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**REGULAR ARTICLE**

# SENSORY QUALITY OF POULTRY MEAT AFTER PROPOLIS APPLICATION

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## ABSTRACT

In the experiment, we verify the effect of propolis extract in Ross 308 broiler on the sensory quality of breast and thigh muscle modified by baking at 200 ºC for 60 minutes. The experiment enrolled 360 one day old chickens of hybrid combination Ross 308 and was formed into 4 groups: control group (C) and three experimental groups (EG: I, II, III) of 90 pcs chickens. Custom feeding insisted 42 days. Chickens were fed to 21$^{th}$ day of age an *ad libitum* with the same starter feed mixture HYD-01 (powdery form) and from 22$^{nd}$ to 42$^{nd}$ day of age were fed with the growth feed mixture HYD-02 (powdery form) in the monitored groups. The fed feed mixture HYD-01 and HYD-02 have been produced without antibiotic preparations and coccidiostats. Experimental groups were added to the feed compound of propolis extract in a dose of 200, 300 and 400 mg.kg$^{-1}$. After heat treatment of breast and thigh muscle of 60 pieces chicken of each group samples were anonymously assessed sensory six-member committee (smell, taste, juiciness, tenderness) 5-point scale. Significant differences ($P \leq 0.05$) between control group and experimental groups (I, II, III) were found in the evaluation of breast muscle in the aroma (+0.15 to +0.23 points), taste between control group and EG I and III (+0.19 to +0.26 points) in juiciness between control group and EG I (+0.37 points) and the fineness of the control group and EG I and II (+0.35 to +0.45 points). In the thigh muscle were found significant differences ($P \leq 0.05$) between control group and EG (I, II, III) in the evaluation of smell compared with group I (+0.25 points), the taste of EG

I and III (+0.20 to +0.24 points), the juiciness of EG I and III (+0.34 to +0.48 points) and the fineness of the EG I and III (+0.30 to +0.43 points). The overall sensory valuation of the most valuable parts of the carcass Ross 308 chickens, were found positive effects of propolis extract on the sensory properties after baking and recommend it to use in the diet of broiler chickens, and as the most important from a sensory point of view seems to be the application in amount of 200 $mg.kg^{-1}$ throughout the feeding period.

**Keywords:** Ross 308 chickens, propolis extract, sensory evaluation, breast and thigh muscle

## INTRODUCTION

Worldwide consumption of poultry meat is growing up as in developed well as in developing countries, in 1999 the world production of broiler chickens reached 40 billion and expects continued growth until 2020 **(Bilgili, 2002).** Poultry products are universally popular, because they are not subject to cultural or religious restrictions and poultry meat itself is perceived as healthy and nutritious as it contains relatively low fat content and more desirable unsaturated fatty acids than other meats. The advantage of poultry meat is the fact that the quality of poultry products are available for a wide range of population and also in terms of acceptable prices, but production costs vary widely around the world **(Van Horne, 2002).** Poultry is sold primarily as poultry slaughter in the state as a dead carcass of the product, but in poorer regions is often sold in the form of live poultry in quantities up to 30% of total production **(Holroyd, 2001).**

**Berri *et al.* (2001), FAO (2002), Strakova *et al.* (2003)** and **Gueye (2009)** noted poultry meat suitable for the production of so-called functional foods for human consumption, which is currently at the heart of agricultural and food research. The nourishment of the population focused of highly digestible animal products in terms of supply of high quality protein, recently.

Besides the production of poultry meat for the food industry is also important in the qualitative composition of which is influenced by various extra-vital and intra-vital factors and a very particular diet **(Pesti *et al.*, 1986; Gonzalez-Alcorta *et al.* 1994; Haščík *et al.*, 2005).**

Several experiments to design the new composition of compound feed after application of various alternatives and various models for maximizing yield and quality

of meat chickens **(Greig *et al.*, 1977; McDonald and Evans, 1977; Allison *et al.*, 1978; Pesti *et al.*, 1986; Gonzalez-Alcorta *et al.*, 1994; Berri, 2000; Lee *et al.*, 2003, 2004; Khojasteh and Shivazad, 2006; Haščík *et al.*, 2006, 2007).**

Sensory analysis is unequivocally assigning in the scientific methods. It is one of the oldest means of quality control, but in principle is an essential part of the mandatory assessment of food quality, while also examining the deeper study of the interdependence between physiological and psychological phenomena in the very process of perception of sensory qualities **(Neumann and Arnold, 1990; Pokorny, 1993).**

Many authors note that the sensory analysis, allowing manufacturers to identify, understand and respond to consumer preferences more effectively **(Hashim *et al.*, 1995; Owens and Sams, 1998; Liu *et al.* 2004; Fanatic *et al.*, 2007; Saha *et al.*, 2009)** and in addition the identification of sensory characteristics and consumer preferences, helping manufacturers to increase competition in the market for other producers **(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 is to investigate the effect of 80% Slovak multifloral propolis extract added to the compound feed chickens Ross 308 in various concentrations on sensory characteristics of their meat.

## MATERIAL AND METHODS

The experiment was realized at the test station of poultry (Slovak Agricultural University in Nitra). The experiment enrolled 360 one day old chickens of hybrid combination Ross 308 and was formed into 4 groups: control group (C) and three experimental groups (EG: I, II, III) of 90 pcs chickens. Custom feeding insisted 42 days. Chickens were fed to 21$^{th}$ day of age an *ad libitum* with the same starter feed mixture HYD-01 (powdery form) and from 22$^{nd}$ to 42$^{nd}$ day of age fed with the growth feed mixture HYD-02 (powdery form) in the monitored groups. The fed feed mixture HYD-01 and HYD-02 have been produced without antibiotic preparations and coccidiostats. Nutritional value of feed mixtures (Table 1) given during the experiment was the same in each group, but the treatment groups was the addition of compound feed and HYD-01, HYD-02 added propolis extract at a dose of 200 (I), 300 (II) and 400 mg. kg$^{-1}$ (III). Propolis extract was prepared from minced propolis **(Krell, 1996)**. Weighed 150 g propolis was the volume of 80% ethanol, 500 cm$^3$.

**Tab 1** Composition of the diets

| 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 |
| Lysin | 0.05 | 0.07 |
| Methionin | 0.15 | 0.22 |
| Palm kernel oil Bergafat | 0.70 | 0.16 |
| Premix Euromix BR 0,5%[1] | 0.50 | 0.50 |
| Analysed 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 |
| $ME_N$ ($MJ.kg^{-1}$) 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

Extraction was carried out in a water bath at 80 °C under reflux for 60 minutes. After cooling was extract centrifuged. The supernatant was evaporated on a rotary vacuum evaporator at a water bath at temperature of 40-50 °C and then weighed. Residue in an

amount of 20 g, 30 g and 40 g was dissolved in 1000 $cm^3$ of ethanol concentration of 80% and applied to 100 kg of the feed mixture.At the end of feeding ($42^{th}$day) from each group were selected 60 pieces of chicken for experiment slaughter analysis with subsequent recovery of sensory (culinary) characteristics of breast and thigh of the chicken carcass after heat treatment at 200 °C for 60 minutes. Sensory assessment of anonymous samples was carried out 6-membered committee, where the self-assessment evaluation method was used 5-point scale introduced by prof. Tilgner. In terms of sensory analysis, we followed the odor, flavor, juiciness and tenderness of the meat.

Results of the experiment we evaluated with statistical program Statgraphics Plus version 5.1 (AV Trading Umex, Dresden, Germany), were calculated variation-statistical values (arithmetic mean, standard deviation) and to determine the evidential difference between groups we used variance analyze with subsequent Scheffe test.

## RESULTS AND DISCUSSION

Results of sensory assessment of sensory characteristics of valuable parts of the carcass of chickens (breastbone and thigh muscles) after application propolis extract of 200, 300 and 400 $mg.kg^{-1}$ in compound feed for feeding of chickens Ross 308 is shown in Table 2. Organoleptic evaluation of the breast muscle were found the highest score in the first experimental group (3.88 to 4.22) and lowest in the control group (3.51 to 3.99). Statistically significant results ($P \leq 0.05$) between control group and experiment (I, II, III) were found in the evaluation of breast muscle in aroma (+0.15 to +0.23 points), in taste between control and EG I and III (+0.19 to +0.26 points) in juiciness between control and EG I (+0.37 points) and fineness of the meat in control and EG I, II (+0.35 to +0.45 points). An important finding is that in all EG (I, II, III), i.e. after application of the propolis extract in the diet of Ross 308 chickens were found improved organoleptic properties of the breast muscle. In the thigh muscle were found similar results like in the breast muscle, the highest score in the organoleptic characteristics of the observed first experimental group (4.16 to 4.40) and lowest in flavor, juiciness and softness in the control group (3.81 to 4.02).

**Tab 2** Sensory evaluation of breast and thigh muscles of chickens Ross 308 (points)

| Sensory traits | | smell | | | | taste | | | | juiciness | | | | tenderness | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C | I | II | III | C | I | II | III | C | I | II | III | C | I | II | III |
| Breast meat | $\bar{x}$ | 3.99b | 4.22a | 4.14a | 4.22a | 3.84b | 4.10a | 3.98ab | 4.03a | 3.51b | 3.88a | 3.67ab | 3.65ab | 3.57b | 4.02a | 3.92ac | 3.69bc |
| | S.E. | 0.110 | 0.181 | 0.117 | 0.286 | 0.207 | 0.283 | 0.140 | 0.177 | 0.242 | 0.308 | 0.241 | 0.201 | 0.275 | 0.239 | 0.342 | 0.228 |
| Thigh meat | $\bar{x}$ | 4.02b | 4.27a | 4.07b | 4.10ab | 3.94b | 4.16a | 3.87b | 4.14a | 3.81b | 4.29a | 3.94b | 4.15a | 3.97b | 4.40a | 4.04b | 4.27a |
| | S.E. | 0.123 | 0.200 | 0.177 | 0.163 | 0.184 | 0.250 | 0.295 | 0.195 | 0.202 | 0.145 | 0.227 | 0.190 | 0.195 | 0.221 | 0.217 | 0.226 |

Note: Average values in the same row, and indicators which are followed by different letters are provable in $P \leq 0.05$; C = control group; I = 1st experimental group; II = 2nd experimental group; III = 3rd experimental group; $\bar{x}$ = mean; S.E. = standard deviation;

**Tab 3** Correlation coefficients among sensory traits of chicken meat quality

| C group | *smell* | | *taste* | | *juiciness* | | *tenderness* | | *total score* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | breast | thigh | breast | thigh | breast | thigh | breast | thigh | breast | thigh |
| group I | | | | | | | | | | |
| *smell* | | | | | | | | | | |
| breast | | | 0.14ns | | 0.16ns | | -0.03ns | | 0.05ns | |
| thigh | | | | -0.80** | | -0.67* | | 0.04ns | | -0.75* |
| *taste* | | | | | | | | | | |
| breast | -0.38ns | | | | 0.29ns | | 0.01ns | | 0.10ns | |
| thigh | | -0.45ns | | | | -0.53ns | | -0.25ns | | -0.65* |
| *juiciness* | | | | | | | | | | |
| breast | 0.12ns | | 0.49ns | | | | 0.47ns | | 0.49ns | |
| thigh | | 0.09ns | | 0.43ns | | | | 0.45ns | | 0.41ns |
| *tenderness* | | | | | | | | | | |
| breast | 0.15ns | | 0.46ns | | 0.62ns | | | | 0.54ns | |
| thigh | | 0.37ns | | 0.59ns | | 0.42ns | | | | 0.20ns |
| *total score* | | | | | | | | | | |
| breast | -0.15ns | | 0.35ns | | 0.45ns | | 0.29ns | | | |
| thigh | | -0.33ns | | -0.07ns | | -0.09ns | | -0.03ns | | |

Note: ns = not significant; * = P≥0.05; ** = P≥0.01;

**Tab 4** Correlation coefficients among sensory traits of chicken meat quality

| C group | *smell* | | *taste* | | *juiciness* | | *tenderness* | | *total score* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | breast | thigh | breast | thigh | breast | thigh | breast | thigh | breast | thigh |
| group II | | | | | | | | | | |
| *smell* | | | | | | | | | | |
| breast | | | 0.35ns | | 0.20ns | | -0.11ns | | -0.22ns | |
| thigh | | | | -0.29ns | | 0.29ns | | -0.12ns | | -0.08ns |
| *taste* | | | | | | | | | | |
| breast | -0.03ns | | | | 0.03ns | | 0.02ns | | 0.20ns | |
| thigh | | -0.51ns | | | | -0.07ns | | -0.24ns | | -0.27ns |
| *juiciness* | | | | | | | | | | |
| breast | 0.18ns | | 0.53ns | | | | -0.06ns | | 0.02ns | |
| thigh | | -0.49ns | | -0.09ns | | | | -0.31ns | | -0.48ns |
| *tenderness* | | | | | | | | | | |
| breast | 0.42ns | | 0.70* | | 0.14ns | | | | 0.13ns | |
| thigh | | -0.13ns | | -0.42ns | | -0.32ns | | | | -0.36ns |
| *total score* | | | | | | | | | | |
| breast | 0.12ns | | 0.57ns | | 0.06ns | | -0.001ns | | | |
| thigh | | -0.73* | | -0.56ns | | -0.29ns | | -0.30ns | | |

Note: ns = not significant; * = P≥0.05;

**Tab 5** Correlation coefficients among sensory traits of chicken meat quality

| C group | *smell* | | *taste* | | *juiciness* | | *tenderness* | | *total score* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | breast | thigh | breast | thigh | breast | thigh | breast | thigh | breast | thigh |
| group III | | | | | | | | | | |
| *smell* | | | | | | | | | | |
| breast | | | -0.09ns | | 0.33ns | | 0.13ns | | 0.25ns | |
| thigh | | | | -0.04ns | | -0.19ns | | -0.18ns | | -0.07ns |
| *taste* | | | | | | | | | | |
| breast | 0.30ns | | | | 0.59ns | | 0.36ns | | 0.69* | |
| thigh | | 0.33ns | | | | -0.06ns | | -0.24ns | | 0.03ns |
| *juiciness* | | | | | | | | | | |
| breast | 0.19ns | | 0.12ns | | | | -0.16ns | | 0.23ns | |
| thigh | | -0.10ns | | 0.24ns | | | | -0.26ns | | -0.07ns |
| *tenderness* | | | | | | | | | | |
| breast | -0.15ns | | 0.08ns | | 0.15ns | | | | 0.08ns | |
| thigh | | 0.17ns | | 0.09ns | | -0.46ns | | | | -0.18ns |
| *total score* | | | | | | | | | | |
| breast | 0.17ns | | 0.22ns | | 0.42ns | | -0.07ns | | | |
| thigh | | 0.37ns | | 0.33ns | | -0.49ns | | -0.57ns | | |

Note: ns = not significant; * = P≥0.05;

Significant differences (P≤ 0.05) between control group and EG (I, II, III) were found in the evaluation of smell compared with EG I (+0.25 points), the taste in EG I and III (+0.20 to +0.24 points), the juiciness in EG I and III (+0.34 to +0.48 points) and the fineness in the EG I and III (+0.30 to +0.43 points). In all experimental groups in addition to EG II (P≥0.05) was found in the evaluation of taste positive values above the organoleptic properties of the thigh muscles in comparison to control group. Correlation coefficients between the sensory properties of chicken meat were shown in Table 3 to 5. Significant correlations between control group and EG I were among in the total number of points in the smell of the thigh muscle (r = 0.75) and taste (r = 0.65), respectively. The correlation coefficients were found only in the thigh muscle, the taste and aroma (r = 0.80), juiciness and flavor (r = 0.67), respectively. Between control and experimental group II were found only correlation coefficients between tenderness and flavor in the breast muscle (r = 0.70) and thigh muscle between the total number of points and aroma (r = 0.73). Probatory data correlation between control group and EG III were found only in the breast muscle between the total score and taste (r = 0.69). Achievements in the correlation factors show a similar trend as found **Krapoth (1987), Tawfik *et al.* (1990)** and **Gueye *et al.* (1997)**. **Połtowicz (2000), Osek *et al.* (2001), Barteczko *et al.* (2003), Haščík *et al.* (2004, 2007, 2011), Bobko *et al.* (2006, 2009), Barac *et al.* (2006), Chekani-Azar *et al.* (2008), Kim *et al.* (2009), Marcinčák *et al.* (2009), Mihok *et al.* (2010)** noted positive results of sensory evaluation of the most valuable parts of the Ross 308 chickens with the application of propolis extract in amount of 200, 300 and 400 $mg.kg^{-1}$ in the feed mixtures were consistent with the values and tendencies which have been identified in the application of various feed additives in the diet of chickens. The results of the increased scoring of juiciness and softness of thigh muscle against breast muscle were correspond with the findings **Scholtyssek and Sailer (1986), Kofrányi and Wirths (1994)** and **Gueye *et al.* (1997),** because the thigh muscles contain more fat, blood capillaries and pigmentation. The authors also note that the required administrative and technological, nutritional and sensory quality of chickens meat can only were reached with proven feed supplements, because not all of the additives may have beneficial effects on sensory characteristics of meat, but can have the opposite tendency.

## CONCLUSION

In the experiment were verified the impact of propolis extract applied in feed compound of Ross 308 chickens in amount of 200, 300 and 400 $mg.kg^{-1}$ on the sensory properties of breast and thigh muscles after baking throughout the feeding period (42 days). Building on the achievements were attained significant differences ($P \leq 0.05$) between control group and experimental groups (I, II, III) in the evaluation of breast muscle in the aroma and taste between control and EG I and III, in juiciness between control group and EG I and softness between control group and EG I and II. In the thigh muscle were found significant differences ($P \leq 0.05$) between control group and EG (I, II, III) in the evaluation of smell compared with EG I, the taste of EG I and III, the juiciness of EG I and III and fineness of the EG I and III. The overall sensory valuation of the most valuable parts of the carcass Ross 308 chickens, were found positive effects of propolis extract on the sensory properties after baking and recommend it to use in the diet of broiler chickens, and as the most important from a sensory point of view seems to be the application in amount of 200 $mg.kg^{-1}$ throughout the feeding period.

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