JMBFS
Journal of Microbiology, Biotechnology and Food Sciences
International peer-reviewed scientific online journal

Published by Faculty of Biotechnology and Food Sciences

EFFECT OF BEE POLLEN DIETARY SUPPLEMENTATION ON MEAT PERFORMANCE OF ROSS 308 BROILER CHICKENS

Peter Haščík[1], Lenka Trembecká[1], Jana Tkáčová[1], Miroslav Kročko , Juraj Čuboň[1], Miroslava Kačániová[2]*

Address(es): doc. Ing. Peter Haščík, PhD.
[1] Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Animal Products Evaluation and Processing, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic.
[2] Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Microbiology, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic.

*Corresponding author:peter.hascik@uniag.sk

doi: 10.15414/jmbfs.2015.4.special3.55-58

ARTICLE INFO

Received 2. 12. 2014
Revised 10. 12. 2014
Accepted 11. 12. 2014
Published 2. 2. 2015

Regular article

OPEN ACCESS

ABSTRACT

A present study was conducted to evaluate the effect of dietary inclusion of bee pollen extract on meat performance of Ross 308 broiler chickens. A total of 180 one day-old Ross chicks were involved in experiment. Chickens were divided into 2 groups, an experimental group (E) and a control group (C). No added supplement was given to the control group, while the experimental group was given the feed mixture supplemented with bee pollen in an amount of 400 mg.kg^{-1}, during the whole fattening period. Data of live body weight, carcass weight, giblets weight and carcass yield were determined at 42 days of the age. The supplementation of bee pollen increased final body weight of broilers by 68.5 g. Each of investigated parameters of meat performance in experimental group was higher to that in control group, although the difference among the groups was not statistically significant ($P \geq 0.05$). The addition of bee pollen at dose 400 mg.kg^{-1} in the feed mixture indicates the slight effect on meat performance of chickens which can be beneficial for fattening of broiler chickens.

Keywords: Meat performance, bee polen, Ross 308, broiler

INTRODUCTION

Antibiotics have been widely used in animal production for decades. Although some are used therapeutically to improve the health and well-being of animals, most were given for prophylactic purposes and to improve growth rate and feed conversion efficiency (as antimicrobial growth performance promoters, AGPs) **(Huyghebaert *et al*., 2011)**. However, there is the fear that the continuous subtherapeutic use of in-feed antibiotics could lead to the development of antibiotic resistant bacteria, which can be harmful to humans **(Nasir and Grashorn, 2006)**. Thus, efforts have been made in different parts of the world to ban the inclusion of all types of antibiotic growth promoters in animal feeds **(Landy *et al*., 2011)**. Due to the emergence of microbes resistant to antibiotics which are used to treat human and animal infections, the European Commission (EC) decided to phase out, and ultimately ban, the marketing and use of antibiotics as growth promoters in feed **(Regulation (EC) No. 1831/2003)**.

The impact of phasing out animal growth promoters could be minimized provided that adequate attention is given to the implementation of alternative disease-prevention strategies and management factors, such as alternative husbandry practices in food animal production **(Toghyani *et al*., 2010)**, especially in poultry production **(Diarra *et al*., 2007; Attia *et al*., 2014)**. Some of the measures implemented have demonstrated to be efficacious and helped to maintain animal productivity at levels close to the ones observed when antibiotics were used in feed **(Castanon, 2007)**.

After ban of feed antibiotics in animal industry in 2006, poultry industry has adapted by improving selective breeding, biosecurity and management practices, environmental control of livestock facilities and introducing changes in birds feed composition and feeding programs **(Da Costa *et al*., 2011)**. Many natural substances used as alternatives to antibiotic in animal feed have been shown to express positive effects on growth performance and different health parameters **(Hong *et al*., 2012; Thiamhirunsopit *et al*., 2014)**.

During the past two decades, the poultry industry has been one of the most dynamic and ever expanding sectors in the world. It helps to fill the gap between requirement and availability of high quality protein for human consumption. The demand for a higher and safer protein source, free of infectious agents, is getting increased **(Pelicano *et al*., 2004; Alkhalf *et al*., 2010)**. Poultry meat is one of the most important foods in many cultures around the world, due to its nutritional characteristics. Carcass evaluation should be considered an important part of poultry-processing activities because it involves observation of standards of quality for the birds according to grading and expected yield. However, carcass composition can change under certain circumstances, such as stress, diet, pre-slaughter handling, the slaughtering process, genetic factors, and more. Genetics has been a major contributor to carcass yield increase, following advances in poultry nutritional knowledge. As carcass yield is such an important factor in the poultry industry from an economic point of view, many efforts have been made to predict it **(Durán-Meléndez, 2010)**.

Broiler chickens are characterized by a very fast growth rate; therefore diet of broilers should contain high concentrations of available nutrients **(Zimnoch *et al*., 2000)**. What is more, composition of feed mixtures for chickens is important in terms of the required ratio between nutrients and energy. Therefore, the evaluation of nutrition supplements designed for feed mixtures is an abiding interest to improve the carcass yield, health and final quality of poultry meat. One of possible alternatives is to use plant-derived substances, which received considerable interest by the poultry industry, because of their antioxidant and antimicrobial effects **(Attia *et al*., 2014)** and favorable effect on meat performance, as well **(Touhy *et al*., 2005)**.

Bee pollen (BP) is one of plant-derived substances. It is an agglomerate of flower pollen collected by bees, mixed with nectar and secretions from the hypofaryngean glands. It is a rich source of indispensable amino acids, water and fat soluble vitamins, and flavonoids **(Oliveira *et al*., 2013; Attia *et al*., 2014)** and it is considered a health food with a wide range of therapeutic properties, among which: antimicrobial, antifungal, antioxidant, anti-radiation, hepatoprotective, chemoprotective, chemopreventive and anti-inflammatory activities **(Pascoal *et al*., 2014).** The major components of BP are carbohydrates, crude fibers, proteins and lipids at proportions ranging between 13 and 55 %, 0.3 and 20 %, 10 and 40 %, 1 and 10 %, respectively. Other minor components are minerals and trace elements, vitamins and carotenoids, phenolic compounds, flavonoids, sterols and terpenes **(Feás *et al*., 2012)**. The composition of bee pollen depends strongly on plant source, together with other factors such as climatic conditions, soil type, and beekeeper activities **(Morais *et al*., 2011).**

The quantity and quality of pollen collected by honeybees affects reproduction, brood rearing and longevity, thus ultimately the productivity of the colony **(Human and Nicolson, 2006)**. The protein content of pollen is considered a direct and reliable measure of its nutritional value. Amino acid composition, however, may define the nutritional value of pollen more accurately than protein

content, since the nutritional value is reduced as soon as inadequate amounts of the essential amino acids **(Cook *et al.*, 2003; Human and Nicolson, 2006)**.
The objective of the present work was to assess the effect of bee pollen extract as a dietary supplement on meat performance of Ross 308 broiler chickens.

MATERIAL AND METHODS

The experiment was implemented in the test poultry station of Slovak University of Agriculture in Nitra. A total of 180 one day-old Ross 308 broiler chicks were randomly assigned to 2 groups. The groups were as follows: control (C) and experimental (E). The experiment lasted for 42 days and it was carried out without segregation between the genders. The broiler chickens were bred in a cage conditions and had *ad libitum* access to feed and water. They were raised in a temperature-controlled room; the temperature began at 33 °C and was decreased gradually to 19 °C until the end of the experiment. The lighting regime was steady during the feeding period.
Experimental broiler chickens were fed during 42 days of age with starter complete feed mixture HYD-01 (until the age of 21st days) and grower feed mixture HYD-02 (from 22nd to 42nd days of age). The composition of feed mixtures is given Table 1. The feed mixtures both starter and grower were produced without any antibiotic preparations and coccidiostatics. Nutrients content and metabolizable energy in feed mixtures were balanced, in terms broiler chickens needs **(Vestník MP SR, 2005)**. Both groups, control and experimental, were fed with the same feed mixtures, except that the pollen extract in amount of 400 mg.kg^{-1} was added to feed mixtures (HYD-01 and HYD-02) given to experimental group. The groups were otherwise kept under the same conditions.
Bee pollen had origin in the Slovak Republic. Bee pollen extract was prepared from minced bee pollen in the conditions of the 80 % ethanol in the 500 cm^3 flasks, according to **Krell (1996)**. The extraction was accomplished in a water bath at 80 °C for one hour. After that the extract was cooled and centrifuged. The obtained supernatant was evaporated in a rotary vacuum evaporator at bath temperature 40 – 50 °C and weighed. Residue in an amount of 80 g was dissolved in 1000 cm^3 of 80 % ethanol and used for 100 kg of feed mixture.
The live body weight of broiler chickens was determined in the test poultry station of Slovak University of Agriculture in Nitra. For the slaughtering, a total of 120 broiler chickens were chosen from both control and experimental group (n=60). The results of meat performance (arithmetic mean, standard deviation, minimum, maximum, coefficient of variation) were processed by the statistic program Statgraphics 5.1. For the determination of significant differences between the tested groups, F-test was used followed by t-test.

Table 1 Composition of feed mixtures

Ingredients (%)	Starter HYD-01 (1. – 21. day of age)	Grower HYD-02 (22. – 42. day of age)
Wheat	35.00	35.00
Maize	35.00	40.00
Soybean meal (48 % N)	21.30	18.70
Fish meal (71 % N)	3.80	2.00
Dried blood	1.25	1.25
Ground limestone	1.00	1.05
Monocalcium phosphate	1.00	0.70
Fodder salt	0.10	0.15
Sodium bicarbonate	0.15	0.20
Lysine	0.05	0.07
Methionine	0.15	0.22
Palm kernel oil Bergafat	0.70	0.16
Premix Euromix BR 0.5 %*	0.50	0.50
Nutrient composition [g.kg^{-1}]		
Crude protein	210.76	190.42
Fibre	30.19	29.93
Ash	24.24	19.94
Ca	8.16	7.28
P	6.76	5.71
Mg	1.41	1.36
Linoleic acid	13.51	14.19
ME_N [MJ.kg^{-1}]	12.02	12.03

* active substances per kilogram of premix: vitamin A 2 500 000 IU; vitamin E 50 000 mg; vitamin D3 800 000 IU; niacin 12 000 mg; d-pantothenic acid 3 000 mg; riboflavin 1 800 mg; pyridoxine 1 200 mg; thiamine 600 mg; menadione 800 mg; ascorbic acid 50 000 mg; folic acid 400 mg; biotin 40 mg; vitamin B12 10.0 mg; choline 100 000 mg; betaine 50 000 mg; Mn 20 000 mg; Zn 16 000 mg; Fe 14 000 mg; Cu 2 400 mg; Co 80 mg; I 200 mg; Se 50 mg

RESULTS AND DISCUSSION

The results of experiment with Ross 308 broiler chickens are given Table 2. As the results were not reported as statistically significant, hardly any of investigated parameters represented in Table 2 (live body weight, carcass weight, giblets weight and carcass yield) were completely affected by dietary treatments. Despite insignificant increase (P≥0.05) in body weight (68.5 g) of group fed diet containing BP extract at the end of the trial (2338.70 g) compared to the control treatment (2270.20 g), it can be enounced that BP has positive effect on weight increase as well as the carcass weight (1629.80 g for C group, 1699 g for E group) and giblets weight (152.08 g for C group, 155.39 g for E group). Carcass yield in experimental group (79.30 %) was also higher than control group (78.54 %).

Table 2 Effect of bee pollen on meat performance parameters of Ross 308 broiler chickens

Parameter	Live body weight (g)		Carcass weight (g)		Giblets weight (g)		Carcass yield (%)	
	Group C	Group E	Group C	Group E	Group C	Group E	Group C	Group E
n	60	60	60	60	60	60	60	60
x	2270.20	2338.70	1629.80	1699	152.08	155.39	78.54	79.30
SD	107.88	111.10	73.64	89.34	19.83	15.29	1.41	1.48
min.	2045	2171	1497	1570	106.61	125.92	75.97	76.39
max.	2395	2479	1756	1830	184.71	182.11	80.96	81.15
CV (%)	4.75	4.75	4.56	5.26	13.04	9.84	1.80	1.87
SS	P ≥ 0.05		P ≥ 0.05		P ≥ 0.05		P ≥ 0.05	

Legend: C – control group, E – experimental group, n – number of broiler chickens, x – arithmetic mean, SD – standard deviation, min. – minimum, max. – maximum, CV – coefficient of variation, SS – statistical significance

Several studies claimed positive effect of bee pollen on growth, performance and internal milieu of broiler chickens **(Villanueva *et al.*, 2002; Wang *et al.*, 2007; Cheng, 2009; Haščík *et al.*, 2011, 2012, 2013; Hashmi *et al.*, 2012; Kačániová *et al.*, 2013**). **Wang *et al.* (2007)** found enhancing calcium absorption and, subsequently, its deposition in the bones after addition of BP. They also attained to finding that bee pollen-supplemented diet raised the body weight of broiler chickens of 35.1 % (1585.67 g) compared to control group (1173.33 g). **Haščík *et al.* (2013)** deduced that the addition of BP in diet of Ross 308 broiler chickens led to an increase of the water content in breast muscles, whereas the protein content, fat content and energy value in breast muscles was decreased. In study of **Hashmi *et al.* (2012)** was observed weight increase in the economic parts of chicken meat (carcass, thighs, breast, liver, gastric and heart) after BP addition in an amount of 5 g.kg^{-1} of feed mixture (while higher amount of BP had negative impact). Positive effect of bee pollen as a dietary supplement in feed mixture of broiler Ross 308 in amount of 400 mg.kg^{-1} was determined by **Haščík *et al.* (2012)** due to increase of carcass values (live body weight, carcass weight, giblet

weight and carcass yield) in males. These authors found that the live body weight was increased by 55.40 g, the carcass weight was increased by 41 g, the giblets weight was increased by 4.09 g and carcass yield was increased by 0.08 %. All these increases were insignificant ($P \geq 0.05$), as well as in our experiment. On the contrary, live body weight (and the other parameters too) of female chicken group was increased by 52.2 g. It might be caused by BP activity on the reproductive female hormones, as they mention. **Angelovičová *et al.* (2010)** who also observed the addition of BP (0.10 %) in broiler chickens diet found out the positive impact of BP on body weight by about 65.05 g (similar to that increase of weight in our experiment).

CONCLUSION

The addition of bee pollen to the feed mixture for Ross 308 broiler chickens in amount of 400 $mg.kg^{-1}$ without segregation between genders; resulted in insignificant ($P \geq 0.05$) changes of meat performance. However, all investigated parameters (live body weight, carcass weight, giblet weight and carcass yield) of meat performance in experimental group were raised as compared with control group of broiler chickens (without addition of bee pollen). Supplementing bee pollen had positive effect on growth performance, but it would be appropriate to carry out further experiments.

Acknowledgments: This work was supported by VEGA 1/0129/13.

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