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Carcass Protein Content and Growth Performance of Hubbard Broiler Influenced by Feeding Protein Levels During Summer Season

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Abstract: The impact of crude protein (CP) levels on carcass protein content and growth of broiler were examined. Day old (200) chicks with average live body weight 41.60 g were equally divided into four groups A, B, C and D, fed 17 (control), 20, 23 and 26% CP, respectively. Feed intake, live body weight, feed conversion ratio (FCR), carcass weight and carcass protein contents were investigated. Average daily weight gain was 33.4, 39.0, 43.9 and 44.4g/bird against the feed consumption of 76.1, 86.0, 93.4 and 89.1 g/bird, with FCR of 2.28, 2.20, 2.12 and 2.00 in group A, B, C and D, respectively. Carcass weight 778.0, 996.3, 1180 and 1190 g/bird, carcass protein content was 37, 41, 46 and 49%, in group A, B, C and D, respectively. Greater ($p<0.01$) carcass weight of 1180 and 1190 g/bird and carcass protein content 46, 49% was obtained from ration contained 23 or 26% CP, respectively compared to control. The total price per bird earned was Rs. 57.76, 67.24 75.24 and 76.32 against total cost of 54.16, 59.77, 67.24 and 69.59/bird, respectively. The broiler growth and carcass protein content improved significantly ($p<0.01$) by increasing level of CP. It is concluded that group A (17% CP) or group D (26% CP) were less economical against 23 and 20% CP levels where fairly higher income was earned. However, from nutritional point of view 26% CP contained ration produced high protein carcass.

Key words: Hubbard broiler, carcass protein content, growth performance

INTRODUCTION

Poultry is one of the well structured sectors of agriculture industry in Pakistan, which generates employment and income for about 1.5 million people. Poultry supply 26.8 percent of the total meat production in Pakistan (GOP, 2013). With the increasing human population of world the consumption of meat is increasing and animal production has many more challenges (Ishibashi and Yonemochi, 2002). Meat is the richest sources of protein and considered to be balanced in all essential amino acid profile.

Proteins are vital to any living organism and are the important constituent of tissue and cells of body. In Pakistan, human diet is 66% deficient in animal proteins (Maqbool, 2002). Nutritionally, foods rich in protein, are called bodybuilding foods. Milk, meat, fish eggs, pulses, oilseeds and nuts are included in this group. There are two types of protein required for poultry production i.e. animal protein and vegetable protein. No doubt the superiority of animal protein over vegetable protein is established due to its better amino acid profile (Philip, 1976).

In many nutritional studies on the effect of diet on the performance, growth rate and feed efficiency are the criteria used. But changes in body composition are of great importance, since it has been shown that changes can occur while growth remains unaltered. The measurement of weight and size of body in nutritional studies don't reflect the true picture of body composition e.g. infantile growth consists of more water, protein and bone minerals and less fat. Weight gains don't provide a good basis for evaluating nutritional adequacy whereas body composition would yield information on the nature of such gains, muscle bone or fats (Reddy, 2001).

Protein, having a major effect on growth performance, is the most expensive component in broiler diets (Dirain and Waldroup, 2002). High dietary crude protein (CP) is generally detrimental for broilers raised under high ambient temperatures due to higher heat increment associated with protein metabolism (Mushraf and Latshaw, 1999; Dirain and Waldroup, 2002). Feeding high CP diets to heat-stressed broilers have shown adverse effects on weight gain, carcass composition,

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feed efficiency and protein and energy utilization (Cheng *et al*., 1997). Where as, small scale poultry farmer in Pakistan usually fed the poultry with locally manufactured mash type feed rather than commercially produced crumble or pelleted for economics reasons and satisfactory quality feed, but how locally manufactured mash feed with different protein level affect the bird's growth and carcass composition in present circumstances of feeding systems has not been well studied in Pakistan.

Therefore quantification of dietary protein for broiler ration under farmer condition is a challenging decision. Moreover, nutritionists face a twin task i.e., to develop a feed economical to a maximum possible level and second one, that provided feed, should keep maximum profitability, because performance of the bird depends upon a broad range of dietary protein. Thus, the objective of this study was to determine the impact of locally produced feed mixture with various protein levels on carcass protein content and growth performance of Hubbard broiler kept during summer season.

MATERIALS AND METHODS

Experimental design: The experimental chicks were divided into randomly designed four groups (A, B, C and D) having 50 chicks in each group. All the groups were provided with ration having different levels of dietary protein. Group A was kept as control group and given constant level of protein (17%). Group B, C and D were given 20, 23 and 26% CP, respectively. The experiment was conducted at the Department of Animal Nutrition, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam during summer season of August and September 2002.

Management: For this study 200 day-old chicks (Hubbard breed) with an average live body weight of 41.60 were purchased from the local chick distributor at Hyderabad Sindh. The shed was cleaned properly, washed with water preferably adding detergent and antiseptic solution. The house was left over for 3 days and limestone was spread over. Saw dust as litter material was spread over whole house to keep birds comfortable. Commercial chick paper (Horka-2000) was placed on the top of litter. Formaldehyde and Potassium permanganate at the ratio of 2:1 was used for fumigation of the shed. All the chicks were weighed for initial live body weight, before arrival at farm. Space availability to each chick was kept equal as 1 sqft/bird. During first week day-old chicks were brooded under electric brooding system. Temperature was maintained from 90 to 95°F after that it was gradually lowered at the rate of 5°F each week, till 75°F. The light was provided 24 h in the shed. The chicks were vaccinated against Newcastle, Hydropericardium and Gumbhoro diseases.

Experimental ration: Four rations with different levels of crude protein levels of 17, 20, 23 and 26%, with iso caloric level were formulated for whole experimental period. Feed ingredients were purchased from the Hyderabad market and mash feed was prepared at TandoJam (Table 1).

Feeding intake: The chicks were fed mash type ration *ad libitum* throughout the experimental period ranging from 0-6 weeks. In the first two weeks feed was given twice a day i.e., early morning at 7:00 a.m. and in the evening at 6:00 p.m. From 3rd week to 6th week of experiment, feed was given 3 times in 24 h i.e., 7:00 a.m. in the morning and 4.30 p.m. in the evening and 11:00 p.m. in the night. Clean water was provided 24 h for drinking. Feed intake and refusal was recorded and calculate for daily and weekly feed consumption of broiler.

Chemical analysis: Before the formulation of experimental ration, ingredients used in the preparation of feed and prepared mash feed were chemically analyzed (Table 2). The analysis of feed was carried out according to the standard analytical methods described by the Association of Official Analytical Chemists (AOAC, 1990), at the post-graduate laboratory, Department of Animal Nutrition, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam. The carcass protein content was analyzed according to the method of AOAC (1990).

Table 1: Formulation of experimental rations

Ingredients	A (%)	B (%)	C (%)	D (%)
Rice	55	50	50	50
Rice polish	6	6	2.5	-
Wheat bran	5	2.5	-	-
Fish meal 50%	6	7	10	14.5
Apc 50%	3	4.55	5	5.5
Blood meal 70%	1	1	2	3.5
Soyabean meal	3	4.5	5.5	9.5
Guar meal	2.5	4.5	5.5	5.5
Canola meal	4.39	5.5	6.5	6
Cotton seed meal	2.5	3.5	4	3.5
Corn gluten feed 30%	5	5.5	5	-
Bone meal	1.01	1	1	-
Lime stone	1.5	1	-	-
Molasses	3.5	3	3	2
Vegetable oil	0.2	0.1	-	-
L-Lysine	0.05	0.025	-	-
Dl methionine	0.05	0.025	-	-
Premix	0.25	0.25	-	-
Kemzyme (GP)	0.05	0.05	-	-
Total percentage	100	100	100	100

Table 2: Chemical composition of experimental rations

	Rations			
Nutrients	A	B	C	D
Crude protein (%)	17	20	23	26
ME (kcal/kg)	3000	3000	3000	3000
Calcium	1.12	1.23	1.22	1.28
Phosphorus	0.75	0.80	0.90	0.95
Lysine	1.15	1.20	1.35	1.25
Methonine	0.42	0.45	0.40	0.50

Live body weight and carcass weight: All birds were weighed for initial body wight and weekly live body weight was taken for calculation weight gain of broiler. At the end of experiment, five birds free from any visible abnormality were randomly selected from each group and were slaughtered to obtained the carcass weight and carcass protein content.

Economics: At the end of experiment the economics of the four rations with different levels of dietary protein as compared to control was also worked out.

Data analysis: The data pertaining to feed intake, weight gain and FCR were analyzed by analysis of variance using completely randomized design through MSTAT-C computer package as applied by Steel and Torrie (1984). The value $p<0.05$ was considered as statistically significant.

RESULTS AND DISCUSSION

Growth performance

Weight gain: The results of weight gain are presented in Table 3. The average final weight was 1444.00, 1681.91, 1886.30 and 1908.33 g/bird, average daily gain was 33.4, 39.4, 43.9 and 44.3 g/bird in groups A, B, C and D, respectively. The weight gain on average was significantly increased ($p<0.01$) in birds of group C and D (23 and 26% protein) ration as compared to diets with lower protein levels (17 and 20%). The results were further subjected to comparison within experimental groups, which suggested that statistically differences among all the treatment groups were significant ($p<0.01$) when compared with control, with the exception of groups C and D where non-significant differences ($p>0.05$) were noticed. Present results are further supported by Abd El-Latif (1997) who reported weight gain of 423.25, 1312.30 and 1854.30 g with diets containing 27.25, 26.07 and 24.49% CP. The results of our study are in consistant with research conducted by Mushraf and Latshaw (1999), Dirain and Waldroup (2002), who reported that high dietary crude protein (CP) is detrimental for broilers raised under high ambient temperatures due to higher heat increment, but we found that high CP increase the weight gain of broiler, due to constant level of ME in the ration that fulfill the energy requirement of birds during hot climate could be the reasons of better performance.

Feed consumption: The broilers in groups A, B, C and D consumed 76.1, 86.0, 93.4 and 89.1 g of feed/day/bird on average, respectively (Table 3). Significantly ($p<0.01$) greater feed was consumed by chicks of group C where the dietary protein was given at the rate of 23% as compared to the broilers of other groups with relatively higher or lower dietary protein contents to this certain limit. Statistically highly significant differences ($p<0.01$) among all the treatments including control except group C and D where differences were non significant. The feed consumption increased significantly with each increased level of dietary protein up to 23%, further increase in dietary protein did not show any stimulation for broilers to consume more feed. The findings of the present research are well comparable with those of Abd El-Latif (1997) who reported 423.25, 1312.30 and 1854.30 g average feed consumption containing high protein diets of 27.25, 26.07 and 24.49% CP as compared to the low protein diets contained 16.96, 16.35 and 15.55% CP. Generally feed intake is influenced by dietary crude protein and amino acid levels (Aletor *et al*., 2000; Sklan and Plavnik, 2002). Our results are in agreement with the findings of Jianlin *et al*. (2004), who reported that broiler chicks receiving a low protein starter diet had inferior body weights and feed conversion ratio at four weeks of age compared with those receiving the required amount.

Feed conversion ratio: The feed efficiency in groups A, B, C and D recorded was 2.281, 2.20, 2.12 and 2.00 in descending order (Table 3). The broiler reared on 26% dietary protein utilized feed more efficiently with feed conversion ratio of 2.00 as compared to the broilers fed on ration containing lower protein percentage than this specific limit. Statistically significant differences ($p<0.05$) were observed, when group A was compared with group D and non-significant ($p>0.05$) when compared with other treatment groups. The birds in group D consumed relatively less quantity of feed and produced relatively greater amounts of weight gain but due to high cost of

Table 3: Broiler weight gain, feed consumption, carcass weight and carcass protein content fed different level of protein

	Groups (Level of protein)			
Particular	A (17%)	B (20%)	C (23%)	D (26%)
Initial weight g/bird	41.60^{a}	41.60^{a}	41.10^{a}	41.90^{a}
Final weight g/bird	1444.00^{c}	1681.9^{b}	1886.30^{a}	1908.33^{a}
Total Weight gain g/bird	1402.40^{c}	1639.63^{b}	1844.90^{a}	1866.54^{a}
Average daily gain g/bird	28.04^{c}	32.80^{b}	36.90^{a}	37.30^{a}
Total Feed consumption g/bird	3200.00^{c}	3612.28^{b}	3924.78^{a}	3742.50^{a}
Average daily feed consumption g/bird	64.00^{c}	72.20^{b}	78.50^{a}	74.80^{a}
F.C.R	2.22^{a}	2.20^{a}	2.13^{a}	2.00b
Carcass weight (g)	778.00^{c}	996.00^{b}	1180.30^{a}	1190.30^{a}
Carcass protein content (%)	37.00^{d}	41.00^{c}	46.00^{b}	49.00^{a}

Means with different superscript in same row significantly differ ($p<0.01$) from each other

Table 4: Economic of experiment

Observation	Ration (A)	Ration (B)	Ration (C)	Ration (D)
Cost of feed per/kg (Rs)	8.80	9.35	10.50	11.65
Total feed consumed/bird (kg)	3.2	3.612	3.924	3.742
Total cost of feed consumed/bird (Rs)	28.16	33.77	41.202	43.59
Cost of day old chicks (Rs)	16.00	16.00	16.00	16.00
Miscellaneous expenditure/bird (Rs)	10.00	10.00	10.00	10.00
Total cost/ bird (Rs)	54.16	59.77	67.24	69.59
Total weight at 42 days/bird (kg)	1.44	1.68	1.89	1.91
Sale price/kg (live body weight) (Rs)	40.00	40.00	40.00	40.00
Total sale price of per birds (Rs)	57.76	67.24	75.24	76.32
Total profit earned per bird (Rs)	3.60	7.47	8.24	6.73

feed this group could be uneconomical. The experimental results of the author are partially supported by Abd El-Latif (1997) who was of the experience that 24 or 27% CP had best feed/gain ratios and feeding up to 27% protein had no further advantage over 24% protein. Our result are in agreement with study of Hai and Blaha (1998) who found no significant differences in FCR when the protein level of the isoenergetic diets was reduced from 20 to 16% and supplemented with essential AA. However, we found that FCR was significantly improved by increasing the dietary protein level at 26% CP in broiler ration.

Economics: At the end of experiment, the birds were sold out and income generated was calculated (Table 4). The average total sale price of the broilers in groups A, B, C and D was Rs.57.76, 67.24, 75.24 and 76.32 against production cost Rs.54.16, 59.77, 67.24 and 69.59 per bird; thus net profit remained Rs.3.60, 7.47, 8.24 and 6.73/bird, respectively. Hence, group A (17% CP) or group D (26% CP) were less economical against 20% and 23% CP levels where fairly higher net profit was earned, while carcass protein content was higher in broiler fed on 26% CP contained ration.

Carcass characteristics

Carcass weight: The average carcass weight was 778.0, 996.0, 1180.3 and 1190.3 g/bird in groups A, B, C and D, respectively (Table 3). The feed contained 23 or 26% CP produced significantly greater carcass% (1180.3 and 1190.3 g/bird) as compared to the feed containing lower CP 20 and 17% (778.0 and 996.0). This greater carcass percentage in broilers fed on ration contained higher dietary proteins levels could be reasoned that proteins are essential elements for growing strong muscles, thus carcass quantity in such broilers increased. When data was further subjected for statically analysis either between treated groups or compared with control were highly significant ($p<0.01$), while differences between group C and group D were non-significant. These findings are further supported by the results of Erazo and Gernat (2000) who were of the conclusion that protein at the rates 23, 26, 29 and 32% had no significant differences for carcass, while our findings showed non-significant differences between 23 and 26% protein levels. Our results did agree the with study conducted by Cheng *et al.* (1997), who find that feeding high CP diets to heat-stressed broilers have shown adverse effects on weight gain, carcass composition, feed efficiency, whereas our results showed significant ($p<0.01$) improvement in weight gain and carcass weight when broiler were fed high protein diet (23 and 26% compared to control 17% CP, this might be due to constant energy ME level in the ration throughout experimental period.

Carcass protein content: The protein content in the carcass was 37, 41, 46 and 49% in groups A, B, C and D, respectively (Table 3). Carcass protein content was significantly ($p<0.01$) greater (49%) in broiler fed on ration contained 26% CP. It was observed that with each increased level of CP in the ration, the carcass protein content was improved remarkably. The carcass protein content was increased by 4, 5 and 3% over control (17%) when broiler fed on ration containing 20, 23 and 26% CP. linear significance in increasing carcass protein was observed when dietary CP as increased. The results of the present study are well supported by the findings of Lesson (2000) who reported that carcass composition is most influenced by balancing the energy protein in the diet and due to increased protein content in the diet there is increased yield of edible meat which is most linear. Urdaneta and Leeson (2004) reported that maximum protein deposition and growth rate was associated with an optimum requirement of crude protein and amino acid. In present study carcass protein content was significantly improved by increasing the CP level and with constant level of energy ME in broiler ration.

Conclusion: In terms of growth performance and carcass protein content, we found that for meeting protein shortage in human diet carcass with high protein content could be obtained by feeding the broiler a locally manufactured ration containing 26% CP, but on the other side 23% CP contained ration was more economical from commercial point of view. Generally, 20% CP contained ration can be fed for whole of the growth period (1-6 weeks) without considering the starter or finisher ration for optimum growth of broiler in field

condition during summer season. It is suggested that for producing high quality carcass (upto 50% protein), the farmer may be fed broiler a ration containing 26% CP, but alongside it would also be imperative to develop some cheaper sources and methods of CP to make this high protein ration economical.

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