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Effect of Different Protein Diets on the Growth Performance of Turkey

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Abstract

An experiment was conducted with the objective to investigate the effect of different levels of protein diets in the turkey rations. The experimental design used for the experiment was Complete Randomized Design (CRD) with 2x4 factorial combinations of treatments: Two levels of breed Broad Breasted White (BBW) and Broad Breasted Bronze (BBB) and four levels of diets (16%, 18%, 20% and 22%). Each treatment was replicated thrice using 24 pens consisting 120 birds. They were allowed adlib feed, water and uniform management throughout the entire experiment. The live weight, feed intake, dressing percentage, sharing of different organs were analyzed. At the end of the experiment the live weight (6.99 kg) was significantly high ($p<0.01$) with BBW at 16% protein in the concentrate. Highest average daily gain did not differ significantly. Similarly, cumulative feed consumption also did not differ significantly. Blood biochemical profile showed normal health condition of the turkeys with mean values of total protein, albumin, globulin and serum calcium were found to be 4.46 g/dl, 1.52 g/dl, 2.95 g/dl and 0.59g/dl respectively where non-significant interaction was observed. Looking towards the result of this experiment, it can be concluded that concentrate diet with 16% protein level has beneficiary effect on the performance of BBW turkey however further experiments are suggested to verify the results in wider scale and locations before recommending the technology on dietary requirement of turkey in our context.

Keywords

Turkey, feeding, Protein, diets, Nepal

1. Introduction

Turkey (*Meleagris Gallopavo*) production is a significant and extremely profitable agricultural business and its product demand is growing globally [1-2]. Turkey farming is an already established enterprise from commercial point of view in western countries but in developing countries it is yet to be established commercially [3]. It is one of the demanding species of poultry raised for meat in its native North America. It is a preferred white meat known for its leanness and delicate flavor. It is well known for its festivals, especially around Christmas and New Year. Low-income countries with food shortages have been described as using village poultry farming systems [4]. It was introduced in Nepal in January 2001 in Nepal. The poultry population of Nepal is about 73 million contribution Agriculture GDP providing by chicken was 1.63%, Turkey 0.001% and Ducks 0.01% Among them, turkey is the least exploited among all [5]. The production of turkey meat is growing an average annual growth rate of 3% worldwide [6]. People are raising turkey for its higher meat production and as an alternative to chicken with a change of taste and also as food for festivals. Also the trend of consuming turkey as white meat is increasing [7]. Thus exploration of feed ingredients using

locally available ingredients to formulate feed for turkey is important in Nepal as it is utmost important to raise poultry after having adequate knowledge regarding their feeding and management in order to achieve maximum profit. In context of Nepal, farmers are raising turkey with limited prior knowledge and experience and there are less extensive research and extension program towards turkey farming as compared to that of chicken. However, its farming is at increasing rate in the present situation. In our context turkeys are fed commercial broiler and layer diet. There is no specific feeding standard for turkey from the feed industry sector [8]. Very few research works have been carried out in turkey in Nepal as compared to chicken. The current study was designed to determine the effect of different level of protein in concentrate diets on the growth performance of turkey.

2. Methods

The experimental trial was conducted under deep litter housing system of Swine and Avian Research Program Khumaltar, Lalitpur, poultry farm from 13th July 2020 to 10th December 2020. A total of 120 birds (60 Broad Breasted White and 60 Broad Breasted Bronze) of 10th week were randomly divided into eight treatment groups having three replications in each treatment in such a way that there was no significant difference in their initial weight. The treatment feed was prepared based on locally available feed ingredients. Complete Randomized Design (CRD) with factorial combinations (2 X 4) was employed. Two levels of breed Broad Breasted White (BBW) and Broad Breasted Bronze (BBB) and four levels of protein level of turkey diets having the following treatment combinations were used. T1 (BBW + 16% Crude Protein); T2 (BBW + 18% Crude Protein); T3 (BBW + 20% Crude Protein); T4 (BBW + 22% Crude Protein); T5 (BBB + 16% Crude Protein); T6 (BBB + 18% Crude Protein); T7 (BBB + 20% Crude Protein); T8 (BBB + 22% Crude Protein). The initial and biweekly body weight of the birds was taken using a spring balance. The daily feed conversion ratio in each treatment was determined by dividing the average daily dry matter intake by their respective weight gain. The blood biochemical parameters were carried out at National Health Research Centre, Khumaltar. Statistical analyses were performed in RStudio (version1.2.5033 – © 2009-2018 RStudio, Inc.) and MS - Excel. Analysis of Variance (ANOVA) was done only after the parameters satisfied the normality test and equal variance test. Separation of means was performed by Duncan Multiple Range Test (DMRT) (Pesti, Vedenov, Cason, & Billard, 2009). Significant difference was observed for means with P-value <0.05, P<0.01 and P<0.001.

3. Results

3.1 Chemical composition of turkey rations

The present analyzed chemical composition of turkey ration is presented in Table 1. The percentage of DM, CP, CF, and EE for grower turkey ration nutrient composition was calculated on the basis of tabulate value that is why the analyzed value showed a slight variation tin their composition.

Table 1. Chemical composition of turkey ration

Ration	Dry Matter (DM, %)	Crude Protein (CP, %)	Crude Fiber (CF, %)	Ether extract (EE, %)	Total Ash (TA, %)
Turkey diet (16% CP)	89.15	15.77	3.38	5.38	7.86
Turkey diet (18% CP)	89.4	17.57	2.78	6.7	5.9
Turkey diet (20% CP)	89.26	19.96	1.85	5.15	8.45
Turkey diet (22% CP)	89.12	21.01	2.2	5.25	7.99

3.2 Body weight of Turkey

Mean biweekly cumulative live weight under different treatment is presented in Table 2. Significant differences were observed at first (P<0.01), second (P<0.001), third (P<0.001), fourth (P<0.001), fifth (P<0.001), sixth (P<0.001), seventh (P<0.001), eighth, (P<0.01), ninth (P<0.01), and tenth (P<0.001) observations with respect to protein levels. Significantly higher cumulative live weight was observed at first (P<0.01), second (P<0.001) and third (P<0.001) observations for 16% and 20% protein in the concentrate diet which was found to be 1.66 kg and 1.62 kg, 2.45 kg and 2.41 kg, 3.10kg and 2.99 kg respectively. Similarly, significantly higher cumulative live weight was seen during fourth (P<0.001), fifth (P<0.001), sixth (P<0.001), seventh (P<0.001), eighth (P<0.01), ninth (P<0.01) and tenth (P<0.001) observation for 16% protein level in the concentrate diet which were 3.66 kg, 4.21 kg, 4.78 kg, 5.21 kg, 5.75 kg, 6.25 kg, and 6.65 kg respectively. However, there was no significant (P>0.05) difference among the breed on cumulative feed consumption.

Table 2. Mean biweekly cumulative live weight (kg) under different treatment of turkey

Treatment	Period of Biweekly										
Protein %	Initial	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
16	0.71	1.66^{a}	2.45^{a}	3.10^{a}	3.66^{a}	4.21^{a}	4.78^{a}	5.21^{a}	5.75^{a}	6.25^{a}	6.65^{a}
18	0.72	1.55^{b}	2.22^{b}	2.76^{b}	3.17^{c}	3.64^{c}	4.03^{c}	4.38^{c}	4.90^{b}	5.27^{c}	5.57^{c}
20	0.69	1.62^{a}	2.41^{a}	2.99^{a}	3.52^{ab}	4.01^{b}	4.39^{b}	4.76^{b}	5.13^{b}	5.49^{bc}	5.83^{bc}
22	0.80	1.61^{a}	2.39^{a}	2.97^{a}	3.41^{b}	3.83^{b}	4.31^{b}	4.89^{b}	5.29^{b}	5.76^{b}	6.13^{b}
Probability	NS	**	***	***	***	***	***	***	**	**	***
Breed											
BBW	0.74	1.63	2.39	2.97	3.45	3.91	4.35	4.81	5.3	5.76	6.10
BBB	0.73	1.60	2.34	2.94	3.43	3.93	4.39	4.81	5.2	5.63	5.99
Probability	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean	0.73	1.62	2.37	2.96	3.44	3.92	4.38	4.81	5.27	5.69	6.04
CV	14.99	2.64	2.55	3.73	4.09	3.98	4.49	5.15	6.14	6.12	6.16
SEM	0.02	0.02	0.03	0.04	0.06	0.07	0.08	0.09	0.1	0.12	0.13
LSD	0.19	0.07	0.10	0.19	0.24	0.27	0.34	0.43	0.56	0.60	0.65
Normality	0.40	0.55	0.44	0.11	0.16	0.18	0.69	0.50	0.46	0.39	0.47
Probability	NS	***	***	***	***	***	***	**	*	**	**

Notes: * Significant at P<0.05, ** Significant at P<0.01, *** Significant at P<0.001, NS=Not Significant; Values bearing different superscripts differ significantly.

3.3 Average daily body weight gain of Turkey

Average daily body weight gain in turkey under different treatment is presented in the Table 3. Results showed significant increase in daily body weight gain during second (P<0.01) and sixth (P<0.01) observation with respect to protein level. During second observation the average daily body weight gain with 16%, 20% and 22% was significantly higher than that of 18% which were found to be 52.24 g, 52.51g, 51.89 g and 44.31g respectively. During sixth observation highest gain was observed with 16% protein level which was 37.98g, lowest gain was observed with 18% and 20% which were 25.91g, 25.44g respectively and that with 22% showed intermediate result which was 31.53g. Average daily body weight gain was not significantly affected by breed of turkey.

Table 3. Average daily body weight gain (g) under different treatment of turkey

Treatment	Period of biweekly									
Protein %	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
16	63.74	52.24^{a}	43.73	37.22	36.58	37.98^{a}	28.40	36.36	33.78	26.37
18	56.14	44.31^{b}	35.91	27.26	31.28	25.91^{b}	23.22	34.96	24.93	19.89
20	61.81	52.51^{a}	38.64	35.68	32.38	25.44^{b}	24.51	25.00	23.97	22.29
22	53.7	51.89^{a}	38.37	29.49	28.04	31.53^{ab}	38.73	26.89	31.29	25.16
Probability	NS	**	NS	NS	NS	*	NS	NS	NS	NS
Breed										
BBW	59.63	50.99	36.66	33.72	30.64	30.70	30.27	28.56	30.64	23.93
BBB	58.10	49.49	41.67	31.11	33.50	29.73	27.16	33.04	26.34	22.93
Probability	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean	58.86	50.23	39.17	32.41	32.07	30.21	28.71	30.8	28.49	23.42
CV	14.47	6.91	15.66	27.32	26.98	25.47	33.85	31.64	32.24	24.99
SEM	2.81	1.34	1.96	2.63	2.25	2.07	2.48	2.01	2.27	1.24
LSD	14.74	6.00	10.62	15.32	14.97	13.31	16.82	16.87	15.90	10.13
Normality	0.57	0.41	0.38	0.29	0.27	0.24	0.17	0.59	0.50	0.37
Probability	*	NS	*	*	NS	NS	NS	NS	NS	NS

Notes: * Significant at P<0.05, ** Significant at P<0.01, *** Significant at P<0.001, NS=Not Significant; Values bearing different superscripts differ significantly.

Mean daily dry matter consumption under different treatment is presented in the Table 4. There was significant difference in protein level during first (P<0.01), second (P<0.001), third (P<0.001), fourth (P<0.001), fifth (P<0.001) and seventh (P<0.05) observation on daily dry matter consumption. Significantly lower dry matter intake was observed in 18% protein level during first to fifth observation whereas in seventh observation significantly lower dry matter intake was observed with 22% protein level. There was significantly higher daily dry matter intake with 16% protein level during first observation whereas it was not significantly different from second to fifth and seventh observation.

Table 4. Mean daily feed consumption (g) under different treatment of turkey

Treatment	Period of Biweekly									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Protein %										
16	99.77^{a}	127.83^{a}	174.12^{a}	192.24^{a}	218.48^{a}	220.00	225.56^{a}	239.86	244.17	310.62
18	83.29^{c}	106.18^{b}	150.39^{c}	166.09^{b}	182.95^{b}	195.50	212.09^{a}	218.08	204.56	250.35
20	93.29^{ab}	135.34^{a}	178.93^{a}	194.72^{a}	219.52^{a}	220.35	219.15^{a}	228.46	230.63	268.05
22	87.35^{bc}	112.38^{b}	160.05^{b}	168.61^{b}	179.58^{b}	195.72	173.65^{b}	201.43	193.50	222.75
Probability	**	***	***	***	***	NS	*	NS	NS	NS
Breed										
BBW	94.78^{a}	128.46^{a}	176.25^{a}	187.57^{a}	204.50	213.35	216.11	230.48	226.57	274.19
BBB	87.08^{b}	112.39^{b}	155.49^{b}	173.27^{b}	195.77	202.44	199.12	213.44	209.86	251.69
Probability	**	***	***	***	NS	NS	NS	NS	NS	NS
Mean	90.93	120.43	165.87	180.41	200.14	207.89	207.61	221.96	218.22	263.94
CV	6.92	7.94	4.31	3.95	5.94	12.51	13.88	16.94	17.94	19.17
SEM	2.18	3.54	3.76	3.56	5.05	5.50	7.44	8.74	9.57	12.01
LSD	10.89	16.56	12.37	12.35	20.57	45.03	49.89	65.10	67.75	87.25
Normalaity	0.10	0.88	0.77	0.45	0.75	0.89	0.43	0.06	0.18	0.10
Probability	**	NS	**	**	**	NS	NS	NS	NS	NS

Notes: * Significant at P<0.05, ** Significant at P<0.01, *** Significant at P<0.001, NS=Not Significant; Values bearing different superscripts differ significantly.

Table 5. Blood biochemical parameters under different treatment of turkey

Treatment	Blood biochemical parameters				
	Total protein (g/dl)	Serum albumin (g/dl)	Serum globulin (g/dl)	Albumin/Globulin	Serum calcium (mg/dl)
Protein %					
16	4.23	1.50	2.73	0.81	10.93^{b}
18	4.05	1.48	2.57	0.62	10.34^{b}
20	4.94	1.57	3.37	0.47	12.10^{a}
22	4.61	1.51	3.08	0.49	11.24^{ab}
Probability	NS	NS	NS	NS	*
Breed					
BBW	4.53	1.56	2.96	0.67	11.02
BBB	4.39	1.47	2.92	0.52	11.31
Probability	NS	NS	NS	NS	NS
Mean	4.46	1.52	2.94	0.59	11.16
CV	12.82	9.08	17.67	5.95	6.97
SEM	0.13	0.03	0.12	0.02	0.19
LSD	0.99	0.23	0.89	0.62	1.34
Normality	0.87	0.07	0.18	0.09	0.19
Probability	NS	NS	NS	NS	NS

Notes: * Significant at P<0.05, ** Significant at P<0.01, *** Significant at P<0.001, NS=Not Significant; Values bearing different superscripts differ significantly.

3.4 Blood Biochemical Parameters

Data on various biochemical parameters of turkey under different treatment is presented in the Table 5. There was no significant difference on Total protein, Serum albumin, Serum globulin and Albumin to Globulin ratio with respect to protein level, breed of turkey and their interaction. The mean values were found to be 4.46 g/dl, 1.52 g/dl, 2.95 g/dl and 0.59g/dl respectively. However, Serum Calcium was found to be significantly different ($P<0.05$) with respect to protein level but not breed and interaction between protein level and breed. Significantly higher calcium i.e., 12.10 mg/dl was observed in 20% protein level.

4. Discussion

The results are in agreement with states that significant increase in body weight up to 28 weeks in turkey fed with commercial layer finisher diet and the cumulative body weight at 28^{th} week was 5.67 kg but did not mention the breed of turkey used for the study [7]. In contrast reported high body weight (6.64 kg) at 16 weeks of age in British United Turkey (BUT) which might be possibly due to different breed of turkey and difference in ration composition used for the study [9]. Significant difference in cumulative body weight between Bronze and White turkeys fed with commercial broiler diet where Bronze turkeys showed significantly higher body weight then white turkeys whereas other study did not report significant difference in weekly live weight among black, white and bronze turkey except at the age of 20 and 21 weeks where Bronze type turkeys showed significantly highest live body weight followed by Black and White turkey respectively [10-11].

The results show the similar trend that in turkey up to 28 weeks of age and as feed consumption increased significantly with the increase in age of commercial breed turkey (B.U.T) whereas other study indicated consistent increase in feed intake under extensive and semi-intensive system of management in British United Turkey up to the age of 22 weeks followed by consistent decrease in feed intake till 28 weeks of age [7, 9, 12].

The results are observed non-significant difference in total serum protein due to different dietary protein as well as interaction between floor space and dietary protein levels. Similarly, other study also reported no significant difference between various dietary protein levels on serum biochemistry profile. The results are also in agreement with the results obtained was slightly higher values of total protein and serum calcium on turkey fed on alfalfa diet [13, 14, 15, 16].

5. Conclusion

Results obtained from this study were concluded that the better cumulative weight (6.99 kg) was obtained with Broad Breasted White at 16% protein in the concentrate diet. Highest average daily gain was observed during initial stage and it progressively decreased as the age of the bird increased. Initially it was high (73.19g) with Broad Breasted White at 20% protein in the concentrate diet but was at par with same breed at 16% protein and another breed at 16%, 18% and22% protein in the concentrate diet. Cumulative feed consumption was 28.15 kg which did not differ significantly with respect to interaction between breed and protein level in the concentrate diet. Blood biochemical profile showed normal health condition of the turkeys with mean values of total protein, albumin, globulin and serum calcium were found to be 4.46 g/dl, 1.52 g/dl, 2.95 g/dl and 0.59g/dl respectively where non-significant interaction was observed. Thus it can be concluded that it is beneficial to raise both Broad Breasted White and Broad Breasted Bronze turkey with 16% protein in the concentrate diet. However, to verify the results, extensive research covering multi-location study need to be conducted before coming into concrete conclusion.

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