Potravinarstvo® Scientific Journal for Food Industry

Potravinarstvo, vol. 7, 2013, no. 1, p. 107-110
doi:10.5219/280
Received: 10 June 2013. Accepted: 3 July 2013.
Available online: 26 July 2013 at www.potravinarstvo.com

ISSN 1337-0960 (online)

SENSORY EVALUATION OF BROILER MEAT AFTER ADDITION SLOVAK BEE POLLEN IN THEIR FEED MIXTURE

Peter Haščík, Ibrahim Omer Elamin Elimam, Jozef Garlík, Marek Bobko, Miroslav Kročko

ABSTRACT

The study aimed to investigate the impact of Slovak bee pollen as supplement dietary in different doses (1000, 1500, 2500, 3500 and 4500 mg.kg^{-1} of feed mixture) on the sensory quality of broiler chickens. The study was carried out 180 one day-old chickens, which were divided into 6 groups (n=30). From each halves were separately sensory evaluated part from a thigh and breast. Samples of heat treated meat were evaluated by a 6 member semi-trained panel of laboratory co-workers. Panelists evaluate aroma, juiciness, taste and tenderness on 5 point hedonic scale where 1 (the worst) and 5 (the best) were the extremes of each characteristic. The values of aroma, taste, juiciness and tenderness in breast and thigh muscles were higher in experimental groups in compare to control. The bee pollen has a positive impact on the taste, aroma, juiciness and tenderness of chickens thighs and breasts. Although the value of shear force in chicken thigh was significantly highest in E2 samples, addition of bee pollen to the diet for broiler chickens had no significaly negative effect on the thigh tenderness. Baking losses, as the second technological parameter, were also not significantly affected by nutrition with bee pollen supplement.

Keywords: broiler; bee pollen; sensory; smell; juiciness; shear force

INTRODUCTION

Poultry meat is suitable for the production of so-called functional foods for human consumption, which is currently at the heart of agricultural and food research **(Berri et al., 2001; FAO 2002; Strakova et al., 2003; Gueye, 2009)**. Sensory evaluation is analysis of product attributes perceived by the human senses of smell, taste, touch, sight, also tenderness. Volunteers (consumers or users of the product) are used to assess the sensory characteristics and providing a response. There are two general types of sensory methods. Laboratory/analytical methods use a small number of panellists to determine if a difference exists between samples and the nature, direction, and intensity of the difference. Consumer affective methods involve a larger number of panellists and include tests that measure how consumers feel or react to the product to provide a measure of preference, acceptance, and like/dislike **(Brenda et al., 2000)**. Colour, appearance, and texture are important factors that consumers will consider before making a decision to buy poultry **(Liu et al., 2004)**. Quality assessment parameters of chicken meat, including sensory flavour and texture profiles, cooking loss/cooking yield and shear force, have been widely used in scientific studies to validate preprocessing treatments and postharvest processing technologies for chicken meat **(Swatland et al., 1999; Lyon et al., 2001)**. Also, shear force (Warner-Bratzler, WB) data are more strongly related to sensory panel tenderness rating using the slice shear force (SSF) protocol developed for broiler tenderness classification **(Shackelford et al., 1999)**, rather than the traditional WBSF protocol **(Shackelford et al., 1999)**. Bee pollen is a bee product which constitute a part of dietary supplements rich in proteins **(Le Blancet al., 2009; Baltrusaityte et al., 2007)**. The bees are among the beneficial insects that produce mainly the honey, and also many by-products such as royal jelly, beeswax, propolis, pollen and bee stings. Bee pollen represents a rich source of proteins (25 %), essential amino acids, oils (6 %), containing more than 51 % of polyunsaturated fatty acids of which 39 % represents linolenic acid, 20 % represent palmitic acid and 13 % linoleic acid. Bee pollen also represents a source of more than 12 vitamins, 28 minerals, 11 enzymes or co-enzymes, 11 carbohydrates (35 - 61 %; mainly glucose, fructose and sucrose), free amino acids, flavonoids, carotenoids and phytosterols **(Crane, 1990; Abreu, 1992; Xu et al., 2009)**. It is well known great amount and variability of bee pollen phenolic constituents (total phenols, phenyl-propanoids, flavonoids and anthocyanins) and its antioxidant activity **(Broadhurst, 1999; Leja et al., 2007; Saric et al., 2009)**. The objective of present study was to evaluate the effect of bee pollen as a dietary supplement added to broilers in different doses to the sensory quality of broiler chicken meat.

MATERIAL AND METHODS

Animals and diets

The experiment was implemented in the test poultry station of Slovak University of Agriculture in Nitra. The experiment included 180 one day-old chicken hybrid combination Ross 308, which were divided into 6 groups (n=30): control (I) and experimental groups (E1, E2, E3, E4 and E5). Experimental broiler chickens were fed during 42 days of age by *ad libitum* system with feed mixture HYD-01 (until the age of 21st days) and HYD-02 (from 22nd to 42nd days of age). Feed mixtures HYD-01 and HYD-02 were produced without any antibiotic

preparations and coccidiostats. Nutritional value (Table1) of feed mixture was the same in each group during the whole experiment. However, the diet of broiler chickens in experimental groups were supplemented by natural bee pollen at doses of 100 mg.kg^{-1} (E1); 1500 mg.kg^{-1} (E2); 2500 mg. kg^{-1} (E3); 3500 mg. kg^{-1} (E4) and 4500 mg.kg^{-1} (E5).

Sample analysis

One hundred and twenty broiler chickens were submitted to sensory analysis at the end of fatting period (42nd days). From each group were chosen 20 pieces of chickens halves and submitted to heat treatment at 200 °C for 60 minutes. From each halves were separately sensory evaluated part from a thigh and breast. Samples of heat treated meat were evaluated by a 6 member semi-trained panel of laboratory co-workers. Panelists evaluate aroma, juiciness, taste and tenderness on 5 point hedonic scale where 1 (the worst) and 5 (the best) were the extremes of each characteristic. Shear force is defined as the force, which is necessary to slit the meat sample of 1 cm^2 cross section across the fibres of the meat. Shear force (Warner-Bratzler WB) of culinary prepared meat (breast and thigh meat) were determined by the Warner-Bratzler apparatus (Chatillon Brandt, USA) according the method of **Goodson et al. (2002)**.

Statistical analysis

The results of the experiment were evaluated with statistical program Statgraphics Plus Version 5.1 (AV Trading Umex, Dresden, Germany). The variables-statistical values (arithmetic mean, standard deviation) were calculated and to determine the significant differences among groups was used variance analyses with subsequent Scheffé's test.

Table 1 Composition of the broiler feed mixture

Ingredients (%)	Starter (1 to 21 days of age)	Grower (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
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
[1]Premix Euromix BR 0,5 %1	0.50	0.50
Analyzed 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
MEN (MJ.kg-1) by calculation	**12.02**	12.03

[1] 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 current study was conducted to investigate the influence of bee pollen as supplement dietary in different levels (1000, 1500, 2500, 3500 and 4500 mg.kg^{-1}) on broiler´s Ross 308 meat sensory. Values of the aroma, taste, juiciness and tenderness of breast muscle were higher in the experimental groups in compare to the control group (table 2). The significant differences ($P \leq 0.05$) were found in aroma of breast muscle between control group and experimental groups E2 and E3. Also significant differences were found in breast muscle aroma between E1 and E2. Values of juiciness chickens breast were significantly ($P \leq 0.05$) lower in control meat samples than in samples of E2. Sensory values of thighs muscles from control group were lower than in experimental groups (table 3). Significantly ($P \leq 0.05$) lower values of chickens thigh aroma were found in control samples compare to samples of E4 group. Also significatly differences ($P \leq 0.05$) of chickens thigh aroma were found between samples of E3 – E4 and E3 – E5. Taste, juiciness and tenderness were significantly higher in samples of E5 groups compare to control. Significantly higher values of taste were found in E1 and E5 samples of thigh. Significantly ($P \leq 0.05$) better tenderness was found

in thighs of E4 and E5 samples. Also **Haščík et al., 2011; 2013** found comparable results of sensory evaluation carried on chickens breast and thigh muscles, however with propolis addition to broiler chickens nutrition. **(Haščík et al., 2011; 2013)**. The improvement of sensory parameters found in experimental groups were probably due to content of the predominant minerals in bee pollen such as phosphorus, potassium, calcium and magnesium also phenolic compounds and total flavonoids **(Carpes et al., 2009; Almeida et al., 2005)**. Although, these minerals play a functional role in sugar and lipids metabolism, maintaining the osmotic pressure, regulating the acid-base balance, maintaining cell permeability and the neuro-muscular activity **(Georgetown et al., 2007)**, they can contribute to the sensory qualities of broiler´s meat. Bee pollen increases the water content in tissues of broiler´s meat **(Haščik et al., 2013; Čuboň et al., 2013)** and from that reason it can leads to improvement of the sensory parameters as juiciness and tenderness. In the parameter of shear force ($kg.cm^{-2}$) were statistical differences found only in the thigh muscles of chickens (table 4). Values of shear force determined in breast muscles were not significantly higher in E2 and E4 samples. Significantly lower values of shear force were found in samples of E1 and E3 in compare to control. Also among experimental samples were found significant differences. Samples of chicken breast from E2 were characterized by significantly highest values of shear force. This results are in accordance with **Bobko et al., (2012).** These autors found significant influence of different plant supplements applied in chicken nutrition on the sensory quality of their meat. On the other hand **Haščík et al. (2012)** reported more firmness consistency of chicken meat after propolis suplement addition to broilers. The baking looses (%) were not significantly higher in the control group than in experimental groups. This findings are in agreement with **Bobko et al., 2012 and Haščík et al., 2012** who were focused in different plant supplements and propolis evaluation for improving the sensory quality of chickens meat.

CONCLUSION

The bee pollen has a positive impact on the taste, aroma, juiciness and tenderness of chickens thighs and breasts. Although the value of shear force in chicken thigh was significantly highest in E2 samples, addition of bee pollen to the diet for broiler chickens had no significatly negative effect on the thigh tenderness. Baking losses, as the second technological parameter, were also not significantly affected by nutrition with bee pollen supplement.

Table 2 broiler breast muscles sensory evaluation

	Control	E1	E2	E3	E4	E5
Aroma	4.18 ± 0.16^{a}	4.20 ± 0.18^{a}	4.39 ± 0.16^{b}	4.36 ± 0.19^{b}	4.21 ± 0.22^{abc}	4.24 ± 0.11^{abc}
Taste	4.03 ± 0.19	4.04 ± 0.25	4.18 ± 0.19	4.16 ± 0.12	4.09 ± 0.14	4.12 ± 0.10
juiciness	3.75 ± 0.22^{a}	3.79 ± 0.28^{ab}	4.06 ± 0.33^{b}	3.83 ± 0.19^{ab}	3.84 ± 0.24^{ab}	3.95 ± 0.23^{ab}
tenderness	3.83 ± 0.31	3.92 ± 0.27	4.06 ± 0.36	3.95 ± 0.26	4.0 ± 0.28	4.12 ± 0.20

Table 3 broiler thigh muscles sensory evaluation

	Control	E1	E2	E3	E4	E5
Aroma	4.10 ± 0.30^{ac}	4.18 ± 0.20^{abc}	4.22 ± 0.25^{abc}	4.14 ± 0.17^{a}	4.33 ± 0.11^{b}	4.31 ± 0.12^{bc}
Taste	3.93 ± 0.20^{a}	4.15 ± 0.25^{b}	4.05 ± 015^{ab}	4.05 ± 0.20^{ab}	4.12 ± 0.17^{ab}	4.17 ± 0.15^{b}
juiciness	4.10 ± 0.15^{a}	4.17 ± 0.29^{ab}	4.23 ± 0.16^{ab}	4.13 ± 0.11^{ab}	4.22 ± 0.23^{ab}	4.27 ± 0.13^{b}
tenderness	4.18 ± 0.69^{a}	4.24 ± 0.16^{ab}	4.30 ± 0.14^{ab}	4.28 ± 0.11^{ab}	4.36 ± 0.15^{b}	4.33 ± 0.14^{b}

Table 4 Quality indicators for meat of fattening chickens Ross 308

		Control	E1	E2	E3	E4	E5
Shear force [$kg.cm^{-2}$]	Breast	1.91 ± 0.7	1.86 ± 0.7	2.01 ± 0.1	1.88 ± 0.7	2.06 ± 0.8	1.64 ± 0.4
	Thigh	1.31 ± 0.3^{ac}	0.94 ± 0.3^{b}	1.52 ± 0.4^{a}	0.98 ± 0.3^{b}	1.13 ± 0.2^{abc}	1.17 ± 0.4^{bc}
Baking losses[%]	Broiler carcass	30.29 ± 1.4	28.25 ± 1.9	29.85 ± 1.5	29.21 ± 1.2	29.69 ± 1.3	30.27 ± 0.5

Conflict of Interest Statement:

This manuscript has no conflicts of interest. This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors. All authors contributed equally to this work.

REFERENCES

Abreu, M. 1992. Food use of pollen in relation to human nutrition. *Alimentaria,* vol. 235, p. 45-46.

Almeida-Muradian, L. B., Pamplona, L. C., Coimbra, S., Barth, O. M. 2005. Chemical composition and botanical evaluation of dried bee pollen pellets. *Journal of Food Composition and Analysis,* vol. 18, no. 1, p. 105-111. http://dx.doi.org/10.1016/j.jfca.2003.10.008

Baltrusaityte, V., Venscutonis, P. R., Ceksteryte, V. 2007. Radical scavenging activity of different floral origin honey and beebread phenolic exreacts. *Food Chemistry*, vol.101, no.

2. p. 502-514. http://dx.doi.org/10.1016/j.foodchem.2006.02.007

Berri, C., Wacreinier, N., Millet, N., Le Bihan-Duval, E. 2001. Effect of selection for improved body composition on muscle and meat characteristics of broilers from experimental and commercial lines. *Poultry Science*, vol. 80, p. 833-838. PMid: 11469641

Bobko, M., Haščík, P., Bobková, A., Kňazovická, V., Tóth, T., Angelovičová, M., 2012. Influence of different plant supplements applied in chicken nutrition on quality of their meat. *Journal of microbiology biotechnology and food sciences*. no. 1, p. 1020-1031.

Lyon, B. G, Lyon, C. E., 2000. *Meat quality: sensory and instrumental evaluations.* Poultry Meat Processing. Print ISBN: 978-0-8493-0120-9, eBook ISBN: 978-1-4200-4217-7.

Broadhurst, C. L. 1999 . Bee products: medicine from the hive. *Nutrition Science*, vol. 4, p. 366-368.

Carpes, S. T., DeAlencar, S. M., Masson, M. L. 2009. Chemical composition and free radical scavenging activity of Apismellifera bee pollen from Southern Brazil. *Journal Food Technology*, vol. 12, no. 3, p. 220-229. http://dx.doi.org/10.4260/BJFT2009800900016

Crane, E., 1990. *Bees and Beekeeping. Science, Practice and World Resources.* Comstock Pub. Ithaca, NY, USA, 593-594.

Čuboň, J., Haščík, P., Elimam, I. O., Garlík, J., Kačániová, M., Mohammed, H. A. 2013. The influence of bee pollen on the meat chemical composition for broiler´s Rosas' 308 muscles. *Journal of Microbiology, Biotechnology and Food Sciences,* vol. 2, p. 1128-1137.

FAO. 2002. World agriculture towards 2015/2030. Rome, Italy.

Ciurescu, G. Anca, G., Nagy, C. I. 2007. Effects of the mineral premix based on phosphate fritte with chelated bioelements on broiler performance. *Archiva Zootechnica* vol. 10, p. 26-32.

Goodson, K. J., Morgan, W. W., Reagan, J. O. 2002. Beef customer satisfaction:Factors affecting consumer evaluation of clod steaks. *Journal Animal Science*, vol. 80, p. 401-408. PMid: 11881929

Gueye, E. F. 2009. The role of networks in information dissemination to family poultry farmers. *World's Poultry Science Journal*, vol. 65, p. 115-123.

Haščík, P., Elimam, I. E., Garlík, J., Kačániová, M., Bobko, M., Kňazovická, V., Vavrišinová, K., Arpášová, H., Bučko, O. 2013. The effect of bee pollen as dietary Supplement on meat chemical Composition for broiler Ross 308. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, vol. 12, p. 71-76. http://dx.doi.org/10.11118/actaun201361010071

Haščík, P., Garlík, J., Kňazovická, V., Kačániová, M., Elimam, I., Omer, E., Pochop, J., Benczová, E., Vavrišinová, K. 2012. Technological properties of chickens meat after application of propolis extract in their diet. *Journal fo microbiology, biotechnology and food sciences*, vol. 1, p. 1295-1304.

LeBlanc, B. W., Davis O. K., Boue S., DeLucca A., Debby T. 2009. Antioxidativ activity of sonorant desert bee pollen. *Food Chemistry*, vol. 115, p. 1299-1305. http://dx.doi.org/10.1016/j.foodchem.2009.01.055

Leja, M., Mareczek, A., Wyzgolik, G., Klepacz-Baniak, J., Czekonska, K. 2007. Antioxidative properties of bee pollen in selected plant species. *Food Chemistry*, vol. 100, p. 237-240. http://dx.doi.org/10.1016/j.foodchem.2005.09.047

Liu, Y., Lyon, B., G., Windham, W. R., Lyon., C. E., Savage, E. M. 2004. Prediction of physical, color, and sensory characteristics of broiler breastsby visible/near infrared reflectance spectroscopy. *Poultry Science,* vol. 83, no. 8, p. 1467-1474. PMid: 153390271

Lyon, B. G., Windham, W. R., Lyon, C. E., Barton, F. E. 2001. Sensory characteristics and nearinfrared spectroscopy of broiler breast meat from various chill-storage regimes. *Journal Food Qual*, vol. 24, 2001, p. 435-52. http://dx.doi.org/10.1111/j.1745-4557.2001.tb00621.x

Saric, A., Balog, T., Sobocanec, S., Kusic, B., Sverko, V., Rusak, G., Likic, S., Bubalo, D., Pinto, B., Reali, D., Marott, T. 2009. Antioxidant effects of flavonoid from Croatian *Cystus incanus* L. rich bee pollen. *Food and Chemical Toxicology*, vol. 47, p. 547-554. http://dx.doi.org/10.1016/j.fct.2008.12.007 PMid: 19124059

Shackelford, S. D., Wheeler, T. L., Koohmaraie, M. 1999. Evaluation of slice shear force as an objective method of assessing beeflongissimus tenderness. *Journal of Animial Sciences*, vol. 77, p. 2693-2699. PMid: 10521029

Strakova, E., Večerek, V., Suchy, P., Vitula, F. 2003. *The comparison of carcass quality in fattening chicks and pheasants.* Současnost a perspektivy chovu drůbeže. Praha, p. 83-87, ISBN 80-213-1037-5.

Swatland, H. J. 1999. On-line assessment of poultry meat quality. Richardson RI, Mead GC, editor. *Poultry meat science.* New York: CABI Publishing. p 315-345.

Xu, X., Sun, L., Dong, J., Zhang, H. 2009. Breaking the cells of rape bee pollen and consecutive extraction of functional oil with supercritical carbon oxide. *Innovative food science & emerging technologies*, vol. 10, p. 42-46. http://dx.doi.org/10.1016/j.ifset.2008.08.004

Acknowledgments:

This work was supported by the VEGA grants from the Ministry of Education Science, Research and Sport of the Slovak Republic, grants No. 1/0897/11 and 1/0129/13.

Contact address:

Doc. Ing. Peter Haščík, Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Evaluation and Processing of Animal Products, Trieda A. Hlinku 2, 949 76 Nitra, E-mail:peter.hascik@uniag.sk

Msc. Ibrahim Omer Eliman Elimam, Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Evaluation and Processing of Animal Products, Trieda A. Hlinku 2, 949 76 Nitra, E-mail: alkrshola@yahoo.com

Ing. Jozef Garlík, Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Evaluation and Processing of Animal Products, Trieda A. Hlinku 2, 949 76 Nitra, E-mail: jozef.garlik@gmail.com

Ing. Marek Bobko, PhD., Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Evaluation and Processing of Animal Products, Trieda A. Hlinku 2, 949 76 Nitra,
E-mail: marek.bobko@uniag.sk

Ing. Miroslav Kročko, PhD., Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Evaluation and Processing of Animal Products, Trieda A. Hlinku 2, 949 76 Nitra,
E-mail: miro.krocko@uniag.sk