costa et al., 2007), anti-inflammatory and antioxidant (Liu et al., 2008) and antiparasitic properties (Magi et al., 2006). It has been established that some natural feed products can have a prophylactic effect against a number of intestinal diseases due to their immunological and pharmacological action (Laine et al., 2008).

The effect of adding herbs in pig farming, especially in young pigs, has mainly signified, on the one hand, the improvement in health and on the other hand the improvement of some productive indicators – growth, consumption and utilization of feed.

In the studies of Ivanova (2012) the combination of the *Organum vulgare* and *Potentilla Erecta Raus* herbs did not have an effect on feed consumption, average daily gain and feed utilization in grower pigs. However, the addition of this combination of herbs, before and after weaning has a positive influence on post-weaning diarrhea prevention.

The addition of herbs to the water or feed of suckling pigs improved their growth and health state (Ivanova-Peneva et al., 2006).

The use of *Organum vulgare* and *Potentilla Erecta Raus* in combined feeds for suckling pigs has been studied by Ivanova-Peneva and others (2010). The authors established an improvement in growth (by 11%, $p \leq 0.01$) for the suckling period (1–34 days) and live weight at weaning (7.500 kg vs. 6.883 kg and 6.944 kg) due to the added herbs. The conclusion of the authors was that the herbs *Organum vulgare* and *Potentilla Erecta Raus* have a therapeutic effect and can be successfully used in the rearing of suckling pigs for prophylactic and therapeutic purposes.

The effect of the addition of a mixture of plant extracts, including *Rehmannia glutingsa, Angelica gigas, Discorea japonica, Glucurrhiza uralensis, Glycyrrhiza uralensis, Schisandra chinensis* and *Ligusticum jeholense*, on the productivity of some blood indicators was studied by Lee Paik (2007). Gain and feed intake were significantly higher in the groups receiving herbal mixture, and no difference in dosages was found. The addition of the herbal mixture decreased the content of E. coli, while those of Lactobacilli were increased.

The addition of an herbal mixture (2.04 and 3.0%) to the rations of fattened pigs in studies done by Paschma et al. (2010) reduced ammonium emissions over three test seasons (summer, autumn and winter).

The inclusion of Chinese herbs (1.0% and 0.5%) in studies done by Chen et al. (2011) increased live weight by 9.89% and 4.42% and reduced feed consumption by 7.07% and 4.49%. The authors also reported a positive effect of the added Chinese herbs on liver and kidney functions.

A number of authors (Castillo et al., 2006; Alakomi et al., 2006; Santoro et al., 2007; Moon et al., 2006) found that the beneficial effect of herbs and plant extracts on the gastrointestinal microflora was mainly related to the inhibitory effect on various intestinal parasites and bacteria.

Kanev et al. (2002) studied the effect of Ropadiar (essential oils of *Organum vulgare*, thyme and sage) on the growth of suckling pigs. The authors found that the use of Ropadiar at a dose of 0.05% in the formula of suckling pigs from 7 to 35 days of age provided higher feed, nutrients and energy consumption and higher average daily gain.

In her thesis, Zapryanova-Boeva (2011) tested the biologically active plant supplement Vemo-Herb (extracts of Chicory, Smoke tree and tansy)

on the productive traits of growing and fattening pigs, sows and their offspring. The author found that the supplement improved growth rate by 29% compared to the animals that hadn't been fed with growth stimulant and up to 18.8% compared to groups with nutritional antibiotic supplementation. The addition of VemoHerb increased the gain of fattened pigs by 9 to 18%. In sows, the addition of herbal extracts had increased feed consumption, live weight of piglets at birth and their gain during the suckling period.

The addition of conventional foods with Spirulina platensis seems to be a promising trend due to the nutritional value of this type of algae, which is known to be a rich source of protein, fatty acids, fiber, essential vitamins and minerals. It also has functional properties due to the presence of antioxidants, omega 3, antiviral and anti-cancer components. When Spirulina platensis is added to processed cheese, the content of protein, ash, fiber, selenium, zinc, iron, magnesium and potassium is increased in order to increase the nutritional and health value of the final product. There has been an increase in the activity of antioxidants, improvement of organoleptic, physical and rheological properties, which has led to the conclusion that the supplement has excellent nutritional, functional and health properties that can be used as a food product (Tohamy and al., 2019).

Natural plant charcoal is a feed additive, which we tested in weaned pigs. The supplement is obtained from specially selected French oak by carbonization. The product has a very good absorption capacity and captures enterotoxins produced by harmful bacteria and mycotoxins from feed, as well as some pathogenic bacteria such as clostridia, salmonella and E. coli.

Activated charcoal is a fine black powder that is obtained from the decomposition of various organic materials, which is then exposed to oxidizing gases at high temperatures to activate and increase the surface area (Clegg and Hope, 1999).

Struhsaker et al. (1997) stated that activated charcoal adsorbs a wide range of compounds. Adsorption therapy with activated charcoal as an indigestible carrier has been one of the important methods to prevent the ingestion of toxic substances or harmful substances formed in the gastrointestinal tract (McLennan and Amos, 1989; McKenzie, 1991; Jindal et al., 1994).

Chu et al. (2013) found that the inclusion of bamboo charcoal in the rations of fattened pigs increased productivity and feeding efficiency by reducing gaseous emissions and harmful microflora in faeces. The authors concluded that the charcoal used has been shown to reduce stress as reported by lower cortisol levels and increased serum Ig G concentrations.

Some researchers have studied charcoal and activated charcoal as a feed supplement. Charcoal affected the growth and carcass characteristics of pigs for fattening (Hwang, 1995) and was used as a feed additive for the production of high quality meat (Kim, 1990). Activated charcoal also affected meat quality and pork storage (Lee et al., 2011).

Activated charcoal supplementation in rations of fattening pigs has not been tested locally. In our research with grower pigs (Nedeva and Yordanova, 2013) we established that the addition of plant charcoal (3 kg/t feed) during a 14, 21, 35 and 49-day period after weaning increased growth intensity with 17.65–24.81% and decreased feed consumption and nutrition with 5.47–18.17%. In the conditions of our experiment the added plant supplement has successfully decreased the number of digestive disorders.

The literature analysis indicated that herbal and plant extracts are one of the alternatives for growth promoters as their dosage, type and combinations of application will continue to be a subject of study for nutritional science.

Biodiversity in nature, including microorganisms, terrestrial plants, seaweed and marine organisms, offers a valuable source of new bioactive substances. In reference to this we are monitoring the progress of development in immune mechanisms, through which the dynamic interaction of the intestinal microbiota and its host usually favours the homeostatic, symbiotic relationship and the way macroalgal bioactive substances are fed in both maternal and piglet rations can be used to support this symbiotic relationship (Sweeney et. al., 2016).

In summary, the reasonable use of antibiotics and the continuous development of alternatives are needed for ensuring the long-term sustainable development of livestock breeding.

At the same time, we need to strengthen surveillance and law enforcement to control antibiotic resistance and food chain residues within established safe levels. In addition, we need to improve the management of animal nutrition and production hygiene. Exploring alternatives to antibiotics will be a long process. In addition to research and development of new effective and safe alternatives, we need to step up research into the effects of the combined use of antibiotics and their alternatives, aimed at maintaining a healthy agricultural economy and preserving powerful antibiotics for effective human therapy.

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