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Effect of Feeding Different Levels of Protein on Mortality, Carcass Characteristics, Biochemical Parameter, Time Motion Study and Economics of Desi Ducks under Intensive System of Rearing

[1]N.K. Behera, [1]L.K. Babu, [2]S.K. Sahoo, [2]S.C. Giri, [1]P.K. Pati, [1]B. Panigrahi and [1]S.K. Joshi
[1]Department of Livestock Production and Management, Collage of Veterinary Science and Animal Husnabdry, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, India
[2]Regional Center, Central Avian Research Institute, Bhubaneswar, India

Corresponding Author: S.K. Joshi, Department of Livestock Production and Management, Collage of Veterinary Science and Animal Husnabdry, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, India Tel: 08950169303

ABSTRACT

The present study was carried out on 360 unsexed day-old ducklings (Desi) procured from the hatchery of Regional Center, CARI, Bhubaneswar distributed randomly into three treatment groups with three replicates in each group during brooding (0-8 weeks of age) by feeding 18, 20 or 22% crude protein respectively and growing periods (8-16 weeks of age) by feeding 14, 16 and 18% crude protein respectively to study the mortality, carcass characteristics, biochemical parameters, time motion study and economics. It was found that the mortality of ducklings under different treatments ranged from 6.67-8.33% during 0-8 weeks of age and was within normal range indicating that the different levels of protein supplementation in the diet could not influence the health condition of the ducks. There was no significant difference in the carcass traits with respect to dressing percentage or percentage of giblet, blood loss, feather weight, inedible viscera and cutup parts between different treatments at 16 weeks of age. There was no significant difference in the serum uric acid concentration (mg dL^{-1}) between different levels of protein supplementation in the diet. Further, the total time spent for rearing 40 ducks from 0-4 weeks of age was 4.71-4.8 h man and during 5-8 weeks of age, it was 4.94-5.27 h man. One laborer working for a period of 8 h man per day can manage 1864-1900 ducks of 0-4 weeks of age and 1699-1811 ducks of 5-8 weeks of age. The feed cost per kg live weight gain was lowest in the ducks with 14% crude protein in the ration during 9-16 weeks of age compared to the ducks provided with the ration containing 16 or 18% crude protein.

Key words: Protein, mortality, carcass characteristics, biochemical parameter, time motion study, desi ducks

INTRODUCTION

There continues to be increased demand for animal protein to meet the nutritional requirements of growing population of humans (Joshi *et al*., 2014). Ducks are the second largest source of table eggs and there are about 23 millions ducks in India duck eggs have a preference over chicken eggs in certain States and areas due to its economic and nutritional importance. Compared to chicken ducks need less elaborate houses. They are hardy, more easily brooded and more resistant to common avian diseases. Considering importance and scope of ducks rearing, more research can be done by means of introduction of high yielding strains of birds associated with good

nutritional management to solve the ever expanding animal protein demand (Mohanty *et al*., 2015). Orissa is well known for its hot humid climate and poor economic condition of farmers having more than 60 inches annual rainfall and more riverbeds, which is suitable for duck rearing. Feed is an important and critical input for the poultry industry as it accounts for 60-70% of production cost (Singh *et al*., 2015). Maximum productive and reproductive efficiency can be obtained by feeding balanced ration according to their requirements, which varies with age and level of production of the ducks. An economic balanced duck ration is indirectly a matter of correcting deficiency and directly a matter of economic production. The nutritive value of protein of various feed ingredients directly depends upon the availability of critical amino acids. Therefore, a correct level of protein of high biological value in a ration is of prime importance for optimum economic performance. Further Jull (1977) opined that birds on high percent of protein diet attained maximum weight considerably earlier than those on a low percent protein diet. From the available literature, it is observed that very limited works have so far been done to access the nutrient requirement especially the level of protein requirement of desi ducks for different purposes. Therefore, an attempt has been made in the present study to find out the effect of different levels of protein with isocaloric starter ration (0-8 weeks) and grower ration (9-16 weeks) on mortality, carcass characteristics, biochemical parameters, time motion study and economics for different activities of duck rearing up to 16 weeks of age under hot and humid conditions of Orissa.

MATERIALS AND METHODS

The present study was carried out on 360 unsexed day-old ducklings (Desi) procured from the hatchery of Regional Center, CARI, Bhubaneswar distributed randomly into three treatment groups with three replicates in each group during brooding (0-8 weeks of age) by feeding 18, 20 or 22% crude protein respectively and growing periods (8-16 weeks of age) by feeding 14, 16 and 18% crude protein respectively to study the mortality, carcass characteristics, biochemical parameter, time motion study and economics. There were 9 pens, each having a floor area of 75 sq feet (13×5.6 feet) with 40 ducklings in each pen. The individual body weight of ducklings was recorded up to nearest 5 g after wing banding. Rice husk was used as litter. The starter and grower rations prepared in the Regional Center, CARI, were fed to the ducks during the experimental period. The birds were given wet mash from day old onwards to 8 weeks of age (Table 1) and from 9-16 weeks of age (Table 2). The feed and drinking water were supplied *ad lib* and necessary health care measures were adopted.

Biochemical parameters: To study the serum total protein and uric acid in the blood, samples were collected from different treatments with two ducks from each replicate on 8th week of age. The wing vein, present on the ventral surface of the humeral-radial ulnar joint directly beneath the skin, was punctured with a 23 gauze needle and blood samples were collected in sterilized, dry centrifuge tubes and then kept slanted. After 2 h, the tubes were kept in incubator at 37°C for 30 min and then centrifuged at 3000 rpm for 15 min to separate serum and the separated serum samples were preserved at -10°C for further analysis.

Estimation of serum total protein: The total protein of serum was determined by following the method described in the reagent kit supplied by CREST BIOSYSTEMS, a division of Coral Clinical System, Goa and expressed as g dL^{-1} (Biuret method).

Table 1: Composition of duckling ration (0-8 weeks)

	Parts per quintal		
Ingredients	T_1 (18%)	T_2 (20%)	T_3 (22%)
Wheat	53.00	56.00	60.00
Rice polish	17.50	15.00	10.50
DORB	12.00	6.00	0.00
Soya bean	11.00	14.50	20.00
Fish meal	3.00	5.00	6.00
Mineral mix (ISI)	2.50	2.50	2.50
Oyster shell	0.50	0.50	1.00
DCP	0.50	0.50	0.00
Total	100.00	100.00	100.00
Salt	0.18	0.18	0.18
DL-meth	0.05	0.05	0.05
Lysine	0.055	0.055	0.055
Vit. A, D, E, K	0.01	0.01	0.01
B Comp (Spectro Bee)	0.015	0.015	0.015
Toxin binder	0.10	0.10	0.10
ME (Calculated) kcal kg^{-1}	2728.00	2729.00	2727.00
CP (Estimated) %	18.14	20.07	22.03
Cost/kg feed (Rs)	18.18	19.35	20.52

Table 2: Composition of duck ration (9-16 weeks)

	Parts per quintal		
Ingredients	T_1 (14%)	T_2 (16%)	T_3 (18%)
Wheat	50.00	53.00	56.00
Rice polish	17.00	17.00	14.00
DORB	22.00	13.00	6.00
Soya bean	8.00	11.00	16.00
Fish meal	0.00	3.00	5.00
Mineral mix (ISI)	2.00	2.00	2.00
Oyster shell	0.50	0.50	0.50
DCP	0.50	0.50	0.50
Total	100.00	100.00	100.00
Salt	0.18	0.18	0.18
DL-meth	0.05	0.05	0.05
Lysine	0.055	0.055	0.055
Vit. A, D, E, K.	0.01	0.01	0.01
B Comp (Spectro Bee)	0.015	0.015	0.015
Toxin binder	0.10	0.10	0.10
ME (Calculated) kcal kg^{-1}	2606.00	2617.00	2636.00
CP (Estimated) %	14.22	16.08	18.28
Cost/kg feed (Rs)	16.56	18.00	19.40

Estimation of uric acid: The uric acid of serum was determined by following the method described in the reagent kit by CREST BIOSYSTEMS, a division of Coral Clinical System, Goa and expressed as mg dL^{-1} (Uricase/PAP method).

Time motion study for different activities of duck rearing: The observation on time required for different activities of rearing of ducklings under different treatment groups from morning to evening was recorded for all the groups at 1st week of age and then at 4 weeks interval till the end of the experiment (16 weeks). The observations were taken for two consecutive days and their mean was calculated. The observations on feeding of birds, watering, stirring/removal of litter material, collection of dead birds and cleaning of utensils were recorded.

Statistical analysis: The data were subjected to standard statistical analysis as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Mortality: The mortality of ducklings under different treatments is presented in Table 3. It was found that the mortality ranged from 6.67-8.33% during 0-8 weeks of age which was within the normal range indicating that the different levels of protein supplementation in the diet could not influence the health condition of the ducks. The mortality during 9-16 weeks period ranged from 1.67-3.33% which remained within the normal range. The present findings agree with the report of Panda and Mohapatra (1989) who observed the mortality of layer ducks during brooding (0-11 weeks) and growing (12-16 weeks) to be 10 and 5%, respectively. The present study does not agree with the report of Singh and Moudgal (1976) who observed more mortality of Pekin ducks in higher levels of crude protein or with Singh and Singh (1977) who reported that the mortality rate as a result of feeding low protein in ration during starting or growing period was generally higher as compared to normal feeding birds.

Carcass characteristics: The carcass characteristic of male desi ducks of 16 weeks of age under different treatments is presented in Table 4. The dressing percentage of the carcass ranged from 77.72-79.19% with a mean of 78.55%. The present finding is less than the report of Baruah *et al*. (1991) who reported 86.41% of dressed yield (%) in indigenous ducks of Assam at 12 weeks of age. There was no significant difference in the carcass traits with respect to dressing percentage, or percentages of giblet, blood loss, feather weight, inedible viscera and cut up parts between different treatments. The present findings are in agreement with those of Lai *et al*. (2003) who reported that there was no significant difference in proximate composition of breast meat, dressing percentage, abdominal fat and breast meat weight, when fed with dietary crude protein in Pekin ducks up to 10 weeks of age. Further Marion and Woodroof (1966) and Gowda *et al*. (1977) reported that varying protein levels did not influence dressing percentage in broiler chicken. On the contrary Jeroch *et al*. (1977) found that the meat yield in ducks could be improved by increasing the levels of protein in the ration. Further the present study indicated that in the male birds the blood loss, feather weight, inedible viscera and giblet expressed as percentage of live weight basis were 3.02,

Table 3: Effect of different treatments on mortality of ducks

Treatment number	Mortality % (0-8 weeks)	Mortality % (9-16 weeks)
1	8.33 (10/120)	3.33 (2/60)
2	7.50 (9/120)	1.67 (1/60)
3	6.67 (8/120)	1.67 (1/60)

Figures in the parenthesis represent number dead/total

Table 4: Carcass characteristics of male desi ducks under different treatments (16th week)

Characteristics	T_1 (14%)	T_2 (16%)	T_3 (18%)	Mean	Remark
Live wt. (g)	1173.33±48.08	1080.00±47.28	1180.66±51.01	1144.67±32.40	NS
Dressed wt. (g)	924.00±45.35	839.33±24.52	935.00±49.13	899.44±30.22	NS
Eviscerated wt. (g)	846.67±39.03	762.67±14.43	861.67±43.55	823.67±30.81	NS
Dressing (%)	78.75±0.91	77.72±1.30	79.19±1.15	78.55±0.43	NS
Blood loss (%)	2.95±0.47	3.21±0.30	2.91±0.28	3.02±0.09	NS
Feather wt. (%)	5.28±0.49	4.57±1.17	3.98±0.39	4.61±0.38	NS
Inedible viscera (%)	13.01±0.35	14.51±0.49	13.92±0.56	13.81±0.43	NS
Giblet (%)	6.59±0.54	7.09±0.63	6.21±0.35	6.63±0.25	NS
Neck (%)	11.89±0.60	11.49±1.11	12.65±0.91	12.01±0.34	NS
Wing (%)	20.24±1.25	20.59±1.28	21.32±0.59	20.71±0.32	NS
Breast (%)	24.25±0.45	25.17±1.12	23.02±1.09	24.15±0.62	NS
Back (%)	22.60±1.32	20.06±0.54	20.85±0.43	21.17±0.75	NS
Thigh (%)	7.99±0.70	8.44±0.72	7.20±0.06	7.87±0.32	NS
Drum stick (%)	9.76±0.38	9.83±0.39	9.40±0.27	9.67±0.13	NS
Cutting loss (%)	3.27±0.23	4.41±0.30	4.57±1.38	4.42±0.66	NS

Ns: Non significant

Table 5: Biochemical profile of blood in desi ducks at 8 weeks of age

	Treatments			
Parameters	T_1 (18%)	T_2 (20%)	T_3 (22%)	Remark
Total protein (g dL^{-1})	6.34±0.02	6.32±0.02	6.30±0.05	NS
Uric acid (mg dL^{-1})	9.37±0.74	9.04±0.67	7.70±0.17	NS

Ns: Non significant

4.61, 13.81 and 6.63%, respectively. In male birds the cut up parts such as neck, wing, breast, back, thigh, drum stick and cutting loss expressed as percentage of eviscerated weight were 12.01, 20.71, 24.15, 21.17, 7.87, 9.67 and 4.42%, respectively.

Biochemical parameter: The blood biochemical profile such as total protein and uric acid concentration are presented in Table 5.

The total protein content in the blood of 8 weeks old desi ducks ranged from 6.30 (T_3)-6.34 (T_1) g dL^{-1} under different treatments. The present value of total serum protein is higher than the report of Pitt *et al*. (1980) who reported a value of 5.94±0.10 g dL^{-1} in 8 months old laying White Pekin duck and the report of Levengood *et al*. (2000) who reported 4.7±0.1 g dL^{-1} in 6-8 months old Mallard ducks, but well within the normal range of 6-8 g dL^{-1} as per manual supplied in the kit by CREST BIOSYSTEM, a division of Coral Chemical System, Goa. This higher value but within normal range might be due to early age of the ducks (8 weeks). The impact of different levels of protein supplementation in the diet of desi ducks was found to be non significant with respect to total protein content of the blood under different treatments. In contrary to the present study Zavarey (1984) reported that nutritional factors mainly affected serum total protein and being higher in high protein diet. This contraindication might be due to difference in the utilization of level of protein.

There was no significant difference in the serum uric acid concentration (mg dL^{-1}) between different levels of protein supplementation in the diet. However, the value was lowest in T_3 with 22% protein (7.70 mg dL^{-1}) and highest in T_1 with 18% protein (9.37 mg dL^{-1}). Higher serum uric acid concentration in all the treatment groups than normal (3.4-7.0 mg dL^{-1} for male and 2.5-6.0 mg dL^{-1} for female) as per the instruction manual supplied in the kit by CREST BIOSYSTEM, a division of Coral Chemical System, Goa might be due to more intake of protein by the ducks which might have resulted in increased serum uric acid concentration.

Time motion study: The total times spent for different activities of duck rearing from 0-4, 5-8, 9-12 and 13-16 weeks of age were studied. During the period of 0-4 weeks of age, the total time required (man min/40 ducklings per day) was almost similar in all groups ranging from 10.1-10.4 min. The total time spent for rearing 40 ducks from 0-4 weeks of age, required 4.71-4.8 h man and during 5-8 weeks of age it was 4.94-5.27 h man. Similarly total time required to manage 20 ducks from 9-12 weeks of age ranged from 8.3-8.6 min man per day and it ranged from 7.9-8.0 min man per day during 13-16 weeks of age. More time required during growing might be due to less number of birds per pen. One laborer working for a period of 8 h man per day can manage 1864-1900 ducks of 0-4 weeks of age and 1699-1811 ducks of 5-8 weeks of age. On the other hand about 1100-1200 ducks of 9-16 weeks age can easily be managed by one laborer working for a period of 8 h man per day.

The result with respect to the time motion study for different activities of duck rearing could not be compared due to the scarcity of literature.

Table 6: Cost of feeding/kg live weight gain of duck during different phase of growth

Attributes	T_1	T_2	T_3	Remark
0-8 weeks period				
Cost of feed/kg (Rs)	18.18	19.35	20.52	
Feed intake per duck (g)	2541.45±29.94^A	2931.92±48.09^B	2945.70±58.64^B	**
Cost of feed consumed per duck (Rs)	46.19±0.55^A	56.71±0.93^B	60.43±1.19^C	**
Average body weight gain (g)	531.81±17.71^A	670.42±13.61^B	742.60±46.11^C	**
Feed cost/kg live weight gain (Rs)	87.35±2.83	84.65±1.79	81.37±4.89	NS
9-16 weeks period				
Cost of feed/kg (Rs)	16.56	18.00	19.40	
Feed intake per duck (g)	5523.04±50.99	5388.28±68.06	5611.67±59.01	NS
Cost of feed consumed per duck (Rs)	91.46±0.84^A	96.99±1.22^A	108.87±1.14^B	**
Average body weight gain (g)	555.74±37.71	493.96±16.46	493.25±12.67	NS
Feed cost/kg live weight gain (Rs)	165.56±8.44^A	196.61±3.95^B	220.90±4.05^C	**

Mean bearing different superscript in the same row differ significantly. **p≤0.01, Ns: Non significant

Economics: The cost of feeding per kg live weight gain of duck during different phases of growth is presented in Table 6. There was a significant difference ($p<0.01$) in the cost of feeding per duck during 0-8 weeks of age between different treatments ranging from Rs 46.19 (T_1)-60.43 (T_3). The feed cost per kg live weight gain was lowest in T_3 (Rs 81.37) followed by T_2 (Rs 84.65) and T_1 (Rs 87.35); although the differences were found to be non significant among different treatments. During 9-16 weeks period the cost of feed consumed per duck was significantly lower in T_1 (Rs 91.46) than T_3 (Rs 108.87). The cost of feeding per kg live weight gain was also significantly lowest ($p<0.01$) in T_1 (Rs 165.56) than T_2 (Rs 196.61) and T_3 (Rs 220.90) indicating superiority in the performance of the ducks of T_1 (14% crude protein) than T_2 (16% crude protein) and T_3 (18% crude protein).

CONCLUSION

The mortality of ducklings under different treatments ranged from 6.67-8.33% during 0-8 weeks of age and was within normal range indicating that the different levels of protein supplementation in the diet could not influence the health condition of the ducks. There was no significant difference in the carcass traits with respect to dressing percentage or percentage of giblet, blood loss, feather weight, inedible viscera and cutup parts between different treatments at 16 weeks of age. The protein content in the blood of 8 weeks old desi ducks ranged from 6.30-6.34 g dL^{-1} and were non significantly different within different treatments. The serum uric acid concentration (mg dL^{-1}) value was lowest in T_3 with 22% protein (7.70 mg dL^{-1}) and highest in T_1 with 18% protein (9.37 mg dL^{-1}). Further, the total time spent for rearing 40 ducks from 0-4 weeks of age, required 4.71-4.8 h man and during 5-8 weeks of age it was 4.94-5.27 h man. Similarly total time required to manage 20 ducks from 9-12 weeks of age ranged from 8.3-8.6 min man per day and it ranged from 7.9-8.0 min man per day during 13-16 weeks of age. On the other hand about 1100-1200 ducks of 9-16 weeks age can easily be managed by one laborer working for a period of 8 h man per day. The feed cost per kg live weight gain was lowest in the ducks provided with the ration containing 22% crude protein than 20 or 18% crude protein during 0-8 weeks. The feed cost per kg live weight gain was lowest in the ducks with 14% crude protein in the ration during 9-16 weeks of age compared to the ducks provided with the ration containing 16 or 18% crude protein.

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