

EFFECT OF PARTIAL SUBSTITUTION OF STANDARD MEAL IN CHICKEN FEED BY RAPE SEED ON CARCASS AND MEAT QUALITY**

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Abstract: Effect of partial substitution of crushed soybean by different portions of rape seed on yield and chicken breast quality (nutritive and technological) was investigated in the paper. ROSS 308 hybrids were used for investigations. Control group (K) was fed with standard mixture and experimental groups with mixture in which crushed soybean partially substituted by 10% (O1), 15% (O2) and 20% (O3) extruded rape seed (EZUR). Rape seed was extruded with corn germ in ratio 50:50.

It was concluded that there are no significant differences in breast meat yield between control and experimental groups ($P > 0.05$). The changes in chicken meal had no influence ($P > 0.05$) on nutritive quality of breast meat (the contents on protein, connective tissue protein, free fat and total ash). Additionally was found that the technological quality of breast meat of the control and experimental groups averagely corresponds to „normal“ meat quality considering the parameters and criteria for quality determination (pH_u , L^* , water holding capacity_u).

Key words: chicken meat, feed, rape seed, carcass and meat quality

Introduction

As known, carcass and chicken meat quality depend on numerous exogenous (external) and endogenous (genetic) factors. Feed as an exogenous factor is considered to have dominant influence, over 30%, on carcass and meat quality (Rede and Petrović 1997; Čepin and Čepona, 2001; Džinić 2005).

Standard chicken meals are based on corn, crushed soybean and fish

meal. Domestic production of the basic ingredients of protein feed (soybean and fishmeal) is insufficient, thus they mostly are provided by import. Due to low prices and the progress in selection, rape has become more important in our region, and because of the increased production the solution to the deficient chicken feed.

Recent rape sorts with the reduced contents on glycosinolates and eruka acid enable its broad application in chicken feed (*Clandinin and Roblee, 1981; Stanačev et al., 2006*).

Considering the above mentioned, the aim of this work was to investigate the carcass quality (meat yield) and breast meat quality (nutritive and technological) of chickens fed with mixture in which crushed soybean partially substituted by different portions of rape seed.

Material and Methods

Ross 308 hybrids were used for the investigations conducted under production conditions at the experimental farm „Pustara“ in Temerin and in the Laboratory at the Faculty of technology in Novi Sad. Feed and water supply were *ad libitum* applying floor stocking system. During fattening chickens were fed with standard mixture (K) as control and with experimental mixtures where crushed soybean was substituted by 10% (O1), 15% (2) and 20% (O3), respectively, extruded rape side (EZUR). Rape seed was extruded with corn germ in ratio 50:50.

After 42 days of fattening, broilers were hungered for 12 hours, slaughtered and processed by bloodletting, scalding, plucking and evisceration and chilled. Cutting, boneing and determination of the breast meat yield were followed by taking samples from (n=8) from the control (K) and experimental groups (O1, O2 and O3) for estimation of nutritive and technological quality of meat. Basic chemical composition of meat was established by determination of water content (*JUS ISO 1442, 1997*), proteins (*JUS ISO 937, 1991*), free fats (*JUS ISO 1443, 1997*) and total ash (*JUS ISO 936, 1998*), and the content on hydroxiprolin - connective tissue was estimated by referential method (*JUS ISO 3496, 2002*). Technological quality was evaluated by determinations of pH_u , water holding capacity (WHC_u) and colour. Meat pH value was determined 24 hours *post mortem* (pm) using portable pH-meter ULTRA X. WHC_u was determined by compression method and expressed in % of held water (*Grau und Hamm, 1953*). Breast meat colour was determined on the fresh cross section 24 hour pm using Minolta Chroma Meter CR-400, and colour characteristics were

presented in u *CIEL* **a***b** system (lightness *L**, redness and greenness - *a**, yellowness and blueness - *b**, *Robertson*, 1977). In order to interpret the results properly, the obtained data were statistically processed by calculating arithmetic mean values (t-test) (*Haživuković*, 1991).

Results and Discussion

Carcass quality of the control and experimental groups (*Table 1*) was investigated. The highest mass of chilled carcass “ready to grill” was 1472.6 g, but not significantly higher than in control broiler group ($P > 0.05$). The highest breast mass of 506.0g and meat yield of 370.6 g were determined for chicken carcasses O3 (20% extruded seed), and the lowest for control chicken group K. The determined differences between values for breast mass and meat yield of control and experimental groups were statistically not significant ($P > 0.05$).

Table 1. Mass of chilled carcass „ready to grill“, breast and breast muscles yields in chickens (n=8) of control (K) and experimental groups (O1, O2 and O3)

Group	Chilled carcass mass		Breast mass and share		Breast muscle mass and share	
	g	%	g	%	g	%
K	1472.6±125.4	100	477.5±33.5	32.39	354.0±17.3	77.23
O1	1397.4±90.4	100	484.8±56.0	34.69	356.1±47.8	74.92
O2	1446.2±185.9	100	483.8±60.6	34.14	359.6±56.1	74.56
O3	1458.6±151.4	100	506.0±81.9	34.69	370.6±48.1	74.59
P	> 0.05		> 0.05		> 0.05	

Investigations of chemical composition of breast meat (*Table 2*) showed the water content to range from 74.07 % in O3 (20% ERS) to 75.34 % in O1 (ERS). From the results in the same Table it can be seen that the protein content was the lowest in O1, i.e. 23.08 % and the highest in group O3 – 23.64 %. The same Table presents the content on free fats to range between 0.22 (O3) and 0.38 (O2), with standard deviation from 0.01 to 0.07 %. The mean value for total ash of breast meat ranged from 1.12 (K) to 1.36 % (O2). Further the protein content in connective tissue both in control and experimental groups was uniform, from 0.28 to 0.30 %. The determined differences in contents on water, protein, free fat and total ash of chicken breast meat between control and experimental groups were not statistically significant ($P > 0.05$). It was also confirmed that chicken meat contains

some more proteins (23 %) the other kinds of meat, less fat (1-5 %), so it could be considered to be dietetic food (Dakić, 1968; Pavlovski and Palmin, 1973; Perić *et al.*, 1984; Džinić, 1991 and Kovačević, 2001). In relation to other meat kinds (cattle and pig) chicken meat contains the least protein of connective tissue and the quantity affects the texture, that is the meat tenderness (Rede and Petrović, 1997).

Table 2. Basic chemical composition and content on connective tissue protein in chicken breast (n=9) of control (K) and experimental groups (O1, O2 and O3)

Group	Water	Proteins	Free fat	Total ash	Protein content of connective tissue
	(%)	(%)	(%)	(%)	(%)
K	75.09 ± 0.09	23.47 ± 0.21	0.32 ± 0.01	1.12 ± 0.02	0.28 ± 0.04
O1	75.34 ± 1.93	23.08 ± 0.10	0.35 ± 0.07	1.23 ± 0.10	0.31 ± 0.05
O2	75.18 ± 0.60	23.28 ± 0.24	0.38 ± 0.03	1.16 ± 0.01	0.29 ± 0.02
O3	74.97 ± 0.16	23.64 ± 0.04	0.22 ± 0.04	1.17 ± 0.01	0.30 ± 0.04
P	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05

Investigations of technological characteristics of breast meat (Table 3) showed the chicken breast muscles of experimental group O3 (20 % ERS) to have the highest average pH_u value of 5.74, while breast muscles of the control group K showed the lowest pH_u value of 5.69. The differences between average pH_u values for breast muscles of the control (K) and experimental groups (O1, O2 and O3) are not statistically significant ($P > 0.05$), and the average pH_u values of muscles characterize the meat to have quality between normal and somewhat lower, based on pH_u parameters and criteria for meat quality determination. Namely, Ristić (1981) differentiates three quality levels of breast musculature, based on the pH_k values: $pH_u = 5.6 - 5.7$, PSE - pale, soft, exudative, $pH_u = 6.4 - 6.7$, DFD - dark, firm, dry, and $pH_u = 5.9 - 6.2$, RFN - reddish-pink, firm, non exudative. The presented results from the same Table refer to breast muscles of group K to have averagely the highest lightness (L^*) of 52.28, while averagely the darkest breast muscles, but statistically not significant ($P > 0.05$), were in the group O3 (20 % ERS), with the lightness (L^*) of 49.05. Further, the average redness (a^*) in chicken breast meat ranged from 2.95 in group K to 3.90 in group O3. From the same Table it can be seen that the highest average yellowness (b^*) of 3.46 was determined in breast muscles of the group K, while the lowest average yellowness (b^*) of 12.98 was in group O2. On the

basis of the parameters for lightness L^* and the criteria for this characteristic submitted by *Qiao et al. (2001)*, defining the meat with $L^* > 53$ to be lighter than „normal“, „normal“: $48 < L^* < 52$ and darker than normal: $L^* < 46$, the investigated muscles, regarding the colour, can be considered to have „normal“ characteristics. The results from the same Table also indicate the average WHC_u value of breast muscles to be the highest in the group O1 with 82.92 % and the lowest in the group O2 - 87.37 %. The determined differences between the average WHC_u values were not statistically significant ($P > 0.05$).

Table 3. Technological characteristics (pH_u , WHC_u and colour) of chicken breast meat (n=8) of the control (K) and experimental groups (O1, O2 and O3)

Group	pH_k	L^*	a^*	b^*	WHC_k (%)
K	5.69 ± 0.12	52.28 ± 2.75	2.95 ± 0.40	3.46 ± 0.63	85.22 ± 5.86
O1	5.70 ± 0.07	51.05 ± 2.28	2.85 ± 0.49	2.58 ± 0.70	82.92 ± 5.45
O2	5.73 ± 0.07	50.66 ± 2.60	2.67 ± 0.45	1.98 ± 0.87	87.37 ± 3.59
O3	5.74 ± 0.06	49.05 ± 1.69	3.90 ± 1.17	2.23 ± 0.53	87.24 ± 3.59
P	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05

Conclusion

On the basis of the results it can be concluded that there were no significant differences ($P > 0.05$) in breast meat yield between the control and experimental groups. The modification of chicken meal did not affect ($P > 0.05$) the nutritive quality of breast meat (content on proteins, connective tissue proteins, free fats and total ash). Additionally, it was found that the technological quality of breast meat of the control and experimental groups, according to parameters and criteria for quality estimation (pH_u , L^* , water-holding capacity_u), averagely corresponds to „normal“ meat quality.

UTICAJ SUPSTITUCIJE DELA STANDARDNOG OBROKA U ISHRANI PILIĆA SA ZRNOM ULJANE REPICE NA KVALITET TRUPA I MESA

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Rezime

U radu je ispitan prinos i kvalitet (nutritivni i tehnološki) mesa grudi pilića hranjenih smešom u kojoj je supstituisan deo sojine sačme sa različitim količinama zrna uljane repice. Ispitivanja su obavljena na pilićima hibridne linije ROSS 308. Kontrolna grupa (K) pilića je hranjena sa standardnom smešom, a ogledne grupe sa smešom u kojoj je sojina sačma supstituisana sa supstituisana sa 10% (O1), 15% (O2) i 20% (O3) ekstrudirano zrna uljane repice (EZUR). Zrno uljane repice je ekstrudirano sa kukuruznom prekrupom u odnosu 50:50.

Zaključeno je da nisu utvrđene značajne ($P > 0.05$) razlike u prinosu mesa grudi kontrolne i oglednih grupa. Izmene u obroku za piliće nisu ispoljile uticaj ($P > 0.05$) na nutritivni kvalitet mesa grudi (sadržaj proteina, proteina vezivnog tkiva, slobodne masti i ukupnog pepela). Takođe je utvrđeno da tehnološki kvalitet mesa grudi, prema parametrima i kriterijumima za utvrđivanje kvaliteta (pH_k , L^* , sposobnost vezivanja vode_k) kontrolne i oglednih grupa prosečno odgovara „normalnom“ kvalitetu mesa.

Ključne reči: pileće meso, ishrana, zrno uljane repice, kvalitet trupa i mesa

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