Slovak J. Anim. Sci., 42, 2009 (2): 75–78

ISSN 1337-9984

INFLUENCE OF LOW LEVELS OF PROTEIN AND SEX ON CARCASS TRAITS AND NUTRIENT CONTENT IN BROILER MEATS

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ABSTRACT

The aim of this experiment was to study how a reduced content of protein and sex during raising influences breast and leg fattiness and, in consequence, the chemical composition in 6-week-old broilers. A total of 1214 one-day-old of ROSS 308 broilers were divided into three experimental groups. The group 1 (control) received feeds with a nutritional value recommended by feeding standards for growing broilers, while the group 2 (T1) and 3 (T2) received rations with reduced levels of protein in all feeds for the raising period. The breast and leg percentages were determined. Chemical analyses (dry matter, protein, fat and ash content) were carried out. The results of the study allowed us to conclude that sex significantly ($P<0.05$) affected the percentage of the legs; while a lower level of protein content in the diet reduced the breast percentage non-significantly. Most remaining meat quality traits tested were similar to those obtained in the control group, and differences between groups were non-significant ($P>0.01$).

Key words: protein level; broiler; sex; meat

INTRODUCTION

There has been a notable increase in growth rate and feed efficiency in commercial broiler chickens in the last 20 years. Protein has major effect on the growth performance of the bird and it is the most expensive nutrient in broiler diets (Kamran et al., 2004). It accounts for 15% of feed cost (Singh, 1990). Application of reduced protein level-feeds for poultry may present an alternative to reduce feeding costs (Gardzielewska et al., 2005). One of the most important decisions for broiler nutritionist is the level of protein in diet. Because of the expense of providing sufficient protein to growing broilers, numerous studies have been carried out to investigate the possibility of reducing dietary crude protein (CP) levels. Manipulation of the dietary protein can have various effects on broiler performance (Fraps, 1943). Findings on different levels of (CP) effect in iso-energetic diets on broiler metabolism and body composition are differing and more research is necessary in order to understand broilers' response to different levels of protein.

Besides nutritional management (amount), ration composition (quality) is another important factor affecting carcass composition. Among the different nutritional components, proteins (amino acids) are fundamentals, as they are related to the synthesis of structural tissues (Furlan et al., 2004). Tabeidian et al. (2005) compared CP levels, at NRC (1994) recommendation (21.16%) and even 10 percent more than NRC recommendation (NRC × 1.10), and concluded that an increase of diet protein up to 10% higher than the NRC recommendation would not effect carcass weight.

Buyse et al. (1992) found that broilers reared on a 15% protein diet increased their feed intake in an attempt to meet their protein and amino acid requirement. Nawaz et al. (2006) investigated three levels of CP - 20, 21and

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Received: January 27, 2009
Accepted after corrections: February 17, 2009

22% offered to birds from hatching to 28 d of age, and finisher diets with levels of CP 16, 17 and 18%, and 18, 19 and 20%, respectively were offered during 29-42 d of age, and no significant differences of dietary treatments were observed on any of the carcass traits.

Excesses of some EAA increased the requirements for others (D'Mello and Lewis, 1970a, b, c). Guirguis (1978), however, found that the best proportion of EAA to non-EAA for growth depends on the sex of the birds. Rezaei et al. (2004) found that thighs, drumsticks and breast meat percentages were not affected when dilute diets were consumed during an age of 8-14 d. Lee and Leeson (2001) reported that male broilers fed with diets diluted up to 50 % with oat hulls from 7 to 14 d avoided a depression of breast meat yield. When fed low protein level (18%) from 0-8 weeks, Oyedeji et al (2005) observed better breast meat yield results compared to groups which were offered diets with higher level of protein. In contrast, Khajali and Moghaddam (2006) found significantly ($P<0.05$) improved breast meat yield after increasing dietary methionine level.

Furlan et al. (2004) concluded that carcass protein was affected by the level of protein in the diet. Hassanabadi and Nassiri (2006) observed that the broiler chickens after early feed restriction compensated retarded growth and showed less abdominal and carcass fat content. Male broiler chickens' productive traits were better than those of females. Fraps (1943) pointed out that differences occurred in the carcass composition of birds fed with different levels of the dietary protein. The results of Gardzielewska et al (2005) concluded that lower level of protein content in the feed reduced carcass fattiness in broiler quails. While Rezaei et al. (2004) observed that decreasing dietary protein had no significant effect on breast meat yield; it was found that reduced protein level in the feeding ration does not influence the chemical composition of meat chickens (Jamroz et al., 1981: Jamroz et al., 1984: Daszkiewicz et al., 1998). Dry matter in the breast of male and female broiler quails decreased with the decrease of protein in the diet. CP and CF values were similar to control in the study conducted by Gardzielewska et al (2005). The aim of our study was to determine the influence of different levels of CP on broiler performance, and to investigate the response of bird's sex to the effect of CP level from the viewpoint of protein reservation sources used in broiler nutrition.

MATERIAL AND METHODS

The experiment was conducted on 1214 chickens of commercial broilers (ROSS 308). They were randomly assigned to three groups. The trial was carried out in the experimental base UKSUP at the biological-testing station in Viglash. Each group composed of 4 replications with a total of 100 chickens. The experiment contains one control group and two trial groups. Chickens were stocked on the litter. Microclimatic conditions and light modes were regulated automatically for optimal conditions for these hybrids.

Chickens were fed with feed mixtures pre-starter, starter, grower and finisher. The scheme of the trial and documentation of the differences of crude protein and additives are detailed in table1. The nutrient content of the four stages of the growth are illustrated in table 2.

Table 1: Scheme of the experiment

Group		Control	T1	T2
Crude protein $g.kg^{-1}$	Pre-starter	233	218	206
	Starter	228	209	198
	Grower	207	193	187
	Finisher	191	188	178
Additive	$g.kg^{-1}$	-	2	2

At the age of 42 days, 8 male and female birds of the body weight similar to the sex's average from each group were slaughtered. In the trial the following parameters were observed: breast percentage, leg percentage, and chemical analysis of some nutrients were conducted. Percentages were calculated for dry matter, crude protein, fat and ash of the breast and leg meats. For calculation of percentages of breast and leg, the following formula was used:

Breast or thigh and leg percentage = (breast or leg weight x 100) / Live Body weight.

Crude protein was chemically analyzed by the Kjeldahl method. For fat, the Soxhlet method was used. For calculating the percentages of dry matter (DM), crude protein (CP), crude fat (CF) and ash the following formula was used:

DM, CP, CF or Ash percentage = (DM, CP, CF or Ash weight of the sample x 100) / Sample weight.

The data were analyzed using CRD design for breast and leg percentages. Significances between control and treatment means were separated using the Duncan's (1955) multiple rang test. For nutrient percentages a T-test was used.

RESULTS AND DISCUSSION

The effects of treatments and sex on breast percentages (table 3) were non-significant ($P<0.05$). These results agree with Rezaei et al. (2004) and Garcia et al. (2002) for the treatment and sex effect respectively.

Table 2: Calculated nutrient composition of experimental diet

Nutrient		Pre-starter			Starter			Grower			Finisher		
		K	T1	T2	K	T1	T2	K	T1	T2	K	T1	T1
Additive	%	-	0,20	0,20	-	0,20	0,20	-	0,20	0,20	-	0,20	0,20
ME	MJ/kg	12,4	12,4	12,4	12,6	12,6	12,6	12,9	12,9	12,8	13,2	13,2	13,2
Crude protein	g/kg	230	210	200	225	205	195	200	185	180	190	185	172
L – Lysin	g/kg	14,40	12,80	12,15	13,50	12,60	11,80	11,70	11,40	11,20	10,50	11,00	10,50
D,L – Methionine	g/kg	5,10	6,20	5,86	4,90	6,10	5,67	4,50	5,40	4,80	3,90	5,30	5,10
L – Therionine	g/kg	9,30	8,40	8,10	8,60	8,75	8,20	7,60	7,90	7,80	7,00	7,90	7,60
Limestone	g/kg	10,00	6,10	6,10	10,00	6,10	6,10	9,00	6,10	6,28	8,40	6,20	6,20
Available phosphorus	g/kg	5,00	2,45	2,50	5,00	2,50	2,50	4,50	2,50	2,50	4,30	2,50	2,50
NaCl	g/kg	1,60	1,50	1,50	1,60	1,50	1,47	1,60	1,50	1,55	1,60	1,50	1,55
Linolic acid	g/kg	17	17	17	17	17	17	14	17	14	14	17	14

This could be attributed to the fact that broilers reared on a low protein diet increased their feed intake in an attempt to meet their protein and amino acid requirements (Buyse et al., 1992). Also, this is supported by the higher level of Methionine in T1 and T2 groups as the breast meat yield was improved (P< 0.05) by increasing Methionine level in the diet (Khajali and Moghaddam, 2006). The interaction between sex and treatments was significant.

The differences between treatments on leg percentages (table 4) were significant (P<0.05). A higher value was observed in T2, the difference with the control was non-significant. This means that decreasing the protein level influenced the utilization of protein in the diet. Feeding regimen increases enzyme secretion such as sucrase, amylase and lipase and also alters the functional development of the enzymes of protein digestion such as amino peptidase and dipeptidase and may therefore influence the growth rate of broilers. The protein efficiency ratio was improved (P<0.001) in chicks fed with a 190 g CP/kg diet versus chicks fed with 225 g CP/kg diet in the study conducted by Kidd et al. (2001). A significant (P<0.05) difference of leg percentage was observed between both sexes. The leg percentage of male birds was higher than the female birds. Differences between treatments were non-significant (P<0.01) for dry matter, crude protein, fat and ash content of breast and leg meat.

Table 3: The effect of protein levels and the sex on the breast percentage (%) in broilers

Treatment / Sex	Control	T1	T2	Mean
Female	24.27± 0.33	24.65± 0.80	24.34± 0.45	24.42± 0.29
Male	25.07± 0.41	23.25± 0.42	23.15± 0.50	23.82± 0.30
Mean	24.67± 0.28	23.95± 0.45	23.74± 0.34	

Table 4: The effect of protein levels and the sex on leg percentage (%) in broilers

Treatment / Sex	Control	T1	T2	Mean
Female	19.46± 0.39	19.09± 0.13	19.71± 0.80	19.41± 0.14^{a}
Male	19.76±0.15	19.34± 0.08	19.82± 0.26	19.67± 0.10^{b}
Mean	19.61± 0.20^{b}	19.26± 0.12^{a}	19.76± 0.13^{b}	

Mean values with different superscripts within a column and rows differ significantly (P<0.01)

Table 5: The effect of protein levels on nutrient composition (Dry Matter, Crude Protein, Fat and Ash) of the breast meat in broilers

	Dry matter	Crude Protein	Crude Fat	Ash
Control	25.26±0.10	23.46±0.20	0.61±0.13	1.19±0.003
T1	25.13±0.13	23.27±0.15	0.61±0.09	1.17±0.020
T2	25.37±0.19	23.48±0.19	0.60±0.08	1.20±0.009

Table 6: The effect of protein levels on nutrient composition (Dry Matter, Crude Protein, Fat and Ash) of the leg meat in broilers

	Dry matter	Crude Protein	Crude Fat	Ash
Control	25.96±0.37	19.86±0.14	4.44±0.30	1.05±0.01
T1	25.37±0.26	19.84±0.19	5.24±0.30	1.10±0.03
T2	25.81±0.62	19.96±0.12	5.48±0.72	1.05±0.01

CONCLUSION

Results of this study showed the possibility of using lower levels of protein in the broiler diet with additional growth promoters (additives), which allow saving extra costs for protein sources and at the same time providing ecological benefits. There were no significant differences between groups in breast, legs and some nutrient composition of breast and leg muscle.

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