

Effect of bee pollen in chicken diet on selected parameters of mineral profile

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The aim of the experiment was to monitor the effect of bee pollen extract on selected parameters of mineral profile (phosphorus, potassium, sodium, chlorides) of ROSS 308 hybrid chicken broilers ($n = 196$). Chickens were divided into three groups (C, control; E1, and E2 experimental groups). Experimental chickens received bee pollen in feed mixture in various doses as follows: E1 – 400 mg kg⁻¹; E2 – 800 mg kg⁻¹. Feeding period lasted 42 days. After 42 days of feeding chickens were slaughtered and blood samples ($n = 10$ in each group) were obtained. The blood serum was separated from whole blood by centrifugation at 3000g for 30 min. The following parameters (phosphorus, sodium, potassium, chlorides) were determined using automatic analyzer Microlab 300 (Merck®, Germany) and microprocessor-controlled analyzer EasyLite (Medica, Bedford, USA) according to the producers instructions. Mineral parameters were not influenced ($P > 0.05$) after bee pollen treatment. Detailed of the physiological mechanism involved in this should be further investigated.

Keywords: bee pollen, broiler chickens, serum mineral parameters

1. Introduction

Bee pollen is one of the widely used natural supplements. Honeybee collects pollen and mixes it with its own digestive enzymes. Bee pollen are rich source of protein (25 %); essential amino acids; oil (6 %), containing more than 51 % PUFA of which 39 % is linolenic, 20 % palmitic and 13 % linoleic acids; more than 12 vitamins; 28 minerals; 11 enzymes or coenzymes; 11 carbohydrates (35–61 %) which are mainly glucose, fructose and sucrose; flavonoids and carotenoids; phytosterols (Crane, 1990; Abreu, 1992; Quian Wei et al., 2008; Xu et al., 2009). It contains many essential nutritional elements important for growth and development of animals and humans. Many studies claimed positive effect of bee pollen on internal milieu of animals (Bell et al., 1983; Orzaez Villanueva et al., 2002; Haščík et al., 2011; Capcarová et al., 2012 and Petruška et al., 2012). Composition of feed mixtures for chickens is important but also in terms of the required nutrients and energy and their ratio. Further opportunities to influence the yield, health, and the final quality of poultry meat is the addition of various additives to feeding mixtures. Animal infectious diseases, especially the viral diseases, are worldwide concerned as they usually cause a great loss in domestic animal and poultry industry (Kong et al., 2004; Fan et al., 2011). The aim of this study was to determine the effect of bee pollen

as alternative feed additives on the selected parameters of mineral profile of broiler chickens.

2. Material and methods

2.1 Animals and diets

The blood samples of 42-day-old chickens ($n = 30$) were used for the determination of the selected mineral parameters (phosphorus, sodium, potassium, chlorides). The blood serum of broiler chickens (ROSS 308 hybrid) were used for the mineral analysis. The animals were kept in a thermoneutral hall (33 °C at the beginning, 19 °C at the end). The fattening was performed from day 1 to day 42 of the experiment. One-day-old broilers were randomly divided into three groups and fed with a complete feed mixture (Biofeed, a.s., Kollarovo, Slovak Republic) as follows: feed mixture starter (powdery form) from day 1 to day 21 of feeding and feed mixture grower (granular form) from day 22 to day 42 of feeding. The ingredients and the nutrient composition of the diets are shown in Table 1. Feed and water were provided *ad libitum*. The chickens were healthy; the conditions of animal care, manipulation and use corresponded to the instructions of the Ethical Commission. Care and use of the animals as well as experimental devices met the requirements established in the Certificate of Authorization to Experiment on Living Animals (State

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Veterinary and Food Institute of Slovak Republic, No. SK PC 30008).

Table 1 Feed mixture composition (according to manufacturer)

Ingredient	Starter	Grower
Dry matter in g kg ⁻¹	917.30	913.30
Crude protein in g kg ⁻¹	211.30	199.70
Fat in g kg ⁻¹	25.50	23.00
Starch in g kg ⁻¹	413.00	434.80
Total sugar in g kg ⁻¹	49.50	31.70
Metabolizable energy in MJ	11.68	11.55
Calcium in g kg ⁻¹	12.12	8.20
Phosphorus in g kg ⁻¹	7.83	6.83

2.2 Pollen samples

Bee pollen was collected in the Nitra region, Slovakia, in summer 2011. Freshly collected bee pollen was dried at 40 °C with light protection and ground into powder. The material (1 kg) was extracted with 70 % ethanol three times under the reflux for 2 h. After filtration and centrifugation (1700 xg, 30 min), the solution was concentrated under reduced pressure in a rotavator at 45 °C to evaporate the solvent and finally dried under high vacuum.

2.3 Dosage of feed additives

Pollen was administered to both feed mixtures in various concentrations. The animals were divided into the following groups: the control group (C) received feed mixture without bee pollen addition, the two experimental groups (E1) received the addition of 400 mg of bee pollen per 1 kg of feed mixture, and the second experimental group (E2) was given 800 mg of bee pollen in kg⁻¹.

2.4 Blood sampling and analyses

After 42 days of feeding chickens were slaughtered and blood samples ($n = 10$ in each group) were obtained. The blood serum was separated from whole blood by centrifugation at 3000 g for 30 min. The following parameters (phosphorus, sodium, potassium, chlorides)

were determined using automatic analyzer Microlab 300 (Merck®, Germany) and microprocessor-controlled analyzer EasyLite (Medica, Bedford, USA) according to the manufacturers' instructions.

2.5 Statistical analysis

SAS software and Sigma Plot 11.0 (Jandel, Corte Madera, USA) were used to conduct statistical analyses. One-way ANOVA was used to calculate basic statistic characteristics and to determine significant differences among the experimental and control groups. Data presented are given as mean and standard deviation (SD). Differences were compared for statistical significance at the level $P < 0.05$.

3. Results and discussion

The mineral parameters are summarized in Table 2. No significant differences ($P > 0.05$) in sodium, potassium, chlorides and phosphorus content in chicken blood were found among the control and experimental groups (E1 and E2). Several authors have found phenolic and flavonoid compounds present in bee pollen (Nagai et al., 2004; Almeida-Muradian et al., 2005; Basim et al., 2006). The flavonoids constitute a large group of secondary plant metabolites. Recently, dietary flavonoids have attracted a notable interest based on *in vitro* and *in vivo* studies suggesting a variety of beneficial biological properties in broiler chickens. Some changes in serum biochemical parameters in animals blood were observed after various feed additives given to the feed mixture, as probiotics (Capcarová et al., 2010; Capcarová et al., 2011), *Rhus coriaria* (Capcarová et al., 2012), propolis (Petruška et al., 2012; Capcarová et al 2013/14).

Positive effects of bee pollen on the chicken's health is supported by the findings of Wang et al. (2005) and Wang et al. (2007) who reported an early development of thymus and cloacal bursa, a decrease in the degeneration of the cloacal bursa and promotion of the splenic immune response, as well as an early development of the small intestine in broiler chicks. Haščík et al. (2013) concluded that the addition of natural bee pollen as a dietary supplement to the feed mixture for broiler Ross 308 in the amount (2 500 mg kg⁻¹, 3 500 mg kg⁻¹ and 4 500 mg kg⁻¹) led to an increase of the water content in experimental groups in the breast muscles, but it had

Table 2 Effect of bee pollen on mineral parameters and electrolytes of broiler chickens in mmol l⁻¹

Parameter	Control group (without propolis supplement)	E1	E2
Phosphorus	2.29 ± 0.48	2.13 ± 0.16	2.07 ± 0.72
Sodium	157.89 ± 2.30	160.02 ± 2.91	160.01 ± 2.77
Potassium	4.70 ± 0.47	4.52 ± 0.66	4.71 ± 0.59
Chlorides	110.34 ± 1.45	111.46 ± 1.63	112.27 ± 2.33

E1, E2 – experimental groups, values shown as means ±SD

decreased the protein content, fat content and energy value in the breast muscles.

Bee pollen supplementation significantly increased the number of *Lactobacillus* spp. and *Enterococcus* spp. in the caecum of chickens (Kačániová et al., 2013). Our previous study confirmed positive effect of bee pollen on antioxidant status of rats (Capcarová et al., 2013). Similar results were found in study with rabbits (Attia et al., 2010).

4. Conclusions

In this experiment the addition of bee pollen to the feed mixture for broiler chickens resulted in slight changes of mineral spectrum of animals. To our knowledge there are not a lot of similar studies on effect of bee pollen in various doses given to the feed mixture and its effect on mineral profile of broiler chickens. Further investigation with different doses of bee pollen will be worthy of further investigation. Bee pollen could be therefore used as a potential feed additive with prebiotic activity to the poultry diet.

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6. References

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