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Full Length Research Paper

The effect of extruded rapeseed grain on the production parameters, carcass and breast meat quality of broilers

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This paper investigates the effect of extruded rapeseed grain on production parameters, carcass and breast meat quality of broiler chicken. There were three levels mixture of extruded rapeseed grain and corn meal used included with 10, 15 and 20%. Rapeseed grain is extruded with corn meal in ratio of 50:50%. At the beginning of the fattening period, four groups with 75 day-old chicks of hybrid Ross 308 were formed in four replications. The experiment lasted for 42 days. At the end of the experimental period, eight chickens from each group were sacrificed for the purpose of testing the carcass quality and breast meat of broilers. Inclusion of various amounts of this mixture in the diet for broilers resulted in a statistically significant difference in body weight of chickens. At the end of the experiment, control group achieved body weight of 2115.80 g and the experimental groups in a row, 2018.17, 2036.49 and 2047.32 g respectively. Feed conversion was increased from 2.5 to 3.5% in groups with extruded rapeseed grain. Partial substitution of soybean meal with extruded rapeseed grains did not significantly affect the carcass quality of chickens, or the nutritional quality of breast meat.

Key words: Extruded rapeseed, feeding, chicken, carcass quality, meat quality.

INTRODUCTION

Consumption of poultry meat in the world market is increasing, so the need for intensified production is constantly present. As such, it is necessary to provide high-quality feed, in-line hybrids with high genetic potential and the appropriate zootechnical measures. When it comes to animal feed, protein feed in Serbia do not meet the needs of livestock, and as such, it is necessary to provide a large part through imports. In order to solve this problem, the production of rapeseed is activated again, owing to low cost and progress in the selection process.

Newer varieties are known as canola and contain 38 to 48% oil, 18 to 28% protein, less than 10 µmol glucosinolates/g and less than 0.1% erucic acid, which allows wider use of this feed in poultry nutrition. However, high levels of fiber and low energy value is still the limiting factor in increasing inclusion of rapeseed meal in the diet of non-ruminates (Saben et al., 1971; Kennelly et al., 1978; Bayley and Hill, 1975; Bell and Shires, 1982), while canola seed characteristics suggest that it might be a good feed meal, as the most harmful ingredients diluted due to the high oil content, which also increases the energy content (Marjanović-Jeromela et al., 2003; Stanaćev et al., 2011). In addition, it is essential that the seed-ground is adequate so it could be effectively digested. However, the limiting factor for its use is very small seeds and lack of appropriate milling technology that would violate the structure of tissues and opened the seed, so that the nutrients can get more access to enzymes (Slominski et al., 2003). In recent years, this is achieved by mixing rapeseed with corn meal before going

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Table 1. Experiment with chicks as planned.

Group	Control	Level of extruded canola seed mixture (%)		
Treatment	**I**	**II**	**III**	**IV**
In starter	-	10	15	20
In grover	-	10	15	20

through the hammer, and then, extruding the mixture of such further enhances the utilization of nutrients and inactivates the enzyme myrosinase (Sakač et al., 2004; Filipović et al., 2004; Puvača, 2011). The oil contains a significant amount of energy and present excellent source of polyunsaturated fatty acids, linoleic and linolenic (Leeson and Summers, 1997). It is also important to emphasize that the rapeseed is a tasteless feed, which should be gradually introduced into meals, as it would otherwise reduce the consumption of feed (Živković, 1978). The content of the meal for chickens significantly influences the quality and quantity of the produced meat, and numerous researchers stated that the feed dominantly, actually with over 30% influences the quality of carcass and meat (Rede and Petrović, 1997; Džinić, 2005).

The aim of research was to examine the production parameters, quality of carcass and nutritive quality of breast meat of chickens, fed with the mixture in which the part with soybean meal is exchanged with different quantities of extruded rapeseed grain with corn meal.

MATERIALS AND METHODS

Researches were conducted in the productive conditions on the experimental farm “Pustara” in Temerin with the floor breeding system. At the beginning of the fattening, four groups were formed with 75 day old chickens of hybrid Ross 308. The experiment was conducted with four repetitions on the total of 300 chickens per treatment. Two mixtures were used for feeding. For the first three weeks, starter and then, finisher mixture were used until the end of the experiment. In the last week, coccidiostatics was excluded from the finisher mixture. The control group was fed with the mixture based on the soybean meal, and in the experimental group, three levels of mixture with extruded rapeseed grain in the ratio of 10, 15 and 20% (Table 1). Mixtures were isoprotein and isoenergetic. Rapeseed was extruded with corn meal in ratio of 50: 50%. During the experimental period that lasted for 42 days, chickens were fed water *ad libitum*, and microclimatic conditions were regularly controlled. Control of body weight gain and feed consumption was conducted every seven days. At the end of the experimental period, chickens were sacrificed after 12 h of starving. Eight carcasses, ready for barbecue, from each group were cut into basic anatomic parts (Regulations: Sl. List SFRJ, br.1/81 and 51/88), breast meat, drumstick with the thigh, back, wings and abdominal fat tissue and were measured. After that, breast deboning was conducted on basic tissues for the purpose of determining breast meat gain and for determining nutritive quality of meat. Chemical researches were conducted by methods AOAC (1980). For the purpose of correct interpretation of results, the given data were statistically done by calculating the arithmetic average ($\bar{x}$), standard deviation (σ), and the significance between arithmetic averages with the Duncan’s test (Hadživuković, 1991).

RESULTS AND DISCUSSION

Based on the obtained results, it can be stated that the introduction of the mixture with extruded rapeseed grain in the feed of chickens significantly affected the intensity of growth (Table 2). In the first fattening period with younger chickens, growth depression was slightly more prominent in group II and III as compared to the control group, while in the group IV, the depression effect is slightly prominent (631.28; 585.90; 585.90; 611.53 g). At the end of the experiment, control group achieved body mass of 2115.80 g, and experimental groups 2018.17; 2036.49 and 2047.32 g respectively, presented in relative values are 4.61, 3.75 and 3.24% less than in the control group. With the analysis of variance and t – test, signifycant differences were established ($P<0.01$) between groups I and II; I and III and I and IV, while the differences between experimental groups II and III; II and IV and finally, groups III and IV are not statistically significant.

Different inclusion of extruded rapeseed grain almost did not have any influence on the efficacy of the used feed (Table 3). In the first period, the least feed consumption was in group IV, 1.56 kg/kg of gain and was followed by groups I, III and II. The most efficient feed conversion in the second period of fattening and for the whole experiment was in the control group (1.89 and 1.80 kg/kg of gain), and in the experimental groups, feed conversion was increased from 2.67 to 3.45%. By examining carcass quality of the control group and the experimental groups of chickens (Table 4) it is concluded that the biggest mass of the cold carcass “ready for barbecue” is with the control group (1467.4 g), and the smallest mass with the chickens of the group II (1392.4 g). However, determined numerical differences are not statistically significant ($P>0.05$). The biggest breast mass of 506.0 g is determined with the chickens in the group IV, and the smallest 477.0 g with the chickens of group I. Determined differences between breast mass of the control and experimental groups are not significant ($P>0.05$).

Amount of abdominal fat was relatively small and was between 12.2 to 14.4 g. With reference to the fact that the abdominal fat is a good indicator of the content of the total fat in the body, it can be stated that the chicken

Table 2. Body weight of chicks (g).

Group	I	II	III	IV
Extruded canola seed mixture (%)	**0**	**10**	**15**	**20**
0	41.02	41.07	40.75	40.85
1	129.58	120.96	128.34	121.32
2	352.01	333.67	349.82	332.49
3	631.28^{Aa}	585.90^{B}	585.90^{B}	611.53^{b}
Index (%)	100.00	92.81	92.80	96.87
4	1024.90	998.29	1041.30	1009.46
5	1492.39	1435.94	1459.93	1463.35
6	2115.80^{A}	2018.17^{B}	2036.49^{B}	2047.32^{B}
Index (%)	100.00	95.39	96.25	96.76

A-B, $P < 0.01$; Aa-B and Aa-b, $P < 0.05$.

Table 3. Feed conversion (kg/kg).

Group	I	II	III	IV
Extruded canola seed mixture (%)	**0**	**10**	**15**	**20**
I Period	1.57	1.63	1.59	1.56
Index (%)	100.00	103.57	101.27	99.55
II Period	1.89	1.95	1.96	1.97
Index (%)	100.00	103.22	103.38	103.96
Average	1.80	1.86	1.85	1.85
Index (%)	100.00	103.45	102.84	102.67

Table 4. The mass of carcass and valuable carcass parts (g).

Group	Cold carcass mass (g)	Breast mass (g)	Mass of drumstick with thigh (g)	Mass of back with the pelvis (g)	Mass of wings (g)	Mass of abdominal fat (g)
	X ± SD	**X ± SD**	**X ± SD**	**X ± SD**	**X ± SD**	**X ± SD**
I	1467.4 ±125.40	477.0 ± 33.50	448.2 ± 47.76	342.8 ± 35.17	185.0 ± 20.04	14.4 ± 5.59
II	1392.4 ±90.45	484.8 ± 56.03	421.4 ± 38.14	306.8 ±15.17	167.2 ± 11.23	12.2 ± 3.11
III	1444.6 ±185.88	493.8 ± 60.56	450.0 ± 62.34	308.2 ± 44.10	179.2 ± 22.83	13.4 ± 4.56
IV	1454.4 ±151.38	506.0 ± 81.92	444.2 ± 43.10	314.8 ±18.85	175.4 ± 11.28	14.0 ± 5.70
P-value	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

carcasses were not fat. Examining the gain of breast muscles, as it is stated in Table 5, numerical differences were also defined, but they were not statistically significant ($P>0.05$). Chicken breast of group IV had the biggest amount of meat in mass of breast determined with chickens of the control group and it was 74.23%. The biggest amount of breast meat (25.48%) in the cold carcass of chickens is with group II of chickens and with the rest of the groups is between 24.05 to 25.41%. Determined differences were not statistically significant ($P>0.05$).

Examining the basic chemical composition of breast meat (Table 6), it is determined that water content in breast meat is the lowest in group IV (74.97%) and the highest (75.34%) in the experimental group II. From the date in Table 6, it can be noticed that the lowest content of protein is 23.08% and it is established in group II, and the highest level of protein is in breast meat of group IV and is 23.64%. Furthermore, in Table 6, it can be seen that the content of free fat in breast meat is very low and in an interval from 0.22% (IV) to 0.38% (III), and standard deviation in an interval from 0.01 do 0.07%. It is also noticeable that the average value of the total ash of breast meat is in the range from 1.12% (I) to 1.23% (II). Determined differences for all examined parameters of breast meat quality are not statistically significant ($P>0.05$).

Table 5. Breast muscle mass and their share in the mass of the breast and chilled carcass weight.

Group	Breast muscle mass (g)	Proportion of breast muscle mass in breast mass (%)	Proportion of muscle mass in the breast of chilled carcass weight (%)
	X ± SD	X ± SD	X ± SD
I	354.1 ± 17.27	74.23 ± 3.16	24.05 ±1.85
II	356.1 ± 47.84	73.45 ± 3.44	25.48 ±3.00
III	359.6 ± 56.11	72.82 ± 2.88	24.87 ±1.22
IV	370.7 ± 48.09	73.26 ± 3.56	25.41 ±1.47
P-value	>0.05	>0.05	>0.05

Table 6. Basic chemical composition of chicken breast meat.

Group	Water (%)	Proteins (%)	Free fat (%)	Total ash (%)
	X ± SD	X ± SD	X ± SD	X ± SD
I	75.09 ± 0.09	23.47 ± 0.16	0.32 ± 0.01	1.12 ± 0.02
II	75.34 ± 1.93	23.08 ± 0.10	0.35 ± 0.07	1.23 ± 0.10
III	75.18 ± 0.60	23.28 ± 0.24	0.38 ± 0.03	1.16 ± 0.01
IV	74.97 ± 0.16	23.64 ± 0.04	0.22 ± 0.04	1.17 ± 0.01
P-value	>0.05	>0.05	>0.05	>0.05

Concerning the basic chemical composition, chicken meat is significantly different from the other kinds of meat. It contains slightly more protein and less smaller fat that decreases significantly energetic value and better digestibility.

Results of the basic chemical content of breast meat are in accordance with results stated by (Dakić, 1968; Pavlovski and Palmin, 1973; Perić et al., 1984; Džinić et al., 1996; Ristić, 1997; Kovačević, 2001) of which chicken meat contains CCA 23% protein, CCA 1% fat and 1.5% total ash.

Conclusion

Based on the obtained results, it can be concluded that the usage of the extruded rapeseed grain significantly influenced the change of body weight in the first and second period of fattening as compared to the control group. At the end of the experiment, the control group gained mass of 2115.80 g, and experimental groups 2018.17; 2036.49 and 2047.32 g respectively. Their differences as compared to the control group are statistically highly significant (P<0.01). Feed conversion was increased from 2.5 to 3.5% in groups with rapeseed. Partial substitution of soybean meal with extruded rapeseed grain affected the quality of the chicken carcass, but those differences were not statistically significant (P>0.05). Changes in the chicken feed did not show influence (P>0.05) on the nutritive quality of chicken breast meat. In all groups, chicken breast meat has high nutritive values.

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