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REGULAR ARTICLE

INFLUENCE OF DIFFERENT PLANT SUPPLEMENTS APPLIED IN CHICKEN NUTRITION ON QUALITY OF THEIR MEAT

Marek Bobko, Peter Haščík, Alica Bobková, Vladimíra Kňazovická, Tomáš Tóth, Mária Angelovičová*

Address: 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

*Corresponding author: marek.bobko@uniag.sk

ABSTRACT

Within the experiment, three groups were created (one control and two experimental groups). We studied the influence of following supplements: alfalfa (*Medicago sativa*) meal (4% - experimental group I) and origanum (*Origanum vulgare*), thyme (*Thymus vulgaris*) and cinnamon (*Cinnamomum* sp.) oils together (0.05% - experimental group II) in mutual rate of 3:2:1, on technological and sensorial parameters of poultry meat in nutrition of chickens of Ross 308. Broilers were fattening for 36 days. Chickens were fed by the system *ad libitum* by the feed mixture HYD-01 from the 1st to the 18th day of age, by the feed mixture HYD-02 from the 19th to the 31st day of age and by the feed mixture HYD-03 from the 32nd day of age to the end of fattening (36th day of age) in loose form. By application of plant oils into the feed mixture, we recorded slightly positive influence on decrease of losses of cooling after 24 and 48 h, on decrease of losses of freezing and on shear force in mammary muscle and on overall sensorial evaluation of breast and thigh muscle ($P \geq 0.05$). Conversely, slightly negative influence was recorded on baking losses and on shear force in thigh muscle ($P \geq 0.05$) in compare with control group. In application of alfalfa meal, positive influence ($P \geq 0.05$) on losses of cooling (24 and 48 h), losses of freezing, baking losses, on shear force of breast muscle and on overall sensorial evaluation of thigh muscle was found. Conversely, shear

force of thigh muscle and overall sensorial evaluation of breast muscle after application of alfalfa meal showed slightly negative values (P≥0.05) in compare with control group.

Key words: alfalfa meal, plant oils, poultry meat, technological and sensorial quality

INTRODUCTION

Poultry meat is one of the most important meat types applied in human nutrition. On the basis of consumption on one head in Slovak Republic, poultry meat has 2nd place immediately after pork meat. Poultry meat is one of the very valuable food-stuffs that are rich in proteins, interesting for its taste, for easy digestibility and for high dietary value. Because of these aspects, poultry meat has had many supporters **(Kerekréty, 1998; Holoubek, 2001)**.

Many years of experience of our ancestors in human healing indicate that the most natural solution to maintaining of animal health and food security for people is using the active plant substances such as alkaloids, tannins and essential oils **(Drdák *et al.*, 1996)**. Using of plant oils is one of the possible alternatives in nutrition of poultry feed as substitution for antibiotics; they positively affect the yield and were evaluated by **Demeterová (2004)**, **Mudroňova *et al.* (2005)**, **Angelovičová *et al.* (2005, 2006)** and others.

Opletal (1998) notes that natural essential oils from spices, aromatic herbs and plant extracts containing active components may also have growth-stimulating effects. **Docic and Bilkei (2003)** state that the plant extracts, as substitution of antibiotics, positively effect on feed intake, gains of body weight, utilization of nutrients and improvementof microbial fermentation in the intestine. **Bikler (2006)** points out that the using of phytogenic additives stimulates the growth of the digestive system and improves its resistance to colonization by pathogenic microorganisms. **Kamel and McKay (2003)** characterize phytogenic substances such as natural substances of plant origin that leave no residues in animal products and then it is notnecessary to abide the protection period before slaughter of animals.

An integral part of the examination of utilization the feed phyto-additives is some issue relating to their impact on technologically-consumer quality of animal products, including their health security. Extensive knowledge witness to a wide range of antimicrobial and antioxidant effects of plant extracts on the quality of the finished product, including poultry meat **(Marcin *et al.* 2004; Horosová *et al.*, 2004)**. And it is necessary to ensure the lowest possible losses in the process of production as well as its harmlessness **(Okál' *et al.*, 1976)**.

Important indicator of the integration of new component in animal nutrition is maintenance of adequate technological, nutritional and sensorial characteristics of meat, because various supplements can also cause its deterioration **(Aleson-Carbonell *et al*., 2004; Perez-Alvarez, 2006)**.

Following the above, this study is focused to examine the effect of adding the plant oils blend and alfalfa meal in varying amounts into the feed mixture to chickens Ross 308. We examined the effects of Alfalfa (*Medicagosativa*) meal and the combination of origanum (*Origanumvulgare*), thyme (*Thymus vulgaris*) and cinnamon (*Cinnamomum*sp.) oils on technological parameters and on total score of sensory quality of poultry meat.

MATERIAL AND METHODS

The experiment was performed in poultry farm Zámostie Company using the technology of breeding on deep litter with fattening chickensof hybrid combination Ross 308. To the experiment, 300 units of one-day-old chickens wereinvolved and there were created three groups of animals: control group (C) and two experimental groups (I, II). Each group consisted of 100 chickens. Fattening lasted 36 days. In the experiment, chickens were fed by the system *ad libitum* by the same starter feed mixture HYD-01 to the 18th of age. From the 19th day of age to the 31st day of age, chickens were fed by growth feed mixture HYD-02 and from the 32nd day to the 36th day (end of fattening), chickens were fed by finished HYD-03. Feed mixtures were in loose structure. Feed mixtures HYD-01, HYD-02 and HYD-03 have been produced without antibiotic and coccidiostat preparations. During the experiment, nutritive values of given feed mixtures were the same in each group, but some supplements were added into the feed mixtures of experimental groups. Alfalfa (*Medicago sativa*) meal in the rate of 4% was added in experimental group I and the combination of origanum (*Origanum vulgare*), thyme (*Thymus vulgaris*) and cinnamon (*Cinnamomum* sp.) oils in amount of 0.05% in the ratio 3:2:1 was added in experimental group II.

At the end of fattening period (36th day), 60 pieces of chickens from each group were selected for slaughter analyses and 6 pieces of chickens from each group were analysed for monitoring of selected indicators of meat quality. Losses of cooling were observed by gravimetric method in cold temperatures +4 °C after 24 and 48 hours. Losses of freezing were monitored by gravimetric method after 2 months of freezing of chicken carcass at -18 °C. To assess the gravimetric method, analytical balances type DENVER INSTRUMENT MXX-5001 (GER) was used. Sensorial properties of poultry meat (breast and thigh meat) were

evaluated after heat treatment of chicken carcass at 200 °C for 60 minutes and after baking for 10 to 15 minutes. Sensorial assessment of anonymous samples was carried out by six-member committee. For the self-assessment, five-point scale was used. In terms of sensorial analysis, smell, taste, juiciness, tenderness and total sensorial score of the meat were monitored.

Shear force of culinary prepared meat (breast and thigh meat) were investigated by the Warner-Bratzler analyser of Chatillon brand (USA) by the method of **Goodson *et al.* (2002)**, Shear force is defined as the force, which is necessary to slit the meat sample of 1 cm^2 cross-section across the fibers of the meat.

From obtained data, the basic variation-statistical values (arithmetic mean, standard deviation) were calculated by the statistical program Statgraphics Plus version 5.1 (AV Trading, Umex, Dresden, Germany). The F-test followed by t-test was used to determine the evidential difference between groups.

RESULTS AND DISCUSSION

Results of quality indicators of poultry meat (breast and thigh meat) after application of plant oils and alfalfa meal are shown in Table 1.

Table 1 Quality indicators for meat of fattening chickens Ross 308 (mean±S.D.)

Observed parameters	C	I	II
Losses of coolingafter 24 h [%]	2.00±1.35	1.97±0.65	1.70±0.68
Losses of cooling after 48 h[%]	2.22±1.40	2.12±0.69	1.78±0.71
Losses of freezing[%]	1.76±0.51	1.68±0.31	1.30±0.61
Baking losses [%]	31.66±1.63	30.72±2.46	31.76±1.78
Shear force of breast meat [$kg.cm^{-2}$]	3.14±0.68	2.78±0.08	2.80±0.23
Shear force of thigh meat [$kg.cm^{-2}$]	3.05±0.61	3.07±0.79	3.36±0.77

Legend: Average values in the same row and in the same indicator for different letters (different groups) are significant at $P \leq 0.05$; C = control group; I = 1st experimental group; II = 2nd experimental group; determined by Scheffe'stest; S.D. = standard deviation;

By the evaluation of carcasses after cooling for 24 hours, losses were recorded (P≥0.05) from 1.70% (experimental group II) to 2.00% (control group). Similar trend was recorded also after 48 hours of cold storage. Again, the highest losses were found in the control group (2.22%) and the lowest losses in the experimental group II (1.78%). And statistically significant difference between the groups of the experiment was not recorded (P≥0.05). The similar findings were found by **Botka-Petrak *et al.* (2005)** and **Huezo *et al.* (2007)**, who noticed the losses of cooling in average of 2.5% from weight of carcasses.

Quick-freezing and proper storage guarantee the high quality of frozen products including poultry and fattening chickens **(Okáľ *et al.*, 1976)**. By the evaluation of freezing losses after two months of storage at -18 °C, we found (P≥0.05) lower losses in experimental groups (1.68% - the experimental group I; 1.30% - the experimental group II) in compare with the control group (1.76%).

Baking losses were lower (30.72%) in group with application of alfalfa meal and baking losses were slightly higher (31.76%) in experimental group II in compare with control group (31.66%), without significant differences between groups (P≥0.05). Achieved results of baking losses are comparable with the findings of **Castellini *et al.* (2002)**, who recorded their values from 32.65 to 35.17%, but achieved values are higher in compare with values of **Culioli *et al.* (1990)**, **Claus *et al.* (2001)** and **Grashorn and Serini (2006)**, who found their level from 17.03 to 26.30%. **Haščík *et al.* (2010)** noted that the baking losses are often influenced by the chemical composition of muscle tissue, especially by the fat in muscle of animals. But they may be affected by the steffness of death **(Young and Lyon, 1994, 1997; Young *et al.*, 1999)**.

Shear force (tenderness) of meat was assessed by Warner-Blatzler method. Its lowest values was recorded in breast muscle in experimental group I (2.78 kg cm^{-2}) and in thigh muscle in the control group (3.05 kg cm^{-2}), without significant differences between groups of the experiment (P≥0.05). The results of shear force are comparable or lower than results of **Costa *et al.* (2007)**, whofound values from 2.94 to 4.01 kg cm^{-2}. The results are also lower in compare with results of **Grashorn and Serini (2006)** and **Bobko *et al.* (2009)**, who recorded the shear force in the breast muscle from 1.86 to 2.37 kg cm^{-2} and in the thigh muscle from 1.64 to 2.56 kg cm^{-2}.

In term of overall sensorial evaluation (Table 2), we found that the highest average value in the thighmeat (P≥0.05) was in the experimental group II with the addition of a mixture of plant oils in the diet of chickens Ross 308 (16.92 points) and the lowest value was in the control group (16.50 points). In the breast meat, we similarly recorded the highest total

Table 2 Sensorial evaluation of meat of chickens Ross 308 [points]

Sensory traits		smell			taste			juiciness			tenderness			total score		
		C	I	II	C	I	II	C	I	II	C	I	II	C	I	II
Breast	$\bar{x}$	4.02	4.13	4.15	4.17	4.23	4.12	4.00	3.87	4.07	4.00	3.93	4.22	16.35	16.17	16.52
meat	S.D.	0.19	0.06	0.17	0.01	0.06	0.17	0.18	0.15	0.30	0.18	0.15	0.15	0.51	0.35	0.12
Thigh	$\bar{x}$	4.12	4.07	4.05	4.00	4.10	4.07	4.15	4.17	4.37	4.22	4.33	4.42	16.50	16.67	16.92
meat	S.D.	0.12	0.06	0.19	0.14	0.06	0.15	0.30	0.30	0.19	0.22	0.25	0.30	0.60	0.60	0.83

Note: Average values in the same row and in the same indicator for different letters (different groups) are significant at $P \leq 0.05$; C = control group; I = 1st experimental group; II = 2nd experimental group; $\bar{x}$ = mean value; S.D. = standard deviation; determined by Scheffe's test;

sensorial score in the experimental group II (16.52 points) and the lowest score was in experimental group I (16.17 points), without significant differences between groups (P≥0.05). Increased point scoresof juiciness and tenderness of thigh muscle in compare with breast muscle correspond to results of **Gueye *et al.* (1997)**, because the thigh muscles contain more fat, blood capillaries and pigment.

Positive results of sensorial evaluation of the most valuable parts of carcasses of chickens Ross 308 in the experiment are in line with those identified in the application of various feed additives in the diet of chickens **(Baracho *et al.*, 2006; Kim *et al.*, 2009; Mihok *et al.* 2010; Haščík *et al.*, 2011)**.

CONCLUSION

In the experiment, we verified the impact of alfalfa meal (4%) and plant oils (0.05%) applied in feed mixtures for chickens Ross 308. We evaluated influence of the supplements on quality indicators and sensorial evaluation of poultry meat. We have not found the significant differences (P≥0.05) in followed parameters: losses of cooling, of freezing, baking losses, shear force and in sensorial evaluation of the valuable parts of the carcass (breast and thigh meat). We have seen in significant (P≥0.05) positive impact of apply in mixture of plant oils on the losses of cooling after 24 and 48 hours, on the losses of freezing and on shear force of breast muscle, compared to control group. After application of alfalfa meal, we have seen a positive influence (P≥0.05) on all indicators of meat quality except shear force of thigh muscle.

The total sensorial evaluation of the breast meat was the highest in the group with the application of plant oils and the lowest was after the application of alfalfa meal (P≥0.05) in compare with the control group. In the thigh meat, we recorded a positive impact on the overall sensorial evaluation (P≥0.05) after application of plant oils as well as of alfalfa meal, compared with the control group.

Based on the verified addition of alfalfa meal and of plant oils in the nutrition of fattening chickens Ross 308 during the whole fattening period, we recommend these supplements to apply in practical terms, because they do not affect quality parameters and sensorial evaluation of meat.

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