

INFLUENCE OF HERBAL DRUGS IN BROILER CHICKEN NUTRITION ON PRIMAL CARCASS CUTS QUALITY ASSESSEMENTS

Nikola M. Puvača*^{1,6}, Ljiljana M. Kostadinović², Olivera M. Đuragić², Dragana B. Ljubojević³, Branislav M. Mišćević⁴, Tibor L. Könyves⁴, Sanja J. Popović², Jovanka D. Lević², Nedeljka B. Nikolova⁵

¹University of Novi Sad, Faculty of Agriculture, 21000 Novi Sad, Trg Dositeja Obradovića 8, Serbia

²University of Novi Sad, Institute for Food Technology, 21000 Novi Sad, Bulevar cara Lazara 1, Serbia

³Scientific Institute of Veterinary Medicine "Novi Sad", 21000 Novi Sad, Rumenački put 20, Serbia

⁴University of Megatrend, Faculty of Biofarming, 24300 Bačka Topola, Maršala Tita 39, Serbia

⁵University "Ss. Cyril and Methodius", Institute of Animal Science, 1000 Skopje, Av. Ilinden 92/a, Republic of Macedonia

⁶Patent Co., 24211 Mišićevo, Vlade Četkovića 1A, Serbia

*Corresponding author:

Phone: +381652191284

E-mail address: nikola.puvaca@gmail.com; nikola.puvaca@patent-co.com

ABSTRACT: Aim of this investigation was to determine the effects of herbal drugs such as garlic, black pepper and hot red pepper in broiler chicken nutrition on carcass primal cuts quality. Total of 1200 one-day old Hubbard broilers were totally randomly distributed into eight dietary treatments with four replicates each. Chicks were fed with three dietary mixtures: starter, grower and finisher. Dietary mixtures in the experiments were as follows: T1 (Control diet), T2 (Garlic powder 0.5 g/100g), T3 (Garlic powder 1.0 g/100g), T4 (Black pepper powder 0.5 g/100g), T5 (Black pepper powder 1.0 g/100g), T6 (Hot red pepper 0.5 g/100g), T7 (Hot red pepper 1.0 g/100g) and T8 (Mixture of spices in ratio of 1:1:1 in total amount of 0.5 g/100g). Addition of herbal drugs had significant ($p < 0.05$) influence on carcass quality of broiler chickens. The highest achieved body weight of chicken was in treatment T6 (2460.6 g) which was followed by treatment T7 (2442.4 g) with statistically significant differences ($p < 0.05$) compared to other treatments. The primal cuts of the most economically important value such as drumsticks with thighs had the highest weights in treatments T7 (530.7 g), T6 (525.2 g), T2 (520.2 g) and T8 (497.1 g), with statistically significant differences ($p < 0.05$) compared to treatments T4, T5 and T1 (438.5 g, 448.7 g and 461.1 g). When it comes to a share of primal cuts in a ready-to-grill carcass weight, significant differences were not observed ($p > 0.05$), while significant differences in the share of wings and beak ($p < 0.05$) were recorded under the influence of added herbal drugs. It can be concluded that the addition of garlic, black pepper and hot red pepper in broiler chicken nutrition showed positive influence on chicken carcass quality.

Key words: *spices, nutrition, chickens, carcass quality*

INTRODUCTION

Over the past decades antibiotics as growth promoters in poultry nutrition have been used in order to improve the quality of the final product (Schwarz et al., 2001; Sarica et al., 2005; Puvača et al., 2013). Although chicken raised with addition of antibiotics achieves good productive performance on one hand, on the other hand their side effects became a real public

health problem worldwide (Donoghue, 2003). To improve chicken healthiness and to fulfil consumer expectations in relation to food quality, poultry producers nowadays commonly apply natural dietary supplements mainly medical, aromatic and spice herbs (Onibi et al., 2009). The positive effects of herbal supplements or phytoadditives on broiler performance (A-

mouzmehr and Dastar, 2009), carcass and meat quality (Khalafalla et al., 2011) have been demonstrated. The chicken products quality on the market is increasingly valued by consumers (Vukelić et al., 2014). Garlic (*Allium sativum* L.) has been widely used as a herbal supplement in broiler chicken diet because of its strong stimulating effect on the immune system and the very rich aromatic oils which enhance feed digestion (Gardzielewska et al., 2003). Black pepper (*Piper nigrum* L.) in broiler nutrition improves health status, increases absorption of selenium, vitamin B complex, enhances the thermogenesis of lipids and accelerates energy metabolism in the body (Al-Kassie et al., 2011a). Hot red pepper (*Capsicum annum* L.) plays an important role in decreasing the deposition of cholesterol and fat in the body, contributes to triglycerides level decreasing and supports the vascular system in the body (Al-Kassie et al., 2011a). All of these spice herbs exhibit antiatherosclerotic, antimicrobial, hypolipidemic, antithrombotic, antidiabetic effects (Mansoub, 2011), antioxidant, anticarcinogenic, antiinflammatory effects (Pradeep and Kuttan, 2004), chemopreventive and chemotherapeutic effects (Al-Kassie et al., 2011a), and also exhibit positive effects on broilers production and blood lipid profile (Puvača et al., 2015).

The aim of this study was to investigate and show the effect of natural growth promoters such as garlic, black pepper and hot red pepper in broiler chicken nutrition on chicken carcass quality.

MATERIAL AND METHODS

Animals, housing and nutrition

Biological tests were carried out under production conditions at the experimental farm "Pustara" in property of the Faculty of Agriculture, Department of Animal Science in Novi Sad and were previously described in Puvača et al. (2015). For experiment eight dietary treatments in four replicates were formed. Every dietary treatment included 150 chickens, which were divided in four pens with 37-38 chicken per each pen. For nutrition of chicks three mixtures were used, starter, grower and finisher. For the first 14 days, during the prepa-

ratory period, chicks were fed with starter mixture based on the corn and soybean meal. Following the preparation period, chicks were fed with grower mixtures for the next 21 days, and then for the last 7 days of fattening period with finisher mixtures of composition and nutritive value which is given in Table 1. Dietary mixtures in the experiments was as follows: T1 (Control diet), T2 (Garlic powder 0.5 g/100g), T3 (Garlic powder 1.0 g/100g), T4 (Black pepper powder 0.5 g/100g), T5 (Black pepper powder 1.0 g/100g), T6 (Hot red pepper 0.5 g/100g), T7 (Hot red pepper 1.0 g/100g) and T8 (Mixture of spices in ratio of 1:1:1 in total amount of 0.5 g/100g). During the experiment chicks were fed and watered *ad libitum*.

Samples collections

At the end of 42 days of the experiment, 12 broiler chickens, 6 male and 6 female of an average body weight from each treatment were selected for the investigation of carcass quality. Before slaughtering broiler chickens were starved for 12 hours, and slaughtered according to standard procedure. Immediately prior to slaughter, the broilers were weighed. Upon slaughter, dressed carcasses were subjected to measurements. Dressed cold carcasses were dissected into primal cuts such as breast, drumsticks with thighs, wings, back, head, neck and legs following the method prescribed by the Regulation on Poultry Meat Quality (1988). Primal cuts were weighed to determine the dressing percentage of the tested broilers chickens. The data obtained were used to calculate the share of individual meat classes.

Statistical analyses

Statistical analyses were conducted within statistical software program Statistica 12 for Windows, to determine if variables differed between treatments. Significant effects were further explored using analysis of variance (ANOVA) with repeated measurements, least square means (LSM) and standard errors of least square means (SELSM), as well as Fisher's LSD post-hoc multiple range test with Bonferroni corrections to ascertain differences among treatment means. A significance level of $p < 0.05$ was used.

Table 1.
Composition and nutritive value of dietary mixtures (g/100 g)

Indices	Diet mixtures		
	Starter	Grower	Finisher
Ingredients			
Corn	55.0	54.2	57.1
Wheat	5.0	8.0	12.0
Soybean meal, 44%	19.5	19.0	9.9
Soy protein concentrate	8.8	5.7	7.8
Sunflower meal, 42%	2.0	4.0	6.0
Corn gluten	2.0	2.0	-
Yeast	1.5	-	-
Chalk	1.75	1.70	1.50
MCP	1.38	1.22	0.98
Premix	2.57	2.58	2.32
Chemical composition			
Dry matter	89.4	89.3	89.4
Moisture	10.5	10.7	10.5
Crude protein	21.1	20.7	17.3
Crude fat	3.9	3.9	4.7
Crude fibre	3.5	3.5	3.6
Crude ash	5.0	4.8	5.6
Ca	0.8	0.9	1.1
P	0.6	0.6	0.5
Metabolic Energy, MJ/kg	12.5	12.8	13.3

*Spices are added on top on the basic diet

RESULTS AND DISCUSSION

From the results given in Table 2 it can be seen that the addition of herbal drugs has statistically significant ($p < 0.05$) influence on all observed parameters of broiler chicken carcass characteristics. The highest live body weight prior to slaughter and after slaughtering and cooling was observed in chickens from treatments T6 (2448.1 g; 1950.7 g) and T7 (2446.8 g; 1957.1 g) with statistically significant differences as related to the control treatment T1 (2120.0 g; 1746.2 g). Addition of hot red pepper in amount of 1.0 g/100g led to statistically significant ($p < 0.05$) weight of ready-to-grill carcass (1631.0 g) compared to the treatments T3 (1518.2 g), T4 and T5 (1351.7 g and 1418.8 g, respectively) and also compared to the control treatment T1 (1425.2 g). The highest dressing percentage (67.2%) was recorded in the treatment T5 and in the control treatment, while the lowest dressing percentage was recorded in treatment T4 with statistically significant differences ($p < 0.05$). According to our assumptions, addition of herbal drugs such as garlic,

black pepper and hot red pepper significantly ($p < 0.05$) influenced on carcass quality of broiler chickens. The results from this study are in agreement with investigation of Fayed et al. (2011) which showed that the dietary addition of garlic in amount of 0.5 kg/t to broiler chicken nutrition led to increased final body weights. This is also in agreement with the findings of Onibi et al. (2009) with other types of poultry. This study also showed that the addition of garlic, black pepper and hot red pepper had positive effect on production results of chickens, which is also in agreement with previous findings of Ashayezadeh et al. (2009) with the use of garlic, black cumin and wild mint; Fadlalla et al. (2010), Stanačev et al. (2011), Issa and Abo Omar, (2012) and Puvača et al. (2014) with the use of garlic powder; Al-Kassie et al. (2011a) with the use of black pepper and Valiollahi et al. (2013) with the use of black pepper and ginger in broiler chicken nutrition. As in this study, the investigation of Khalafalla et al. (2011) showed positive effects of phytogetic feed additives on the quality of broiler carcasses.

Table 2.
Carcass characteristics of broiler chickens fed with dietary herbal drugs addition

Experimental treatments		Parameters			
		Live weight prior to slaughter, g	Weight after slaughtering and cooling, g	Ready-to-grill, g	Dressing, %
T1	LSM	2120.0 ^b	1746.2 ^{bc}	1425.2 ^{cd}	67.2 ^{ab}
T2	LSM	2363.7 ^a	1906.2 ^a	1592.3 ^{ab}	67.2 ^{ab}
T3	LSM	2333.1 ^a	1835.1 ^{ab}	1518.2 ^{bc}	65.1 ^{cd}
T4	LSM	2092.5 ^b	1649.8 ^c	1351.7 ^d	64.6 ^d
T5	LSM	2080.6 ^b	1706.0 ^c	1418.8 ^{cd}	68.1 ^a
T6	LSM	2448.1 ^a	1950.7 ^a	1621.1 ^a	66.2 ^{bcd}
T7	LSM	2446.8 ^a	1957.1 ^a	1631.0 ^a	66.6 ^{acb}
T8	LSM	2360.0 ^a	1894.8 ^a	1564.7 ^{ab}	66.3 ^{bc}
Pooled SE _{LSM}		51.95	45.34	36.12	0.59

Treatments denoted with different letters in the same column are statistically significantly different ($p < 0.05$)

Table 3.
Weights of carcass primal cuts (g)

Experimental treatments		Parameters			
		Breast	Drumsticks with thighs	Wings	Back
T1	LSM	482.2 ^c	461.1 ^{bc}	180.5 ^{bc}	301.3 ^{cd}
T2	LSM	550.2 ^a	520.2 ^a	187.6 ^{ab}	334.2 ^{acb}
T3	LSM	533.0 ^{ab}	478.2 ^{bc}	174.8 ^{bc}	332.1 ^{acb}
T4	LSM	467.2 ^c	438.5 ^c	160.8 ^d	285.1 ^d
T5	LSM	491.1 ^{bc}	448.7 ^c	173.0 ^{cd}	306.0 ^{bcd}
T6	LSM	567.8 ^a	525.2 ^a	186.0 ^{abc}	342.0 ^{ab}
T7	LSM	553.6 ^a	530.7 ^a	197.6 ^a	349.0 ^a
T8	LSM	554.0 ^a	497.1 ^{ab}	183.2 ^{bc}	330.3 ^{acb}
Pooled SE _{LSM}		17.43	14.74	4.81	12.71

Treatments denoted with different letters in the same column are statistically significantly different ($p < 0.05$)

Table 4.
Share of carcass primal cuts in ready-to-grill carcass (%)

Experimental treatments		Parameters			
		Breast	Drumsticks with thighs	Wings	Back
T1	LSM	33.8 ^a	32.3 ^a	12.6 ^a	21.1 ^a
T2	LSM	34.5 ^a	32.6 ^a	11.8 ^b	20.9 ^a
T3	LSM	35.1 ^a	31.4 ^a	11.5 ^b	21.8 ^a
T4	LSM	34.5 ^a	32.4 ^a	11.8 ^{ab}	21.1 ^a
T5	LSM	34.6 ^a	31.5 ^a	12.1 ^{ab}	21.5 ^a
T6	LSM	35.0 ^a	32.4 ^a	11.4 ^b	21.0 ^a
T7	LSM	33.9 ^a	32.5 ^a	12.1 ^{ab}	21.3 ^a
T8	LSM	35.3 ^a	31.7 ^a	11.7 ^b	21.1 ^a
Pooled SE _{LSM}		0.83	0.48	0.27	0.61

Treatments denoted with different letters in the same column are statistically significantly different ($p < 0.05$)

Obvious influence of dietary spice addition was recorded in the weight of carcass primal cuts (Table 3). Addition of garlic, hot red pepper and mixture of herbal drugs led to statistically significant ($p < 0.05$) differences in the weight of breast meat, compared to the control and black pepper powder treatments, but without significant ($p > 0.05$) differences within the treatments. The primal cuts of the most eco-

nomically important parts such as drumsticks with thighs had the highest weights in treatments T7 (530.7 g), T6 (525.2 g), T2 (520.2 g) and T8 (497.1 g), with statistically significant differences ($p < 0.05$) compared to treatments T4, T5 and T1 (438.5 g, 448.7 g and 461.1 g). Weight of wings ranged between 197.6 g (T7) to 160.8 g (T4), back 349.0 g (T7) to 301.3 g (T1), respectively.

Nasir and Grashorn (2010) confirmed positive and significant effects of the addition of two aromatic plants in broiler nutrition on weight gain, average daily weight gain, feed conversion ratio and abdominal fat percentage. Significant influence was observed in regard to carcass yield, breast percentage, crude protein content, grill losses and cooking losses. In opposite to the investigation of Nasir and Grashorn (2010) and to this study, Amouzmehr et al. (2012) showed that supplementation of garlic extracts in amount of 3.0 and 6.0% did not affect carcass characteristics including carcass yield, breast, thigh and abdominal fat. The effect of feeding broiler chicks on diets containing different levels of black pepper as natural feed additive on carcass characteristics were studied by Tazi et al., (2014); the results indicated that treatment supplemented with 1.0% of black pepper had significantly ($p < 0.05$) higher values for body weight gain, feed intake, and dressing, best feed conversion ratio, and commercial cuts percentages such as breast, drumstick and thigh.

Unlike the mass of primal carcass cuts, the share of the main cuts such as breast and drumsticks with thighs, in ready-to-grill carcass weight (Table 4) showed no significant ($p > 0.05$) differences. In terms of the share of breasts, drumsticks with thighs and back, statistically significant differences were not observed ($p > 0.05$). The largest share of wings in ready-to-grill carcass was recorded in the treatment T1 (12.6%) which was statistically significantly different ($p < 0.05$) from those in the treatments T2 (11.8%), T3 (11.5%), T6 (11.4%) and T8 (11.7%), whereas treatments T4 (11.8%), T5 (12.1%) and T7 (12.1%) were not significantly different ($p > 0.05$). Shaverdi et al. (2013) stated that drumstick and breast percentages were increased significantly ($p < 0.05$) for broilers fed on black pepper at 0.02% level in the diet. Al-Kassie et al. (2011b) reported significant influence of hot red pepper to the dressing percentage which ranged from 72.0% in control group to 74.3% in group with addition 0.75% of pepper. Fayed et al. (2011) reported significant difference between the average dressing percentages, while this difference was not significant for giblet

weight of the broilers fed rations with or without supplementation of garlic.

CONCLUSIONS

Based on the obtained results, it can be concluded that the addition of garlic, black pepper and hot red pepper in broiler chicken nutrition had positive effect on the chicken carcass quality. It can also be concluded that significant increase in the carcass weight after slaughtering and cooling and ready-to-grill carcass with favourable dressing percentages was influenced by hot red pepper supplementation in broiler diet, indicating hot red pepper is effective in altering the chicken body conformation. Also, the addition of garlic and hot red pepper led to significantly increased share of economically important parts of chicken carcass. The highest dressing percentage (67.2%) was recorded in the treatment T5 and in the control treatment.

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УТИЦАЈ БИЉНИХ ДРОГА У ИСХРАНИ БРОЈЛЕРСКИХ ПИЛИЋА НА ПРОЦЕНЕ КВАЛИТЕТА ВРЕДНИЈИХ ДЕЛОВА ТРУПА

Никола М. Пувача^{1,6}, Љиљана М. Костадиновић², Оливера М. Ђурагић², Драгана Б. Љубојевић³, Бранислав М. Мишчевић⁴, Тибор Л. Кењвеш⁴, Сања Ј. Поповић², Јованка Д. Левић², Недељка Б. Николова⁵

¹Универзитет у Новом Саду, Пољопривредни факултет, 21000 Нови Сад, Трг Доситеја Обрадовића бр. 8, Србија

²Универзитет у Новом Саду, Научни институт за прехранбене технологије у Новом Саду, 21000 Нови Сад, Булевар цара Лазара бр. 1, Србија

³Научни институт за ветеринарску медицину "Нови Сад", 21000 Нови Сад, Руменачки пут бр. 20, Србија

⁴Мегатренд Универзитет, Факултет за Биофарминг, 24300 Бачка Топола, Маршала Тита бр. 39, Србија

⁵Универзитет "Св. Кирил и Методије", Институт за сточарство, 1000 Скопје, Ав. Илинден бр. 92/а, Република Македонија

⁶Patent Co., 24211 Мишићево, Владе Ћетковића бр. 1А, Србија

Сажетак: Циљ рада је био да се испитају и установе ефекти биљних дрога белог лука, црног бибера и љуте црвене паприке у исхрани бројлерских пилића на квалитет трупа. Укупно 1200 једнодневних пилића линијског хибрида Hubbard је насумично распоређено у осам третмана, са четири понављања. Пилићи су током експерименталног периода храњени starter, grower и finisher смешама: Т1 (Контрола), Т2 (Бели лук 0,5 g/100g), Т3 (Бели лук 1,0 g/100g), Т4 (Црни бибер 0,5 g/100g), Т5 (Црни бибер 1,0 g/100g), Т6 (Љута црвена паприка 0,5 g/100g), Т7 (Љута црвена паприка 1,0 g/100g) и Т8 (Мешавина биљних дрога у односу 1:1:1 у укупној количини 0,5 g/100g). Додатак биљних дрога у храну је значајно ($p < 0,05$) утицао на квалитет трупа пилића. Највећа остварена телесна маса пилића је забележена у третману Т6 (2460,6 g), а потом у третману Т7 (2442,4 g) са статистички значајним разликама ($p < 0,05$) у поређењу са осталим третманима. Највећи удео делова трупа од највеће економске важности као што су батак са карабатаком је забележен код пилића на третманима Т7 (530,7 g), Т6 (525,2 g), Т2 (520,2 g) и Т8 (497,1 g), са статистички значајним разликама ($p < 0,05$) у поређењу са третманима Т4, Т5 и Т1 (438,5 g, 448,7 g и 461,1 g). Међутим, када се погледа удео важнијих делова трупа у маси трупа спремним за роштиљ, статистички значајне разлике у уделу меса груди и батака са карабатацима нису забележени ($p > 0,05$), док су статистички значајне разлике забележене ($p < 0,05$) у погледу удела крилаца и леђа пилића. На крају се може закључити да је додатак белог лука, црног бибера и љуте црвене паприке у храну испољио позитиван утицај на квалитет трупа пилића.

Кључне речи: зачини, исхрана, пилићи, квалитет трупа

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