

Effect of feed supplemented with plant extract and zinc oxide on coliform and lactic acid bacteria in pigs

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Introduction

The gut microbiota plays important role in maintaining the health of the host animal. Beneficial microbes are mainly lactic acid bacteria (LAB) and they can act many different ways: improve immune system, suppress pathogens, help in digestion and produce several beneficial compounds. *Escherichia coli* and other members Enterobacteriaceae (commonly called “coliforms”) are a normal part of the intestinal microbiota of humans and animals. They can be harmless or beneficial symbionts, but many of them known as pathogens (*Salmonella*, *Yersinia*, *Shigella*) or disease causing bacteria (*Escherichia*, *Klebsiella*, *Proteus*, *Enterobacter*, etc.). Coliforms caused diseases plays important role in livestock breeding, especially in the case of swine.

For decades, antibiotics and other antimicrobial agents were used as feed supplements to preserve the health of farm animals. These chemicals were successfully applied against various diseases, but many scientists considered their use a threat in animal feeds. A pathogen may develop resistance and then cause a human health problem and another risk of agricultural use of antibiotics is the presence of drug residues in food (Gioia and Biavati, 2018). The risk of using antimicrobial agents led to the prohibition of antibiotics as feed additives since 2006 in European Union (EU).

The use of some other feed additive chemicals, like zinc oxide, was restricted by the EU Regulation 1334/2003. In the case of swine, zinc oxide is very efficient against post-weaning diarrhoea, but the increased use of it can cause the emergence of multi resistant *E. coli* strains (Yazdankhah *et al.*, 2014) and can be harmful for the environment. In 2017 the European Medicines Agency discussed the risk of oral zinc oxide products and decided to ban the use of zinc in the future, because the negative effects outweigh the benefits of zinc oxide. The removal of these substances from animal feeding increases the pathogen pressure and risks in livestock. Pig breeders need to found a different solution against post-weaning diarrhoea, like pre/probiotics or herbal extracts.

Materials and methods

In our experiment three different mixture of herbal extracts and zinc oxide (control) were used as feed additives. The treated and control groups consisted of 10-10 animals. The stool samples were collected four times in an approximately 80 day long period: on the 10. day after the birth of the piglets, before and two weeks after the weaning and at the end of the pig breeding. The samples were homogenized and diluted in 1% trypton containing saline. The amount (CFU g⁻¹ faces) of bacteria was evaluated on semi selective and differential agar plates: De Man, Rogosa and Shapre (MRS) and Eosin Methylene Blue (EMB) media were used in the case of LAB and coliform, respectively.

Results and discussion

The changes of the total number of coliforms (potential pathogens) and lactic acid bacteria (beneficial microbes) were determined in the case of treated and control animals (Fig. 1.). The colony number of LAB showed nearly the same value at each sampling times (around 10^9 CFU g^{-1} faces), with the exception of the second samples. The reduced amount of LAB may have been caused by the antimicrobial effect of veterinary treatments (like vaccination). There was only a slight difference in the amount of LAB between the stool samples of treated and control animals. The amount of coliform bacteria was decreased continuously. Treatment three (E3) was as effective as control (ZnO), while the first two treatments reduced the amount of coliform bacteria less.

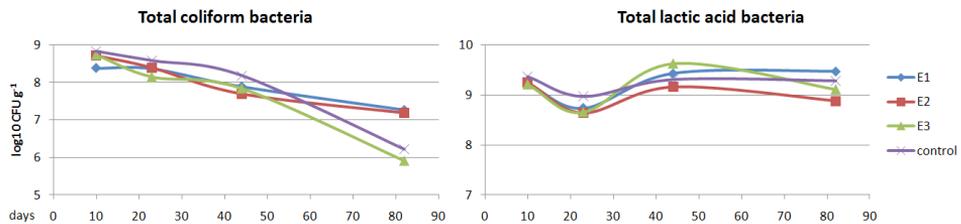


Figure 1: The changes of the total number of coliforms and lactic acid bacteria of pig faces. The feed was supplemented with ZnO (control) and three different mixture of herbal extracts (E1, E2 and E3).

Conclusions

Although antibiotics and other antimicrobial compounds (such as zinc oxide) are efficient against post-weaning diarrhoea, but they will no longer be able to be used as a feed supplement due to their negative effects. Different plant extracts may be suitable alternatives to prevent infection caused by coliform bacteria without disturbing the beneficial part of intestinal microbiome.

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References

- European Commission. (2005): Ban on antibiotics as growth promoters in animal feed enters into effect. http://europa.eu/rapid/press-release_IP-05-1687_en.htm
- European Commission. (2017): <https://www.ema.europa.eu/en/medicines/veterinary/referrals/zinc-oxide>
- European Union. Commission Regulation No 1334/2003. (2003): Amending the conditions for authorisation of a number of additives in feeding stuffs belonging to the group of trace elements. 2003. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32003R1334>
- Gioia, D., Biavati, B. eds. (2018): Probiotics and Prebiotics in Animal Health and Food Safety. Springer International Publishing AG, Cham, Switzerland. <https://doi.org/10.1007/978-3-319-71950-4>
- Yazdankhah, S., Rudi, K., Bernhoft, A. (2014): Zinc and copper in animal feed - development of resistance and co-resistance to antimicrobial agents in bacteria of animal origin. *Microbial Ecology in Health and Disease*. 25: 1. DOI:10.3402/mehd.v25.25862