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REGULAR ARTICLE

EFFECT OF PROPOLIS IN CHICKEN DIET ON SELECTED PARAMETERS OF MINERAL PROFILE

Peter Petruška[1], Eva Tušimová[1], Anna Kalafová[1], Peter Haščík[2], Adriana Kolesárová[1], Marcela Capcarová[1]*

Address: [1]Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Animal Physiology, Trieda A. Hlinku 2, 949 76 Nitra, Slovak Republic

[2]Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Evaluation and Processing Animal Products, Trieda A. Hlinku 2, 949 76 Nitra, Slovak Republic

***** Corresponding author: petruska.peter85@gmail.com

ABSTRACT

The aim of the experiment was to monitor the effect of propolis extract on selected parameters of mineral profile (calcium, phosphorus, magnesium, potassium, sodium, chlorides) of Hubbard JV chickens. Chickens were divided into five groups (C, control; E1 – E4, experimental groups). Experimental chickens (n=10 in each group) received propolis in feed mixture in various doses as follows: E1 – 150 $mg.kg^{-1}$; E2 – 450 $mg.kg^{-1}$; E3 – 600 $mg.kg^{-1}$; E4 – 800 $mg.kg^{-1}$. Feeding period lasted 42 days. Propolis preparation caused a significant ($P<0.05$) decrease of serum phosphorus and magnesium content. Other parameters were not influenced ($P>0.05$) after propolis treatment.

Keywords: Propolis, blood, mineral profile, broiler chickens,

INTRODUCTION

The natural products are going to be substituted for antibiotics in order to improve immune system and fight against pathogens in human and animal life over the several last years. In contrast to antibiotics these products do not have side effects and are very useful in food chain. One of them is flavonoids, which are naturally produced in plants **(Croft, 1998; Hassig et al., 1999)** and is stored in different forms such as propolis. Propolis is a well-known substance that beekeepers find in their hives. There are many factors affecting propolis composition such as collecting location, time and plant source **(Markham et al., 1996)**. The principal components responsible for the biological activities of propolis samples are flavonoids, aromatic acids, diterpenic acids and phenolic compounds. Flavonoids are a group of polyphenolic compounds diverse in chemical structure and characteristics. They occur naturally in fruit, vegetables, nuts, seeds, flowers, and bark and are an integral part of the human diet **(Middleton and Kandaswami, 1993).**

Propolis has important pharmacological properties and it can be used for a wide range of purposes. According to the research intervention in the recent years propolis has shown tendency to be effective against a variety of bacteria **(Velikova et al., 2000)**, especially against gram-positive and some gram-negative bacteria **(Mirzoeva et al., 1997)**, viruses **(Amoros et al., 1994)**, and fungi **(Ota et al., 2001)**. Thus, propolis is an alternative to the use of dietary antibiotics **(Ítavo et al., 2011)**. It has been shown to be beneficial for improving the performance and immunity **(Galal et al., 2008)** and also meat utility **(Haščík et al., 2010).**

The effects of supplementations of EEP (ethanol extract of propolis) affected antioxidant on some blood indicators on level of MDA, and the activities of SOD (superoxide dismutase), CAT (catalase), GSH, and GSH-Px (glutathione peroxidase) in broilers exposed to heat were also determined **(Seven et al., 2009).**

The aim of the present study was to investigate the effect of propolis extract inclusion to the feed mixture on selected parameters of mineral profile of broiler chickens.

MATERIAL AND METHODS

Animals and diets

The experiment was conducted on broiler chickens, hybrid Hubbard JV (n=500). Each group included 100 chickens. Chickens were divided into five groups (control – C and

experimental groups E1 – E4). Experimental chickens received a propolis extract in feed mixture in various doses (E1 – 150 mg.kg^{-1}; E2 – 450 mg.kg^{-1}; E3 – 600 mg.kg^{-1}; E4 – 800 mg.kg^{-1}). The group of chickens received feed mixture without propolis inclusion served as control. The propolis was obtained from pulverized propolis, mixed with 80 % ethanol (Krell, 1996). The feeding period lasted 42 days. Chickens were fed *ad libitum* with complete feed mixture KKZ (Biofeed a.s., Kolárovo, Slovakia) as follows: KKZ HYD-01 (powdery form) from Day 1 of feeding till Day 21 of feeding and KKZ HYD-02 (granula form) from Day 22 till Day 42.

Ingredient and nutrient composition of diets are shown in Table 1. Animals were kept in thermoneutral hall (from Day 1 33°C until final 21°C). In closed hall thermo aggregate was installed and experimental conditions with defined temperature and humidity were simulated by sensor. Simulated conditions were continually monitored using electronic recorder (Hivus s.r.o., Zilina, Slovak Republic). Animals were stabled in fattening hall with deep litter according to Welfare.

Table 1 Diet composition of feed mixture KKZ HYD-01 and HYD-02.

Ingredient	KKZ HYD-01	KKZ HYD-02
Dry matter (g.kg^{-1})	917.3	913.3
Crude protein (g.kg^{-1})	211.3	199.7
Fat (g.kg^{-1})	25.5	23.0
Starch (g.kg^{-1})	413.0	434.8
Total sugar (g.kg^{-1})	49.5	31.7
ME (MJ)	11.689	11.555
Ca (g.kg^{-1})	12.121	8.207
P (g.kg^{-1})	7.833	6.834

Ca, calcium; P, phosphorus

Chickens were healthy and their condition was judged as good at the commencement of the experiment. Conditions of animals care, manipulation and use corresponded with the instruction of ethical commission. Care and use of animals and experimental devices met the requirements of the certificate of Authorization to Experiment on Living Animals (state Veterinary and Food Institute of Slovak Republic.

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 3000g for 30 min. The following parameters (calcium, phosphorus, magnesium, 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.

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 experimental and control groups. Data presented are given as mean and standard deviation (SD). Differences were compared for statistical significance at the level $P< 0.05$.

RESULTS AND DISCUSSION

Mineral parameters results are summarized in Table 2. In our study addition of propolis to the feeding mixture for broiler chickens caused significant ($P<0.05$) decrease of serum magnesium in all experimental groups in comparison with the control group. Propolis significantly ($P<0.05$) decreased serum phosphorus in E2 group in comparison with the control group. **Haro et al. (2000)** demonstrated that addition of propolis caused increase of phosphorus and magnesium level in bones (*femur and sternum*). Probably propolis inclusion in the diet increases absorption of phosphorus and magnesium from the blood to the bone and thus decreased the level of these elements in the blood. Our results confirm this fact

Table 2 Effect of propolis on mineral parameters and electrolytes of broiler chickens in mmol.l^{-1}

Parameter	C	E1	E2	E3	E4
Sodium	163.325±4.013	159.075±0.887	166.7±1.662	162.85±1.422	161.8±1.774
Potassium	4.855±0.297	4.811±0.281	4.529±0.176	4.607±0.202	4.83 ±0.258
Chlorides	130.875±3.304	128.85±0.805	134.363±1.224	131.625±0.969	130.275±1.413
Calcium	2.475±0.176	1.949±0.35	1.903±0.229	1.699±0.172	1.885±0.165
Phosphorus	2.820±0.111^{a}	2.422±0.175	1.405±0.122^{b}	2.655±0.199	2.605±0.418
Magnesium	3.121±0.314^{a}	1.669±0.357^{b}	1.558±0.436^{b}	1.283±0.460^{b}	0.522±0.122^{b}

C - control group (without propolis supplement); E1 - E4 experimental groups, values shown as means ± SD, Means with different letters within the same row differ significantly (P<0.05).

No significant differences (P>0.05) in sodium, potassium, chlorides and calcium content of chicken blood were found among the control and experimental groups (E1 – E4). Similarly to our results, **Seven et al. (2009)** confirmed that concentrations of sodium and potassium were not significantly influenced by addition of propolis. No significant differences were observed in amount of sodium in blood serum of rainbow trout (*Oncorhynchus mykiss*) between the experimental and the control group after propolis treatment **(Talas et al., 2009).**

It is known, that propolis caused changes in antioxidant status of chickens. Vitamin C and propolis decreased the SOD activity and showed a tendency to reduce CAT and GSH (glutathione) levels (**Seven et al., 2010**). According to **Seven et al. (2009)** EEP (ethanol extract of propolis) decreased lipid peroxidation and regulated antioxidant enzyme activities in the broilers exposed to heat stress. The protective role of EEP might be related to its antioxidant effect. Propolis may also influence immunity of animals. The inclusion of propolis may stimulate IgG and IgM production of laying hens and could be an important factor in immune stimulation of laying hens **(Çetin et al., 2010).**

In recent years, there has been a great deal of studies carried out on propolis metabolism, but not studies investigated dose-dependent effect of propolis on mineral parameters of animals. There are many researches focusing on the effects of another phytoadditives or naturals substancies on mineral profiles of broiler chickens. **Capcarova et al. (2010)** concluded that probiotic bacteria (*Enterococcus faecium*) caused slight decrease, of the calcium concentrations, significant increase of inorganic phosphorus after 25 weeks and significant decreasing at week 45 in plasma of broiler chickens. In another report, **Capcarova et al. (2011)** demonstrated that addition of *Lactobacillus delbrueckii* ssp. *lactis* in drinking

water significantly (P<0.05) increased content of calcium and potassium in chicken's blood. In the current study

CONCLUSION

In this experiment the addition of propolis to the feed mixture for broiler chickens Hubbard JV resulted in some changes of mineral spectrum of animals. Administration of propolis significantly decreased the content of serum phosphorus and magnesium in comparison with the control group. To our knowledge there are not a lot of similar studies on effect of propolis in various doses given to the feed mixture and its effect on mineral profile of broiler chickens. Further investigation with different doses of propolis will be worthy of further investigation.

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