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THE EFFECT OF BEE POLLEN AS DIETARY SUPPLEMENT ON MEAT CHEMICAL COMPOSITION FOR BROILER ROSS 308

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Abstract

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The present experiment was aimed to study the effect of bee pollen on the meat chemical composition of broiler's Ross 308 breast and thigh muscles. In the experimental groups were added bee pollen in an amount (group E1 – 2 500 mg.kg^{-1}, group E2 – 3 500 mg.kg^{-1} and E3 – 4 500 mg.kg^{-1}) to the feed mixtures for 42 days. At the end of the study the water content was higher in experimental groups than the control group and on breasts there were a significant difference ($P \leq 0.05$) between control groups and experimental groups (E1, E2 and E3) also there was a significant difference ($P \leq 0.05$) between the experimental E3 and experimental E1, E2 groups. In protein content, the control group was higher than experimental groups and there no significant differences ($P \geq 0.05$) among the groups. In fat content, the control group (2.04%, 13.2%) was higher than experimental groups E1 group (1.59%, except thigh 14.11%), E2 group (1.70%, 13.00%) and E3 group (1.51%, 10.96%) and on breast there were significant differences ($P \leq 0.05$) between control group and experimental groups E1, E3 and on thigh there were significant differences ($P \leq 0.05$) between experimental E3 and experimental E1, E2 groups. In energy value (kJ.100 g^{-1}) of the breast and thigh muscles in control was higher than experimental groups and on the breasts there were a significant differences ($P \leq 0.05$) between control group and experimental groups (E1, E3) and on the thigh there were significant differences ($P \leq 0.05$) between experimental E1 and experimental E3 groups. From the study we concluded that the bee pollen has a positive effect of the breast's meat chemical composition of broiler, which led to increase the water contact and reduce the fat content and energy value, but he had a normal effect on thigh, also bee pollen has normal effect on the protein content of the breast and thigh muscles.

bee pollen, broiler Ross 308, meat, chemical composition

Nutritional value of meat can be assessed on the basis of parameters such as content and composition of proteins, contents of amino acids, content of fat and also from the content of saccharides, mineral substances and vitamins (Suchý *et al*., 2002).

Poultry meat is a highly valued source of nutritional facts for human consumers, both healthy of ill, knowing that this animal origin product is rich in proteins, low in lipids and caloricity (Bălău and Vacaru, 2010). Some influencing factors could affect meat yield and its quality. One of them is represented by the technological system applied in broilers husbandry, knowing that certain issues emphasizes on rearing technology impact on production and poultry welfare (Jones *et al*., 2007).

Many poultry producers moved to alternative organic systems in chickens broiler husbandry, in order to provide better confidence products

(Ristic, 2004; Tuyttens *et al*., 2008). The chemical composition of poultry meat differs significantly, the differences in chemical composition were found between white and red muscle tissues (Matušovičová, 1986). According to Simeonovová (1999) breast muscles contain approximately 22% protein, while in the thigh muscles, which contain more fat, approximately 17.20% of protein was found. Diet composition and feed consumption can affect the chemical composition of muscle tissue to a greater or lesser extent. Particular importance has been attached to a broiler rearing system in the last years (Holcman *et al*., 2003; Ristić, 2004; Bogosavljević *et al*., 2006, 2011).

The bee pollen is created in the male sexual organ of the flower – anthers with the purpose of fertilizing the stigma. It is the main source of proteins for bees (Brožek, 2012). Pollen grains, a fine powder-like material, are the male seeds of a flower blossom which has been gathered by the bees and to which special elements from the bees has been added. Honeybee collects pollen and mixes it with its own digestive enzymes. Bee pollen is a rich source of protein (25%); essential amino acids; oil (6%), containing more than 51% PUFA of which 39% linolenic, 20% palmitic and 13% linoleic acids; more than 12 vitamins; 28 minerals; 11 enzymes or co-enzymes; 11 carbohydrates (35–61%) which are mainly glucose, fructose and sucrose; flavonoids and carotenoids; phytosterols (Crane, 1990; Abreu, 1992; Xu *et al*., 2009).

The present study was conducted to determine the effects of bee pollen as dietary supplemental on broiler's Ross 308 breast and thigh muscles chemical composition.

MATERIAL AND METHODS

The experiment was implemented in the test poultry station of Slovak University of Agriculture in Nitra. The tested chickens were Ross 308. The experiment included 120 one day-old chicks, which were divided into 4 groups: control (C) and experimental (E1, E2, E3) groups, each group have 30 pieces (15 ♂, 15 ♀) of chickens; the fattening duration was 42 days.

The chickens were sponsored in a cage conditions, each cage was equipped with feed dispenser and water intake was ensured *ad libitum* through a self feed-pump. The temperature was controlled during the fattening period and it was 33 °C *at the first day and every week was reduced about 2 °C. The lighting regime during the feeding period was continuous. Each group was fed by same starter c*omplete feed mixture (CFM) HYD-01 (loose structure) from 1st day to 21st day of their age, and from the 22nd to 42nd day of their age, chickens were fed by grower fatting (CFM) HYD-02 (loose structure), in all investigated groups of experiments (Table I.). However, they were added Slovakia mixed bee pollen in an amount (2 500 mg.kg^{-1}, 3 500 mg.kg^{-1}, 4 500 mg.kg^{-1}) to experimental groups (E1, E2, E3) in their feed diet, the pollen which was used was natural bee pollen. The complete feed mixture HYD-01 and HYD-02 had been produced without antibiotic preparations and coccidiostatics. Bee pollen was added to feed mixture in an amount of 250 g (E1), 350 g (E2) and 450 g (E3) for 100 kg of feed mixture.

At the end of the fattening period (day 42) were in each group experimental selected from 30 pieces of chickens for slaughter analysis (15 ♀pieces and 15 pieces ♂). To evaluate the chemical composition was taken breast muscle (*musculus pectoralis major*) without skin and subcutaneous fat, but the thigh muscle (*musculus biceps femoris*), was taken with skin and subcutaneous fat of each group experiment. Chemical composition of meat was rated device INFRATEC 1265 (NSR), where we followed water content, fat content and protein (g.100 g^{-1}). The energy value of (kJ.100 g^{-1}), we investigated the calculation through conversion factors for fat and protein (Strmiska *et al*., 1988). The experimental analyses were evaluated at Experimental Centre for Livestock in Slovak University of Agriculture in Nitra.

It was calculated the basic variation-statistical values (arithmetic mean, standard deviation) with data from the statistical program Statgraphics Plus version 5.1 (AV Trading Umex, Dresden, Germany) and to determine the differences between groups, analysis of variance with followed by Scheffe test was used.

RESULTS AND DISCUSSION

Table (II) shows the chemical composition (water, protein, fat (g.100 g^{-1})) and energy value (kJ.100 g^{-1}), the results of breast and thigh muscles for broiler Ross 308. However the water content in the control group for the breast and thigh muscles (73.82%, 66.69%) were lower than E1 group (74.53%, 66.05%), E2 group (74.35%, 66.52%) and E3 group (74.68%, 68.86%) and on breasts there were a significant difference ($P \leq 0.05$) between control groups and experimental groups (E1, E2 and E3) also there was a significant difference ($P \leq 0.05$) between the experimental E3 and experimental E1, E2 groups.

The protein content in the control group (23.09%, 19.22%) was higher than experimental groups E1 group (22.83%, 18.99%); E2 group (22.94%, 19.25%) and E3 group (22.79%, 19.23%) and there no significant differences ($P \geq 0.05$) among the groups.

In the other hand the fat content in control group (2.04%, 13.2%) were higher than experimental groups E1 group (1.59%, except thigh 14.11%); E2 group (1.70%, 13.00%) and E3 group (1.51%, 10.96%) and on breast there were significant differences ($P \leq 0.05$) between control group and experimental groups (E1, E3) and on the thigh there was a significant differences ($P \leq 0.05$) between experimental E3 and experimental E1, E2 groups.

The energy value in (100 g^{-1}) of the breast and thigh muscles in control (462.6 kJ, 819.1 kJ) were higher than E1 group (442.41 kJ, 849.50 kJ); E2

I: *Ingredients and nutritional composition of experimental feed mixture*

Ingredient	Starter HYD-01 (1 to 21 days of age)	Growth HYD-02 (22 to 42 days 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
Mono calcium phosphate	1.00	0.70
Fodder salt	0.10	0.15
Sodium bicarbonate	0.15	0.20
Lysine 78%	0.05	0.07
Methionine 100%	0.15	0.22
Palm kernel oil Berga fat	0.70	0.16
Premix Euromix BR 0.5%*	0.50	0.50
Nutrient composition		
Crude protein ($g.kg^{-1}$)	210.76	190.42
Fiber ($g.kg^{-1}$)	30.19	29.93
Ash ($g.kg^{-1}$)	24.24	19.94
Ca ($g.kg^{-1}$)	8.16	7.28
P ($g.kg^{-1}$)	6.76	5.71
Mg ($g.kg^{-1}$)	1.41	1.36
Linoleic acid ($g.kg^{-1}$)	13.51	14.19
ME_N ($MJ.kg^{-1}$)	12.02	12.03

Euromix BR – premix provider per kg of diet: vitamin A – 2 500 000 IU, vitamin E – 50 000 mg, vitamin D3 – 800 000 IU, vitamín K3 – 800 mg; vitamin B1 – 600 mg; vitamin B2 – 1 800 mg; vitamin B6 – 1 200 mg; vitamin B12 – 10.0 mg; vitamin C –50 000 mg; nicotinacid – 12 000 mg, calcium pantothenate – 3 000 mg; folicacid – 400 mg; biotin 40 – 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

group (448.29 kJ, 812.35 kJ) and E3 group (438.70 kJ, 735.09 kJ) and on the breasts there were a significant differences ($P \leq 0.05$) between control group and experimental groups (E1, E3) and on the thigh there were a significant differences ($P \leq 0.05$) between experimental E1 and experimental E3 groups.

The present results confirmed Haščík *et al.* (2012) results, who they were tested chemical composition of breast and thigh muscular part ($100\,g^{-1}$) for broiler Ross 308 to verify the differences due to use of bee pollen extract in feed mixture at a dose of (E1 – 400 $mg.kg^{-1}$ and E2 – 800 $mg.kg^{-1}$) they were found that the water content (73.97%, 68.49% C; 74.32%, 69.79% E1 and 74.01%, 70.12% E2) and protein content (23.96%, 18.98% C; 23.28%, 18.82% E1 and 23.65%, 18.92% E2) similar of our results, but the fat content (1.07%, 11.53% C; 1.40%, 10.39% E1 and 1.34%, 9.96% E2) and energy value (441.65 kJ, 752.36 kJ C; 442.70 kJ, 717.60 kJ E1 and 446.64 kJ, 692.20 kJ E2) were contrary with our results it were lower in control group than experimental groups.

The current study confirmed with Haščík *et al.* (2011) results, who they were studying the effect of probiotic preparation for chemical composition of meat cocks different combinations of hybrid chicks. Our study Upheld on protein and fat content with Suchý *et al.* (2002) who tested the chemical composition for muscles of hybrid broiler chickens during prolonged feeding. The present study confirmed on the protein and water content except fat content it was a small amount (0.68 – 0.37%) with Wattanachant *et al.* (2004) who was studying composition, colour, and texture of the Thai Indigenous and broiler chicken muscles. Our study also had similar results on water, protein and fat contents with Wattanachant (2008) who they studied the factors affecting the quality characteristics of Thai Indigenous chicken meat.

The present result was the antithesis with Berri *et al.* (2001) who were studying the effect of selection for improved body chemical composition on muscles and meat characteristics of broilers from experimental and commercial lines, they were found the commercial selection resulted in higher protein content and lower moisture in the breast muscle. Our result was supported Baéza (2006) who was studying the effects of genotype, age and nutrition on intramuscular lipids and meat

II: *Chemical composition of breast and thigh muscles of chickens Ross 308*

Indicator	Groups	Breast Mean ± S.D	Thigh Mean ± S.D
Water content (g.100 g^{-1})	**C**	73.82 ± 0.56^{a}	66.69 ± 2.65^{ab}
	E1	74.53 ± 0.42^{b}	66.05 ± 1.98^{a}
	E2	74.35 ± 0.52^{b}	66.52 ± 2.41^{a}
	E3	74.68 ± 0.41^{b}	68.86 ± 1.92^{b}
Protein content (g.100 g^{-1})	**C**	23.09 ± 0.46	19.22 ± 0.65
	E1	22.83 ± 0.57	18.99 ± 0.35
	E2	22.94 ± 0.44	19.25 ± 0.55
	E3	22.79 ± 0.26	19.23 ± 0.36
Fat content (g.100 g^{-1})	**C**	2.04 ± 0.47^{a}	13.20 ± 3.06^{ab}
	E1	1.59 ± 0.39^{b}	14.11 ± 2.18^{a}
	E2	1.70 ± 0.47^{ab}	13.00 ± 2.52^{a}
	E3	1.51 ± 0.44^{b}	10.96 ± 1.99^{b}
Energy value (kJ.100 g^{-1})	**C**	462.60 ± 17.82^{a}	819.10 ± 108.73^{ab}
	E1	442.41 ± 11.20^{b}	849.50 ± 79.41^{a}
	E2	448.29 ± 16.84^{ab}	812.35 ± 96.30^{ab}
	E3	438.70 ± 15.38^{b}	735.09 ± 73.50^{b}

*C: control group, *E1, E2, E3: experimental groups, *mean: average, *S. D: standard deviation, Mean values in the same columns with different superscripts (a, b, c) are significantly P ≤ 0. 05 levels

quality she found that the increasing lipid levels was increased. Holcman *et al.* (2003) who study the chemical composition of chicken meat from free range and extensive indoor rearing, they found on free range that the protein (16.8%) and fat (13.1%) was the antithesis of our results but the water content was support our results, in the other hand indoor system results in protein (20.4%) and fat (7.0%) contents was an agreement with our results. Berzaghi *et al.* (2005) who were studied the Near-infrared reflectance spectroscopy as a method to predict chemical composition of breast meat and discriminate between different n-3 feeding sources, they were found on their results that the water content was higher in control group than experimental groups this results didn't support our results.

CONCLUSION

From the final results, it was concluded that the addition of natural bee pollen as a dietary supplement to the feed mixture of broiler Ross 308 in the amount (2 500 mg.kg^{-1}, 3 500 mg.kg^{-1} and 4 500 mg.kg^{-1}) to experimental (E1, E2, E3) respectively led to an increase the water content in experimental groups in the breast muscles, but it had decreased the protein content, fat content and energy value in the breast muscles, these results have positive effects to the human body, because high amounts of the fat content are insalubrious. Bee pollen had a normal effect of the thigh's meat chemical composition.

SUMMARY

The aimed of the experiment was to verify the effect of bee pollen as a dietary supplement on meat chemical composition for broiler Ross 308. The experiment has been done in the test poultry station of the Slovak University of Agriculture in Nitra. The experiments included 120 one day-old chicks, which were divided into 4 groups: control (C) and experiments (E1, E2, E3). The fattening duration was 42 days. They were added bee pollen in an amount (2 500 mg.kg^{-1}, 3 500 mg.kg^{-1}, and 4 500 mg.kg^{-1}) to experimental groups (E1, E2, E3) in their feed diet. The chemical composition of breast muscle was reached values without skin and the muscle with skin and subcutaneous fat broiler hybrid combinations Ross 308, (30 pieces) were evaluated using a device INFRATEC 1265 (NSR), where we detect the water content, fat and protein in g.100 g^{-1}. Energy value in kJ.100 g^{-1}, we have searched through the calculation of conversion factors for fat and protein. From the chemical composition analysis they found that the average of the water content on breast and thigh muscles in the control (73.82%, 66.69%) were lower than (E1) group (74.53%, 66.05%); (E2) (74.35%, 66.52%) and (E3) (74.68%, 68.86%) and on breasts there were a significant difference (P ≤ 0. 05) between control groups and experimental groups (E1, E2 and E3) also there was a significant difference (P ≤ 0. 05) between the experimental E3 and experimental E1, E2 groups. The protein content in the control group (23.09%,

19.22%) was higher than experimental groups E1 group (22.83%, 18.99%); E2 group (22.94%, 19.25%) and E3 group (22.79%, 19.23%) and there were no significant differences ($P \geq 0.05$) among the groups. In the other hand the fat content in control group (2.04%, 13.2%) were higher than experimental groups E1 group (1.59%, except thigh14.11%), E2 group (1.70%, 13.00%) and E3 group (1.51%, 10.96%) and on the breasts there were a significant differences ($P \leq 0.05$) between control group and experimental groups (E1, E3) and on thigh there were a significant differences ($P \leq 0.05$) between experimental E3 and experimental E1, E2 groups. The energy value in ($100\,g^{-1}$) of the breast and thigh muscles in control group (462.6 kJ, 819.1 kJ) were higher than E1 group (442.41 kJ, 849.50 kJ), E2 group (448.29 kJ, 812.35 kJ) and E3 group (438.70kJ, 735.09kJ) and on the breasts there were a significant differences ($P \leq 0.05$) between control group and experimental groups (E1, E3) and on the thigh there were a significant differences ($P \leq 0.05$) between experimental E1 and experimental E3 groups.

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