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SENSORY EVALUATION OF HUBBARD JV CHICKENS MEAT AFTER PROPOLIS APPLICATION IN THEIR DIET

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ABSTRACT

In this experiment, propolis extract was applied in the diet of Hubbard JV broiler chickens and we tested its influence on the sensory quality of breast and thigh muscles prepared by baking at 200 °C for 60 minutes, followed by final baking for 10-15 minutes. Five groups were created: one control (C) and four experimental (I, II, III, IV) groups. Each group consisted of 100 chickens. Fattening lasted 42 days. Chickens were fed by *ad libitum* system. The identical starter feed mixture were administered till the 21st day of age. From the 22nd to 42nd day of age, chickens were fed by growth feed mixture in all groups. Feed mixtures were made without antibiotics and coccidiostats. Propolis extract was added to experimental groups at doses of 150 mg.kg^{-1} (I), 450 mg.kg^{-1} (II), 600 mg.kg^{-1} (III) and 800 mg.kg^{-1} (IV). Breast and thigh muscles of 60 chickens from each group were prepared by baking and were anonymously assessed by six-member committee, which evaluated the smell, taste, juiciness and tenderness of meat in five-point scale. No significant differences ($P \geq 0.05$) were found in smell, taste, juiciness and tenderness of breast and thigh muscles between the control and experimental groups. Sensory quality of chicken meat is one of the most important links for its use in food chain. The results of experiment confirmed, that propolis extract in those quantities can be applied in chicken nutrition, because sensory quality of chicken meat has not been worsen after its application.

Keywords: smell, taste, juiciness, tenderness, breast, thigh, muscle

INTRODUCTION

Poultry meat and poultry meat products are the essential part of human nutrition **(Barroeta, 2007)** and have an important role mainly in developed countries. In technological process of meat products, all components with effects beneficial to health are necessary to maintain. These components are water and major components as proteins and fats. Substantial portion in poultry meat consists of highly bio-available vitamins and mineral substances. Functional foods including meat products from poultry have to have almost identical or very similar sensory properties like traditional products. This depends on consumer and his point of view. Functional foods and cooked, baked, marinated or dry products from poultry meat have to be perceived as natural, tasty, safe and salubrious **(Drewnowski and Gomez-Carneros, 2000; Anon, 2006)**. Food safety is an important aspect of food quality and efforts should be led to safety of new functional products from poultry meat **(Burdock *et al.*, 2006)**. The most consumers would be reluctant to accept new foods without proof of product safety into their diet **(Niva, 2006)**. Meat quality may be affected already by manipulation of animal feeding **(Kennedy *et al.*, 2005; Assi and King, 2007)** or *post mortem* manipulation of carcass body. Poultry meat and meat products are important source of proteins, but other components as fats have an important role in their composition, too. Nutrient content in meat products is between 40% and 50% **(Ordo˜nez *et al.*, 1999)**, and fat performs the primary role in sensory aspects as taste and juiciness of all meat products **(Lucca and Tepper, 1994; Hughes *et al.*, 1997; Cofrades *et al.*, 2000)**. And each decrease of fat content may have a notable impact on meat products acceptability **(Giese, 1996)**.

New legislation, EU regulation and bans regarding the use of animal meal, classical antibiotic stimulators for growth and antimicrobial substances in feeds of animal including poultry lead to alternative application of new supplements and biotechnological products in science as well as in practice **(Haščík *et al.*, 2006, 2007; Bobko *et al.*, 2009)**. In meat products, efforts are principally centred on modification of fat or fatty acids content **(Grashorn, 2006)**, or on increasing of selenium content in poultry meat **(Ševčíková *et al.*, 2007)** and variety of functional ingredients in meat through the fruit, cereals, crude fiber, plant proteins **(Shaw, 2008)**, monounsaturated or polyunsaturated fatty acids (omega-3), vitamins, calcium, inulin and others **(Farrell, 1995; Kennedy *et al.*, 2005)**. Maintaining of appropriate technological, nutritional and sensorial properties in meat is one of the conditions for new component integration in animal nutrition, because different supplements can cause the deterioration of meat quality, mainly in term of sensory properties **(Aleson-Carbonell *et al.*, 2004; P´erez-Alvarez, 2006)**. In recent years, bee products (pollen, propolis or their extracts) are employed as alternative substitutes in nutrition of poultry including chicken broilers; and eventually, these bee products can have positive effects on health state, economic use of feed, nutritional as well as sensory product quality and can influence the economy of production in poultry industry **(Kimoto *et al.*, 1999; Mojto and Zaujec 2001; Prytzyk *et al.*, 2003; Haščík *et al.*, 2004, 2005ab, 2007; Wang *et al.*, 2004; Shalmany and Shivazad, 2006; Seven *et al.*, 2008)**.

Sensorial aspects, which are measurable by human senses, are essential for consumer; and the aspects can influence the consumer purchase as well as food preference **(Komiyama *et al.*, 2008)**. According to **Augustin and Fischer (1999), Brestenský (2002), Mojto and Zaujec (2003), Haščík *et al.* (2004)**, evaluated sensory properties are dependent on type of used feed mixture, content of intramuscular fat in meat, way of meat preparation, genetics and many others intra-vital and extra-vital factors. According **Guárdia *et al.* (2010)**, sensory analysis is a scientific discipline, which is useful to determine the objective and reproducible characteristics through the human senses. Sensory evaluation is most frequently performed after heat treatment. And five-point scale is used for each evaluated property, i. e. for smell, taste, juiciness and tenderness. Maximum of twenty points is for comprehensive assessment of meat quality. Nowadays, sensory analysis is uniquely included in the scientific methods despite the fact, that it is one of the oldest methods of food control; sensory analysis is a necessary part of obligatory assessment of food products quality **(Neumann and Arnold, 1990; Pokorný, 1993)**. Many authors found that producers can more effectively identify, understand and respond to consumer preferences by the sensory analyses **(Hashim *et al.*, 1995; Owens and Sams, 1998; Liu *et al.*, 2004; Fanatico *et al.*, 2007; Saha *et al.*, 2009)**. Moreover, sensory properties identification and consumer preferences are helpful for increasing the competitiveness in the market **(Tabilo *et al.*, 1999; Tan *et al.*, 2001; Lawlor *et al.*, 2003; Ponte *et al.*, 2004; Young *et al.*, 2004)**.

The aim of this study was to examine the effect of propolis extract on sensory properties of meat. Propolis originated in Slovakia. We used 80% extract of propolis, which was added to feed mixtures for Hubbard JV chickens in different amounts.

MATERIAL AND METHODS

The experiment was undertaken in poultry test station Zamostie Company. The test animals were broiler chickens of Hubbard JV hybrid combination. Overall, five hundred units of one-day-old chickens were included in the experiment. Then, five groups (each of one hundred chickens) were created: control group (C) without propolis extract application and four experimental groups (I, II, III and IV) with different doses of propolis extract. Fattening lasted 42 days. Chickens were bred on deep litter (sawdust). Feed was administered through the tubular feeders. Feed mixtures used in the experiment were prepared in Biofeed Company with seat in Kolarovo, as required **Kočí and Kočiová (1998)**. Feed mixtures were analysed in term of basic nutrients and energy value at the Department of Animal Nutrition (Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra). Composition of feed mixtures is recorded in the Table 1. Feed was manually served at periodic intervals each day. Chickens were fed by *ad libitum* system. The starter feed mixture HYD-01 (powder form) was served to 21st day of age and was identical for all groups. From 22nd to 42nd day of age, grower feed mixture HYD-02 (powder form) was used in all groups. Feed mixtures were made without antibiotic and coccidiostat preparations. Nutritional value of feed mixtures was identical in all groups during the experiment, but propolis extract was added to the feed mixtures HYD-01 and HYD-02 of experimental groups in following doses: 150 mg.kg^{-1} (I), 450 mg.kg^{-1} (II), 600 mg.kg^{-1} (III) and 800 mg.kg^{-1} (IV). Propolis extract was prepared from milled propolis (Slovak Republic), which was subsequently mixed to 80% ethanol **(Krell, 1996)**. Propolis solution was extracted in water bath at 80 °C under reflux for 1 hour. After extracting and cooling, this mixture was centrifuged. Obtained supernatant was evaporated using a rotary vacuum evaporator and water bath at 40-50 °C. Then, residue was weighted. The evaporation residue at amounts of 15 g, 45 g, 60 g and 80 g was separately dissolved in 1 000 cm^3 of 80% ethanol and applied into the 100 kg of each feed mixture intended for evaluate group of Hubbard JV chickens. Water was administered *ad libitum* by self-powered system using nipple drinkers with drip tray.

At the end of the fattening (42nd day), 60 pieces from each group were selected for carcass analysis and evaluation of sensory (culinary) properties. Sensory evaluation of breast and thigh muscles followed after heat treatment at 200 °C for 60 minutes and final baking during 10-15 minutes. Sensory evaluation of anonymous samples was performed by six-member committee and five-point scale was used for the self-assessment. We evaluated smell, taste, juiciness and tenderness of meat in term of sensory analysis.

The results of experiment (arithmetic average, standard deviation) were processed in statistical programme Statgraphics Plus version 5.1 (AV Trading, Umex, Dresden, Germany). Analysis of variance followed by Duncan test was used to determine the significance of differences between the groups.

Table 1 Composition of the basal feed mixtures

Ingredients (%)	Starter (from 1st to 21st day of age)	Grower (22nd to 42nd day of age)
Wheat	34.00	37.00
Maize	33.92	37.52
Soybean meal (48% N)	23.00	18.00
Fish meal (71% N)	5.00	3.00
Dried blood	-	1.00
Ground limestone	1.00	0.95
Monocalcium phosphate	0.80	0.70
Fodder salt	0.10	0.10
Sodium bicarbonate	0.15	0.20
Lysine	0.13	0.08
Methionine	0.18	0.20
Clinacox 0.5%[1]	0.02	-
Palm kernel oil Bergafat[2]	1.20	0.70
SACOX 12%[3]	-	0.05
Premix Euromix BR 0.5 %[4]	0.50	0.50
Analysed composition [g.kg^{-1}]		
Crude protein	212.40	191.62
Fibre	30.51	29.68
Ash	27.01	20.90
Ca	8.23	7.18
P	6.56	5.87
Na	1.77	1.71
Linoleic acid	13.53	14.06
ME_N [MJ.kg^{-1}] by calculation	12.07	12.16

Legend: [1] anticoccidial with active substance Diclazuril; [2] feed fat based on palm oil; [3] anticoccidial with active substance Salinomycin sodium; [4] active substances per kilogram of premix: vitamin A 2,500,000 IU; vitamin E 50,000 mg; vitamin D_3 800,000 IU; niacin12,000 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 B_{12} 10 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

Results from sensory evaluation of valuable parts of carcass (breast and thigh muscles of Hubbard JV broiler chickens carcasses) after propolis extract application in feed mixture at the doses of 150 mg.kg^{-1}, 450 mg.kg^{-1}, 600 mg.kg^{-1} and 800 mg.kg^{-1} are recorded in Table 2.

Table 2 Sensory evaluation of breast and thigh muscles of Hubbard JV chickens without and with propolis extract in their diet

Property	Group	Breast muscle ($\bar{x}$ ± SE)	Thigh muscle ($\bar{x}$ ± SE)
Smell	C	4.037 ± 0.226	4.025 ± 0.219
	I	4.037 ± 0.213	4.137 ± 0.213
	II	4.000 ± 0.119	4.150 ± 0.220
	III	4.012 ± 0.181	4.037 ± 0.220
	IV	4.125 ± 0.167	4.162 ± 0.244
Taste	C	3.850 ± 0.185	3.925 ± 0.249
	I	3.787 ± 0.229	3.962 ± 0.160
	II	3.812 ± 0.173	3.925 ± 0.237
	III	3.750 ± 0.151	3.887 ± 0.247
	IV	3.762 ± 0.192	3.825 ± 0.266
Juiciness	C	4.150 ± 0.119	4.000 ± 0.160
	I	4.050 ± 0.434	4.000 ± 0.160
	II	4.050 ± 0.141	4.037 ± 0.141
	III	4.037 ± 0.287	3.950 ± 0.262
	IV	4.062 ± 0.119	4.125 ± 0.128
Tenderness	C	3.825 ± 0.287	4.150 ± 0.119
	I	3.825 ± 0.212	4.050 ± 0.434
	II	3.750 ± 0.193	4.050 ± 0.141
	III	3.750 ± 0.107	4.037 ± 0.287
	IV	3.600 ± 0.288	4.062 ± 0.119

Legend: C - control group, I - 1st experimental group (150 mg.kg^{-1} propolis extract), II - 2nd experimental group (450 mg.kg^{-1} propolis extract), III – 3rd experimental group (600 mg.kg^{-1} propolis extract, IV – 4th experimental group (800 mg.kg^{-1} propolis extract); $\bar{x}$ - mean, SE - standard deviation

Firstly we evaluated the particular properties of sensory evaluation in breast muscle. We found the highest score in control group (3.825-4.150) in all properties except the smell. The highest score of smell was recorded in experimental group IV (4.125). Obtained results were statistically compared. No significant differences ($P \geq 0.05$) were found between the control group and experimental groups (I, II, III and IV) in all properties of sensory evaluation of breast muscle.

Then we evaluated the sensory properties in thigh muscle. The lowest score for smell was found in control group (4.025). Score for smell ranged from 4.037 to 4.162 points in experimental groups. The results for taste (C: 3.925; I-IV: 3.825-3.962) were comparable between the control and experimental groups in compare with the results for smell, but the lowest score of taste (3.825) was recorded ($P \geq 0.05$) in experimental group with the highest dose of propolis extract. And in this experimental group IV, we found ($P \geq 0.05$) the highest score of juiciness (4.125) compared with other groups. The highest score of tenderness was recorded in control group (4.150) without significant differences ($P \geq 0.05$) in compare with the other groups.

Valuable parts of carcass bodies were evaluated by sensory analysis. Experiment was performed with Hubbard JV chickens, which were fed by feed mixtures with propolis extract at doses of 150 mg.kg^{-1}, 450 mg.kg^{-1}, 600 mg.kg^{-1} and 800 mg.kg^{-1}. Obtained results from sensory evaluation are in accordance with tendencies that were found by **Połtowicz (2000), Osek et al. (2001), Barteczko et al. (2003), Haščík *et al.* (2004, 2007, 2013), Bobko *et al.* (2006, 2009), Baracho *et al.* (2006), Chekani-Azar *et al.* (2008), Kim *et al.* (2009), Marcinčák *et al.* (2009) a Mihok *et al.* (2010)** in experiments with application of different feed supplements in chicken nutrition.

In general, we found higher score of tenderness in thigh muscle than in breast muscle in the experiment. It is in accordance with results published by **Scholtyssek and Sailer (1986), Kofrányi and Wirths (1994)** and **Guéye *et al.* (1997)**, because thigh muscles contain more fat and blood capillaries. Authors stated that availability and correctness of technological, nutritional as well as

sensory quality in chicken meat is possible to achieve only by verified feed supplements, because any additive substances have not a positive impact on sensory properties of meat and may show an opposite trend.

CONCLUSION

In this experiment, we examined the influence of propolis extract applied in chicken nutrition on sensory properties of breast and thigh muscles after meat baking. Propolis extract was applied in feed mixtures of Hubbard JV chickens at doses of 150 mg kg^{-1}, 450 mg kg^{-1}, 600 mg kg^{-1} and 800 mg kg^{-1} during the whole fattening period (42 days). Based on obtained results, no significant differences were found between the control and experimental groups (I, II, III and IV) in evaluated sensory properties of breast and thigh muscles.

The most valuable parts of carcasses originated in Hubbard JV chickens were evaluated by sensory analysis and we did not find any negative influence of propolis extract on sensory properties of carcasses after their treatment by baking. Therefore, we recommend applying the propolis extract at examined doses in nutrition of broiler chickens.

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