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Effect of Feeding Low Protein Diets on the Performance of Broiler During Hot-Humid Season

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Abstract: An experiment was conducted with 180 randomly selected 7th day old ISA I 757 chicks at Bangladesh Agricultural University, Mymensingh. Four different treatments were considered containing 23, 21, 19, and 17% crude protein respectively. Body weights varied significantly ($P < 0.01$) at 8 weeks of age were 1396.03,1358.01,1270.26 and 1175.95 g. Feed conversion ratio also varied ($P < 0.01$) at the end of the experimental period which were 2.34, 2.44,2.67 and 2.89 for T_1, T_2, T_3 and T_4 respectively. Feed consumption, survivability and dressing percent did not vary significantly all over the experimental period. Considering the above result, it may be concluded that 21% crude protein in the diet may be suitable for hot-humid season.

Key words: Low protein diet, hot-humid season, broiler, body weight and FCR

Introduction

Poultry meat and egg contribute approximately 37% of the total animal protein supplied in the country (Ahmed and Islam, 1990). There is great possibility of growth and expansion of this sector both at domestic and commercial level. It provides a large part of increasing demand for animal protein, side by side it is the source of income and can create employment opportunities for the people.

The consumption of animal protein is only 9.56 g per day per person as against the standard requirement of 36.0 g in Bangladesh which can't meet minimum requirement of the vital function of the body for which a great majority of the people of Bangladesh are suffering from malnutrition (BBS, 1995). It is suspected that the scarcity of supply of protein feed stuff and its high price in the market is the main cause.

In poultry production, the feed alone accounts about 65-70% of the total cost of production (Bhuiyan, 1998). Protein cost account about 15% of feed cost of production (Banerjee, 1992; Singh, 1990). From the economic point of view, the poultry should be supplied with cheaper feed to get maximum return with minimum cost. Feed storage is a major constraint of poultry farming in Bangladesh. It is better to give attention to formulate an economic poultry diet using the feed ingredients collected from country origin. In order to bridge the protein gap in poultry industry, research has been going on to minimize protein requirement.

Bangladesh is a tropical country and during the summer environmental temperature is increased about 40 ^{0}C (Nasim, 1993). The high environmental temperature is not suitable for broilers and sometimes become more harmful during hot-humid environmental condition. Dale (1985) suggested that increase dietary protein at high ambient temperature is not beneficial to broilers. The higher heat increment from increased protein intake out of high protein diet giving suffering to the birds already suffering at high temperature.

The profit of poultry farming mainly depends on economic feeding of balanced ration. The chronic scarcity, high cost and adulteration of animal and plant protein supplements particularly fish meal, oil seeds meal and cake have increased interest to seek alternative sources of protein sources for feeding of poultry.

Performance of broiler is reduced during "Heat stress" both in terms of body weight and feed efficiency (Suzuki *et al*., 1983; Austic, 1985). The cause of the performance decline I under studying numerous laboratories and factor that have been cited include feed intake reduction (Austic, 1985) chances in gastrointestinal micro flora (Suzuki *et al*., 1983) and decline n essential amino acid digestibility including that of methionine. Increasing nutrient density has not been observed to improve the performance of "Heat stress" birds (Adams *et al*., 1962).

Yamazaki *et al*. (1996) showed the excretion of nitrogen increased at protein level increased. Cowan and Michie (1978) showed that increased concentration of protein apparently does not reduce the growth rate depression of broiler raised at 26-31 ^{0}C.

In view of the above facts the present study was conducted to test the effect of feeding low protein diet in the hot-humid season with the following objectives:

I) To assess the effect of feeding low protein diets on the performance of broilers in terms of body weight gain, feed consumption, feed efficiency and survivability.
ii) To investigate whether formulation of rations containing low protein during hot-humid season under Bangladesh condition is feasible.

Materials and Methods

The experiment was conducted at the Bangladesh Agricultural University poultry farm, Mymensingh, for a period of seven weeks. The research was carried out to study the effect of different dietary protein levels on the body weight gain, feed consumption, mortality and cost of production of broiler chicks in hot-humid season.

Collection of experimental birds: One hundred eight randomly selected 7th day old ISA I 757 chicks were collected from "Poultry Development Project" under the department of Poultry Science, BAU, Mymensingh.

Lay out of the experiment: The chicks were allocated randomly to four dietary treatments having three replications in each treatments.

Preparation of house: The experimental houses were cleaned properly in every nock and corner including floor and wall spraying water with the help of hosepipe. Then disinfected through Phenyl solution followed Iosan and left for a week. Before placement of chicks the house was fumigated by formalin and potassium permanganate. After proper drying the house are divided into 12 separate pens of equal size.

Ration used: According to the lay out ration was supplied for different treatments. The Table 2 showed the composition of ration and nutrient composition.

Management: Identical care and management were taken for all the treatment groups during experimental period including feed and water supply, feeder and water space, litter management, lighting, immunization, medication etc. Data recorded against the parameters were body weight, feed consumption, survivability, temperature and humidity and dressing percentage also recorded. Considering the recorded data production cost were calculated.

Table 1: The lay out of the experiment

Treatments	Age of birds	Number of birds in each replication			Total No. of birds	Treatment ration used in the experiment
		R_1	R_2	R_3		
T_1	7days	15	15	15	45	23% protein and ME 2919 kcal/kg diet considered as control.
T_2	7days	15	15	15	45	21% protein and ME 2919 kcal/kg diet.
T_3	7days	15	15	15	45	19% protein and ME 2919 kcal/kg diet.
T_4	7days	15	15	15	45	17% protein and ME 2919 kcal/kg diet.

Table 2: Composition of ration and nutrients

Ingredients	Treatments			
	T_1	T_2	T_3	T_4
Maize	54	55	57	58.5
Rice polish	7	10	12	15
Soybean meal	15	16	16	14
Sesame meal	7	7	7	6
Meat and bone meal	2	3	2	2
Protein concentrate (LNB)	8	5	3	2
Vegetable protein concentrate	5	2	1	0
Di-calcium phosphate	1.5	1.5	1.5	2
Vitamin-mineral premix	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25
Total	100	100	100	100
Nutrient composition				
ME Kcal/kg	2919	2913	2925	2939
CP%	23(22.7)	21(20.6)	19(18.8)	17(16.9)
Ca%	1.45	1.21	0.94	0.96
Av. P.	0.70	0.65	0.57	0.60
Lysine%	1.30	1.14	0.99	0.90
Methionine%	0.46	0.45	0.41	0.40

Table 3: Average weekly cumulative live weight (g/bird) in different dietary treatments

Age in week	Treatments				SED (LSD) value and level of significance
	T1	T2	T3	T4	
2	155.56	164.44	158.33	153.33	5.08NS
3	280.00	268.89	284.44	253.33	15.97NS
4	448.88	432.22	437.78	386.46	20.67NS
5	583.33	579.37	575.55	580.95	23.98NS
6	738.65	760.39	719.48	723.33	54.35NS
7	1133.33	1033.33	1035.22	1055.55	46.82NS
8	1396.03a	1358.01ab	1270.26bc	1175.19c	111.19**

** = Highly significant ($P < 0.01$); NS = Non-significant; The figures in a row having the similar result do not differ significantly.

Statistical analysis: All the recorded and calculated data were analyzed for ANOVA (Steel and Torrie, 1980) using a Completely Randomized Block Design (CRD) with the help of computer packaged program MSTAT. Least Significant Differences (LSD) was calculated to compare the variations between the treatments were ANOVA showed significant differences. The dressing yield parameters were converted to the percentage of their respective body weights for statistical analysis.

Results and Discussion:

Live weight: The live weight of broilers did not vary significantly during 2-7 weeks of age which was supported the result showed by Pesti and Fletchner (1984) but varied significantly ($P < 0.01$) only on 8 weeks of age. Mahapatra *et al*. (1984) drown the similar comment; they said diet had no significant effect on live weight at slaughter. On the other hand Babu *et al*. (1986) found that live weight were significantly greater with 24 and 22% protein than 20%. During hot-humid season higher dietary level of protein become harmful for broiler and bird suffered (Dale, 1985) but, low protein diet do not create such suffering for birds, that is why birds feels easy if it is not very much low which do not satisfy the optimum requirement. In this experiment, control diet (23% CP) and the diet containing 21% CP gave the best body weight at 8 weeks of age. Again, the diet containing 21 and 19% CP did not differ significantly but diet containing 19% CP varied significantly from the control diet. The results of body weight were shown in Table 3.

Feed consumption: Feed consumption did not differed significantly during the whole experimental period (Table 4). Similar result were found by Babu *et al*. (1986) who conducted an experiment with 22, 23 and 24% CP content diets did not show significant difference among the them. Though the cumulative feed consumption was not significant the treatment groups T_3 and T_4 consumed relatively more feed than the other treatments and this was probably lack protein in the diet of T_3 and T_4 treatments. To meet up the requirement the birds of T_3 and T_4 treatments consumed more feed than other two treatments. Similar conclusion was made by Al-Rabdawi and Singh (1989), who concluded that protein levels influenced feed consumption.

Lee *et al*. (1990) also commented that feed intake increased when dietary protein increased. Other factor may also influence on feed consumption, which may be environmental temperature. The birds which were comparative larger in body weight suffered more. Wilson and Wilboro (1948) reported that feed consumption was lowered by high environmental temperature. In this experiment

Table 4: Average weekly cumulative feed consumption (g/bird) of broiler at different weeks of age

Age in week	Treatments				SED(LSD) value and level of significance
	T1	T2	T3	T4	
2	106.66	107.77	96.66	92.00	8.78NS
3	352.22	366.66	381.11	376.44	13.59NS
4	799.83	766.66	841.11	842.22	32.17NS
5	1344.60	1326.15	1350.00	1383.11	28.84NS
6	1876.71	1852.19	1848.73	1878.66	61.69NS
7	2484.16	2484.64	2506.18	2458.11	72.44NS
8	3063.17	3075.91	3086.33	3081.98	73.20NS

Table 5: Weekly Feed Conversion Ratio of broiler at different dietary treatments

Age in week	Treatments				SED(LSD) value and level of significance
	T1	T2	T3	T4	
2	2.12	1.6	1.76	1.97	0.29NS
3	2.08	2.23	2.13	2.46	0.20NS
4	2.19b	2.55a	2.57a	2.81a	0.35*
5	2.75	2.85	2.93	2.80	0.11NS
6	2.80	2.87	3.09	3.05	0.18NS
7	2.36b	2.66a	2.21a	2.66a	0.24*
8	2.34b	2.44b	2.67ab	2.98a	0.35**

** = Highly significant ($P < 0.01$); * = Significant ($P < 0.05$); NS = Non-significant;
The figures in a row having the similar result do not differ significantly.

the birds of T_1 and T_2 treatment was higher in body weight (Table 3) and suffered more with the environmental temperature as experiment was carried out during hot-humid season. During hot-humid season the birds consume more water and feed consumption was decreased (Wilson and Wilboro, 1948).

Feed Conversion Ratio (FCR): Feed conversion ratios in the present experiment differed significantly at 4th ($P < 0.05$), 7th ($P < 0.05$) and 8th ($P < 0.01$)) weeks of age. At 8th weeks of age T_1, T_2 and T_3 were statistically similar but only T_4 differed significantly ($P < 0.01$) with other treatments (Table 5). In this experiment good feed conversion were observed with increasing protein level and this result was supported by the result obtained by Kassim and Suwanpradit (1996). The diet containing 23% CP offered for control group and other diet contained less than 22%. The group which offered 17-21% CP, resulted lower feed efficiency than the control group and the result was similar with the comment downed by Nigra and Sethi (1993) who said feed efficiency was best with the birds providing 22-24% CP. On the other study Multani *et al*. (1993) concluded that 22 or 24% protein showed in summer better feed conversion efficiency and Harigis and Creger (1980) who got higher protein efficiency utilizing higher protein.

Survivability: The survivability percentage was presented in the Table 6 and the result did not differed significantly among the treatments. Lin Jeng Yong and Jenn Chung (1995) carried out in experiment and showed the dietary protein level and feed intake had no effect on mortality. The mortality, which occurred insignificant and caused by other than dietary protein effect. Jahan (2000) and Khatun (2000) reported that there were no significant differences in survivability for broiler birds at different dietary treatments.

Dressing characteristics: Dressing percentage did not differ significantly among the treatment, sexes and there were no interaction effects (Table 7). As the body weight (Table 3) differed only at the 8th week of age but at other weeks it was almost identical. Probably that is why; the dressing percentage did not differ significantly. Lee *et al*. (1990) and Mahapatra *et al*. (1986) also observed the similar result; they said the diet containing different protein level had no significant difference on eviscerated carcass weight.
Except dressing, other dressing character which studied were percentage of blood weight, feather weight, shank weight, head weight, heart weight, viscera weight, liver weight, gizzard weight and abdominal fat. Among those most of them did not differ significantly (Table 7). Kassim and Suwanpradit (1996) reported the similar result, they reported drumstick and thigh weight did not influenced by the protein level.

Cost of production and profit: Total production differed significantly ($P < 0.01$). The diets containing higher percentage of protein showed higher feed cost per broiler (Table 8). During formulation of feed, cost of other nutrients than proteins were constant except feed cost, other cost were constant. So, only the protein level was a factor of difference.
Nigra *et al*. (1993) also drew similar comments and said that protein content had significant effect on feed cost. Again Lee *et al*. (1990) also reported that diet containing 20% CP during starter period gave the least cost per kg body weight of broiler. In the present experiment the profit was highest in the treatment T_2 which were fed with 21% CP. Highest profit was obtained in the T_2 because the body weight (Table 3) and sale per broiler were not significant differed between T_1 and T_2 group but the feed cost per broiler differed significantly and that is why, the total cost per broiler differed significantly.

Conclusion: An experiment was conducted with 180 seven day-old straight run ISA I 757 broiler chicks reared up to 56 days of age at Bangladesh Agricultural University Poultry Farm, Mymensingh to investigate the effect of low protein diet on the performance of broiler during hot-humid season. The experimental birds were allocated to four dietary treatments each with three replication having 15 birds per replication. Diet was formulated having 23, 21, 19 and 17% CP were considered as T_1, T_2, T_3, and T_4 respectively. Here diet containing 23% CP considered as control. Feed and fresh water was given ad-libitum through out the whole period. Body weight, feed consumption, feed conversion ratio, survivability, profit and dressing yield characteristics were recorded. At 56 days of age broilers were dissected to compare dressing characteristics among the dietary treatments.
At 56 days of age, the body weight of broiler on T_1, T_2, T_3, and T_4 were 1396.03, 1358.01, 1270.26 and 1175.95 g respectively. Body weight of birds showed highest for the diet containing 23% CP but it was also almost similar to 21% CP containing treatments. Feed consumption at different treatments was almost similar to each other i.e. 3063.17, 3075.91, 3086.33 and 3081.94

Table 6: Survivability percentage of broiler at different dietary treatments

Age in week	Treatments				SED(LSD) value and level of significance
	T1	T2	T3	T4	
2	100	100	100	100	0.00NS
3	100	100	100	100	0.00NS
4	100	100	100	97.77	1.11NS
5	100	97.77	100	97.77	1.57NS
6	97.77	97.77	97.77	97.77	2.22NS
7	97.77	97.77	95.55	97.77	2.94NS
8	97.77	97.77	95.55	97.77	2.94NS

** = Highly significant (P < 0.01); * = Significant (P < 0.05); NS = Non-significant;
The figures in a row having the similar result do not differ significantly.

Table 7: Meat yield traits of male and female broilers of different dietary treatments

Variable	Sex	Treatments					SED (LSD) and level of significance		
		T_1	T_2	T_3	T_4	Mean	T	S	TxS
Dressing %	M	69.07	68.77	68.26	64.86	67.74	3.50NS	2.47NS	4.95NS
	F	68.98	66.85	70.31	64.66	67.70			
	Mean	69.02	67.80	69.28	64.76				
Blood weight%	M	4.15	3.52	3.16	3.91b	3.68	0.457NS	(0.685)**	(1.37)**
	F	3.88	3.90	5.95	4.80	4.63			
	Mean	4.10	3.71	4.55	4.36				
Feather weight%	M	4.56	6.48	6.69	5.20	5.73	(2.224)	0.457NS	1.48NS
	F	4.44	5.46	9.91	4.63	6.11			
	Mean	4.50	5.97b	8.30a	4.91b				
Shank weight%	M	4.86	4.71	4.87	5.31a	4.93	0.23NS	(0.345)	0.325NS
	F	4.38	4.37	4.20	4.32b	4.32			
	Mean	4.62	4.54	4.53	4.81				
Head weight%	M	3.29	3.06	3.30	3.89	3.38	0.315NS	0.222NS	0.445NS
	F	3.07	3.64	3.01	2.85	3.14			
	Mean	3.08	3.35	3.15	3.37				
Heart weight%	M	0.65	0.58	0.53	0.50	0.57	(0.154)*	0.051NS	0.103NS
	F	0.61	0.72	0.42	0.48	0.56			
	Mean	0.63ab	0.65a	0.47c	0.49bc				
Viscera weight%	M	8.38	7.65	7.56	9.45	8.26	0.96NS	0.679NS	1.35NS
	F	8.24	9.67	6.50	8.14	8.14			
	Mean	8.31	8.66	7.06	8.79				
Liver weight%	M	2.57	2.34	2.04	2.46	2.35	0.143NS	0.101NS	(0.431)
	F	1.96	2.54	2.26	2.42	2.29			
	Mean	2.26	2.44	2.15	2.44				
Gizzard weight%	M	2.45	2.70	2.43	2.58	2.54	0.194NS	0.137NS	0.274NS
	F	2.59	2.84	2.26	2.29	2.49			
	Mean	2.52	2.77	2.34	2.43				
Abdominal fat weight%	M	0.72	0.83	0.54	1.16	0.81	0.304NS	0.215NS	0.430NS
	F	1.01	0.97	0.84	0.90	0.93			
	Mean	0.86	0.90	0.69	1.03				

** = Highly significant (P < 0.01); * = Significant (P < 0.05); NS = Non-significant;
The figures in a row having the similar result do not differ significantly.

Table 8: Cost of production of different treatments

Item of cost (Tk. / bird)	Treatments				SED(LSD) value and level of significance
	T1	T2	T3	T4	
Diet containing protein %	23	21	19	17	--
Chick cost	17.0	17.0	17.0	17.0	NS
Feed cost per broiler	40.31a	35.87b	33.45c	31.14c	2.39**
Total cost per broiler	61.77a	57.33b	34.91c	52.60c	2.39**
Total sale per broiler	83.76a	81.48ab	76.22bc	70.56c	7.22**
Profit	21.99a	24.15a	21.31a	17.96b	4.92*

** = Highly significant (P < 0.01); * = Significant (P < 0.05); NS = Non-significant;
The figures in a row having the similar result do not differ significantly.

g respectively. Feed conversion ratio had significant difference at 4, 7 and 8 weeks of age of broiler. It is observed that control group had better FCR than the other treatment groups at 4 and 7 weeks of age. At 8 weeks of age FCR did not varied significantly. Survivability of the birds among the treatments was satisfactory and was insignificant. All most all the dressing characteristics did not vary statistically. Though the dressing percentage did not vary but T1, T_2 and T_3 showed the higher value than the T_4 treatment. Total cost of production was significantly highest for T_1 and chronologically lower for the other treatment due to low content

of CP. But considering profitability the T_2 showed the more profit that the others treatment, though the T_1 group profit did not vary significantly with T_2 treatment.

Considering the above facts, the following conclusion may drawn.

1. Low protein (17-19% CP) cannot satisfy the requirement and show bad effect on the performance of broiler.
2. For hot-humid season, slightly less protein diet show s better result.
3. For Bangladesh, during hot-humid season diet containing 21% CP may be advised. But for final recommendation this type of experiment should be repeated during several seasons of the year.

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