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Effect of Rearing systems and Dietary protein levels on Growth performance of commercial desi chicken

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Abstract

A biological experiment was carried out to optimize the dietary crude protein level in commercial desi chicken (Aseel) from day old to 14 week of age. Three hundred and sixty number of one day old commercial desi chicks was randomly divided in to six treatment groups with three replicates of 20 chicks each per group. Out of this 180 desi chicks were reared under deep litter system and remaining 180 chicks were reared under cage system. The experimental birds were fed with three different levels of dietary crude protein (18, 20 and 22 per cent) with an isocaloric feed of 2800 Kcal ME / kg and potable water given ad libitum. Standard management practices were adopted throughout the experimental period in cage and deep litter system. Biweekly body weight, weight gain, feed consumption and livability were recorded. Feed conversion ratio was worked out Commercial desi chicken reared in cage system had significantly (P≤0.05) higher body weight, weight gain, feed consumption and better feed conversion ratio compared to birds reared under deep litter system. At 14th week of age, birds reared in cage and fed with 18 per cent dietary crude protein gave significantly (P≤0.05) higher body weight (1299.47 g), body weight gain (1267.27 g), feed consumption (3730.37 g) and better feed conversion ratio (2.94) compared to desi chicken reared in all other treatments. The livability of birds reared in cage system (90 per cent) was higher compared to those reared under deep litter system (87.7 per cent) and maximum in 18 per cent crude protein in cage (93.34 per cent) system.

Keywords*: commercial desi chicken, cage system, deep litter system, body weight*

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INTRODUCTION

Backyard chicken rearing is an old tradition in India. Among 72.22 per cent population living in rural areas, 89 per cent of rural livestock holders rear poultry as an important supplementary income source [1]. Indigenous chicken breeds of India are of importance due to their unique attributes like hardiness and tropical adaptability. India has 20 recognized indigenous poultry breeds and preference for indigenous chicken meat over commercial broiler is due to its characteristic flavour [2]. Market demand for commercial chicken is relatively high, but the supply is rather limited. Farmers before the advent of commercial native chicken were not interested in systematic production and no particular feeding and housing standards for native chicken was followed. However, there is a growing domestic market for native chicken in retail outlets with consumers willing to pay premium price for native chicken meat ([)] In India Aseel is one of the important native breed that is being reared in its native tract Andhra Pradesh for game and meat purposes. Aseel is recognized for its high stamina, majestic gait, disease tolerance and adaptability to adverse climatic conditions [4].This bird is the base for the population of commercial native chicken. These

chickens are being reared under intensive system, usually up to 12 weeks of age. Aseel chicken are slow grower [5] hence, the practice of providing them with standard chick starter (Broiler/layer) diet is neither economical nor suitable to achieve optimum growth performance. Previous studies with indigenous chicken of China had demonstrated that nutrient requirement of native breeds were different compared to those of commercial layer or broiler [6]. Also it has been reported that slow growing birds need lesser dietary crude protein for optimum performance. In this regard we want to know which system of rearing and how much dietary protein are required for that we did this experiment.

MATERIAL AND METHODS

Chicks were divided in to six treatments with three replicates of 20 birds in each i.e 60 birds in each treatment. First three treatments were reared in cages and remaining three on deep litter. Experiment was designed to study the effect of three different levels of dietary crude protein 18, 20 and 22 per cent with an isocaloric diet containing 2800 Kcal/kg ME on growth performance, all the experimental birds were wing banded and maintained under standard managemental conditions on deep litter and cages. Birds were fed *ad libitum* with known quantity of feed. Clean potable water was provided *ad libitum*.

Body weight and weight gain: Body weight of birds were recorded every two weeks of age up to 14 weeks in the morning before feeding by using electronic weighing balance with 0.1 g accuracy. Based on the day old weight, body weight gain was arrived at.

Feed consumption and feed efficiency: Birds were provided with *ad libitum* experimental feed (known weight) during the experimental period and at the end of each week, the left over feed was weighed back and net feed consumption was arrived, for each treatment. Feed efficiency was calculated biweekly up to 14 weeks of age.

Livability: Mortality among birds was recorded on its occurrence during the experimental period. The wing band number was noted and post mortem done to identify the cause of mortality.

Statistical analysis: All the data collected from the experiment were subjected to statistical analysis as per [7] to find out statistical significance between treatments in each rearing system, using MS-Excel and SPSS.

RESULT

Body weight: The body weight was significantly ($P<0.05$) heavier in 18 per cent crude protein fed birds in cage system than 20 and 22 per cent crude protein fed birds in cage and deep litter system. No significant difference observed in 2 week old body weight. At all protein levels the body weight was higher in cage than deep litter. 18 per cent protein has improved the body weight (1299.47 g) of commercial desi chicken than 20 or 22 per cent in cage (1200.38 and 1246.09 g). In deep litter system, the 14 week body weight recorded were 1179.33 g (18 per cent), 1189.53 g (20 per cent) and 1178.77 g (22 per cent). While the cage system maintained significantly higher body weight in 18 per cent protein fed birds than 20 or 22 per cent at 4, 6 and 8 week of age. Same trend was observed in deep litter system also.

Body weight gain

The results revealed a statistically significant ($P\leq0.05$) difference between treatments. Although at 2 week there was no significant difference in cumulative body weight gain of birds fed different levels of dietary crude protein, from 4 to 14 week there was a significant ($P\leq0.05$) difference. Highest cumulative body weight gain was recorded in birds fed with 18 per cent dietary crude protein compared to those fed with 20 and 22 per cent crude protein in diet. During 4^{th} week of age cumulative body weight gain of birds fed with 18 per cent of protein was comparable with those reared in cage and floor (139.99 g and 134.08 g). However, from 10 to 14 week of age the body weight gain in 18 and 22 per cent in cage and deep litter showed no significant difference, but in cage 20 per cent dietary crude protein fed commercial desi chicken recorded significantly low body weight gain.

Table 1-Influence of rearing systems and dietary protein levels on body weight (g) of commercial desi chicken (Mean ± S.E.)

Age in weeks	Cage			Deep litter		
	18	20	22	18	20	22
Day old^{NS}	32.21± 0.38	31.61±0.41	31.83± 0.41	31.04± 0.43	31.24± 0.39	31.76± 0.44
2 week^{NS}	71.01± 1.86	69.29±1.23	71.60± 1.53	72.88± 1.87	73.92± 1.50	70.74± 1.36
4week*	177.31^{a}± 4.02	150.86^{cd}± 3.18	160.96^{bc}± 4.19	165.01^{b}± 3.99	148.05^{d}± 3.27	144.44^{d}± 2.92
6week*	335.27^{a}± 6.69	294.19^{b}± 6.95	300.26^{b}± 7.70	284.66^{d}± 7.61	263.94^{c}± 6.60	251.63^{c}± 5.43
8week*	521.08^{a}± 11.96	433.30^{cd}± 9.02	455.80^{bc}± 10.85	431.96^{cd}± 13.06	469.90^{b}± 12.93	403.94^{d}± 10.38
10week*	788.91^{a}± 16.25	722.16^{bc}± 15.31	760.53^{ab}± 18.38	657.61^{d}± 20.05	680.03^{cd}± 17.81	658.62^{d}± 15.43
10week*	1068.36^{a}± 20.18	992.98^{bc}± 22.59	1038.20^{ab}± 21.66	955.59^{cd}± 26.90	958.59^{cd}± 23.12	924.24^{d}± 18.79
10week*	1299.47^{a}±27.93	1200.38^{b}±27.42	1246.09^{ab}± 23.94	1179.33^{b}± 33.89	1189.53^{b}± 28.41	1178.77^{b}± 24.09

Table 2- Influence of rearing systems and dietary crude protein levels on body weight gain (g) of commercial desi chicken (Mean ± S.E)

Age in weeks	Cage			Deep litter		
	18	20	22	18	20	22
2 week^{NS}	38.80^{ab}±1.70	37.68^{b}± 1.12	39.69^{ab}± 1.39	41.84^{ab}± 1.71	42.68^{a}± 1.43	38.98^{ab}± 1.27
4week*	139.19^{a}± 5.65	119.25^{cd}± .07	126.24^{bc}± 4.96	134.08^{ab}± 3.86	116.81^{cd}± 3.32	112.75^{d}± 2.90
6week*	303.12^{a}± 6.66	262.58^{b}± 6.99	268.36^{b}± 7.75	253.41^{b}± 7.67	227.62^{c}± 8.24	219.92^{c}± 5.49
8week*	488.94^{a}± 11.91	401.70^{cd}± 8.99	423.90^{bc}± 10.89	400.71^{cd}± 13.08	438.58^{b}± 13.02	372.14^{d}± 10.41
10week*	756.77^{a}± 16.21	690.56^{bc}± 15.30	714.81^{ab}± 22.70	626.42^{d}± 20.03	648.72^{cd}± 17.82	626.82^{d}± 15.49
12week*	1036.17 ^{a}± 20.11	961.25^{bc}± 22.56	987.02^{ab}± 28.62	924.41^{bc}± 26.91	927.28^{bc}± 23.17	892.45^{c}± 18.84
14week*	1267.27 ^{a}± 27.90	1148.01^{b}± 33.91	1191.05^{ab}± 32.93	1148.15^{b}± 33.90	1158.22^{b}± 28.47	46.97^{b}± 24.10

Feed consumption

Influence of rearing systems and varying levels of dietary crude protein on cumulative feed consumption of commercial desi chicken presented in table 9 and biweekly feed consumption depicted in graph fig.2. The results indicated a statistically significant (P≤0.05) difference between treatments. Commercial desi chicken reared in cage, fed 18 per cent dietary crude protein feed consumed significantly (P≤0.05) less feed (120.40 g) up to 2 weeks of age than all other protein levels in both system of rearing (140.33 to 144.17 g). However from 4 week to 14 weeks of age cage reared desi chicken fed with diet containing 18, 20 and 22 per cent protein consumed significantly (P≤0.05) more feed than birds reared in deep litter system. But from 6 weeks to 14 week of age 18 per cent diet fed birds in cage system consumed more feed than 20 or 22 per cent protein, significantly less in 10 and 14 week of age. At the end of experiment (14 week of age) cage reared birds consumed 3730.30 g feed, the highest in 18 per cent dietary protein, followed by 3719.71 g in 20 per cent and 3695.47 g in 22 per cent dietary protein compared to 3523.70 g the lowest in 18 per cent protein in deep litter, 3569.87 g in 20 per cent and 3532.50 g in 22 per cent protein diet fed birds reared in deep litter system. But in contrast commercial desi chicken reared in deep litter fed with 18 per cent protein consumed less feed than those fed with 20 or 22 per cent protein from 6 week to 14 week of age. Up to 14 week of age desi chicken in deep litter fed with 18 per cent protein diet consumed 206.67 g less than birds with same protein level reared in cage system.

Table 3- Influence of rearing systems and dietary crude protein levels on feed consumption (g) of commercial desi chicken (Mean ± S.E)

Age in weeks	Cage			Deep litter		
	18	**20**	**22**	**18**	**20**	**22**
2 week^{NS}	120.40^{c}± 0.88	144.11^{a}± 0.73	144.17^{a}± 1.29	144.00 ^{a}± 0.37	144.00 ^{a}± 0.37	140.33^{b}± 1.1
4week*	375.00^{b}± 1.74	377.77^{ab}± 1.42	382.60^{a}± 2.06	363.27^{c}± 0.17	360.33^{c}± 0.21	360.67^{c}± 2.93
6week*	741.03^{a}± 3.20	738.77^{a}± 1.59	739.33 ^{a}± 4.33	697.13^{b}± 0.88	704.07^{b}± 0.69	703.67^{b}± 2.23
8week*	1308.47^{a}± 4.11	1298.57^{b}± 2.35	1304.27^{a}± 5.08	1240.53^{d}± 1.77	1256.10^{c}± 0.75	1252.63^{c}± 1.68
10week*	1998.80^{a}± 4.53	1987.11^{b}± 2.33	1982.70^{b}± 6.13	1878.07^{d}± 0.06	1905.83^{c}± 1.16	1892.47^{d}± 2.61
12week*	2799.50^{a}± 6.46	2788.64^{a}± 1.85	2773.30^{b}± 6.73	2641.03^{d}± 0.65	2678.53^{c}± 0.88	2652.17^{d}± 1.66
14week*	3730.37^{a}± 4.65	3719.71^{b}± 1.89	3695.47^{c}± 5.74	3523.70^{e}± 3.43	3569.87^{d}± 0.64	3532.50^{e}± 0.07

Feed conversion ratio: The feed conversion ratio of commercial desi chicken reared in cage was improved than deep litter system in this study. The feed conversion ratio of desi chicken was poor up to 2 weeks of age in both the system ranging from 3.11 to 4.02 irrespective of dietary protein level, but subsequently improved. At 4 and 6 week of age the feed conversion ratio was significantly ($P<0.05$) better in desi birds fed 18 per cent crude protein in cage (2.58) and deep litter (2.71) than 20 per cent (3.18 in cage and 3.09 in deep litter) and 22 per cent dietary crude protein (2.97 in cage and 3.23 in deep litter). Same trend continued at 6 week of age also registering significantly ($P<0.05$) improved feed conversion ratio in cage with 18 per cent protein (2.41, the best) than 20 (2.87) and 22 per cent protein (2.78) and also than deep litter system in 18 per cent protein (2.75), 20 (3.02) and 22 per cent protein (3.26, the poorest) in this study. The feed conversion ratio was improved up to 6 weeks of age in both system and afterwards it declined. At 8 week feed conversion ratio though significantly different only 18 per cent protein in cage (2.67) and 20 per cent protein in deep litter (2.87) produced improvement. By 10 and 12 week of age, the feed conversion ratio improvement was significant in cage system, than deep litter system. The improved feed conversion ratio in desi chicken reared in cage and deep litter with 18, 20 or 22 per cent dietary protein was observed till 12 week of age in this study., since beyond 12 weeks up to 14 week of age the feed conversion ratio was similar in cage and deep litter system, the increased protein level resulted in poor feed conversion ratio especially in cage system. At 14 week of age the feed conversion ratio in 18, 20 or 22 per cent dietary crude protein fed birds recorded was 2.94, 3.18 and 3.05, whereas in deep litter the feed conversion ratio was 3.08, 3.09 and 3.09 in 18, 20 or 22 per cent protein respectively.

Table 4 - Influence of rearing systems and dietary crude protein levels on FCR of commercial desi chicken (Mean ± S.E)

Age in weeks	Cage			Deep litter		
	18	**20**	**22**	**18**	**20**	**22**
2 week^{NS}	3.11± 0.33	4.02± 0.39	3.65± 0.19	3.53± 0.41	3.39± 0.18	3.79± 0.42
4week*	2.58^{a}± 0.10	3.18^{c}± 0.10	2.97^{bc}± 0.10	2.71^{ab}± 0.01	3.09^{c}± 0.02	3.23^{c}± 0.19
6week*	2.41^{a}± 0.08	2.87^{bc}± 0.03	2.78^{bc}± 0.05	2.75^{b}± 0.11	3.02^{c}± 0.06	3.26^{d}± 0.09
8week*	2.67^{a}± 0.02	3.24^{bc}± 0.07	3.08^{abc}± 0.15	3.10^{abc}± 0.10	2.87^{ab}± 0.05	3.42^{c}± 0.24
10week*	2.62^{a}± 0.13	2.83^{abc}± 0.02	2.69^{ab}± 0.09	2.96^{bc}± 0.06	2.90^{abc}± 0.08	2.98^{c}± 0.08
12week*	2.70^{a}± 0.08	2.90^{ab}± 0.04	2.76^{a}± 0.04	2.86^{ab}± 0.08	2.89^{ab}± 0.04	2.98^{c}± 0.08
14week*	2.94± 0.04	3.18± 0.04	3.05± 0.03	3.08± 0.14	3.09± 0.01	3.09± 0.07

Livability

The livability was higher in cage than deep litter system. While 18 per cent protein fed birds, reared in cage recorded highest livability of 93.34 per cent, 22 per cent protein diet fed birds in deep litter recorded the lowest livability of 85.00 per cent in this study. As the occurrence of mortality was random and throughout the experimental period of 0 to 14 week, the influence of either system or rearing or dietary crude protein levels could not be attributed in this study.

Age in weeks	Cage			Deep litter		
	18	**20**	**22**	**18**	**20**	**22**
2 week^{NS}	100.00	100.00	98.34	100.00	100.00	100.00
4week*	98.34	100.00	95.00	100.00	96.67	95.00
6week*	98.34	98.34	93.34	98.34	91.67	91.67
8week*	98.34	96.67	90.00	96.67	91.67	90.00
10week*	98.34	96.67	90.00	95.00	90.00	90.00
12week*	96.67	93.34	88.40	93.34	88.40	88.40
14week*	93.34	90.00	86.70	91.67	86.70	85.00

DISCUSSION

Body weight and body weight gain: Experiment with commercial desi chicken reared in cage and deep litter, fed with 18, 20 and 22 per cent dietary crude protein has resulted in highest body weight and weight gain in cage system with 18 per cent protein diet than other protein levels and also deep litter s ystem. Similar results were obtained by (8) in Ugandan local chicken, wherein increasing 18 per cent protein decreased body weight and whereas (9) reported improved body weight gain in Bangladesh indigenous chicken by increasing protein level from 16 per cent and (10) also reported similar findings in Venda chicken. No significance difference in body weight and weight gain were reported in native chicken fed with different dietary protein and energy level as reported by (11), (12), (13) and (14). (15) recorded low growth performance in desi chicken fed 16 per cent crude protein than 19 per cent. (16) reported improved growth rate in Kenyan desi chicken by increasing protein level from 10 to 16 per cent. Increasing dietary protein level increased growth performance in native chicken reported by (12), (17), Kamran *et al.* (2008) and Hussein *et al.* (1996). The body weight and body weight gain obtained in this study in cage and deep litter system fed 18, 20 or 22 per cent dietary crude protein were higher when compared to earlier research at 8 week old 521.08 g in 18 per cent protein than reported by (12) 492 g. [17] recorded weight gain of 695.88 g up to 12 week of age with 24 per cent protein, whereas in this study with 22 per cent protein the weight gain were 1191.05 g in cage and 1146.97 g in deep litter. (19) recorded 476 to 402 g eighth week body weight in male and female Sudan local chicken in deep litter whereas it was ranging from 403.94 g to 521.08 g in this study. Wide variations recorded in body weight and weight gain of indigenous / local chicken throughout the world may be attributed to genetic makeup of the local birds and management offered.

Feed consumption and feed conversion ratio (FCR)

The results obtained in this study in commercial desi chicken reared in cage consumed significantly (P≤0.05) more feed than deep litter reared birds irrespective of protein levels. No significant difference in feed conversion ratio of non descript, hilly and naked neck chickens reared under deep litter system (20). The FCR recorded in deep litter system at 12 week of age in this study was 2.79, much better than 4.2 recorded by [21] in Ethopian native chicken under deep litter system. At 8 week of age [12] reported 2.8 FCR whereas in this study it was 3.00, while FCR of 2.81 at 8 week and 3.41 at 6 week of age obtained by (22). 8 week FCR obtained in this study in desi chicken on deep litter was 3.13, much better than 6.36 reported by (23).

livability of commercial desi chicken: Commercial desi chicken reared up to 14 week of age registered 90 per cent livability in cage system and 87.78 per cent in deep litter system in this study is almost in accordance with (24) who reported 90.15 per cent livability (9.85 per cent mortality) in Aseel, 96.28 per cent livability (3.72 per cent mortality) in Kadaknath and 91.72 per cent livability in Hazra (7.28 per cent mortality). Kalitha [*25*] reported highest

mortality of 17.83 per cent (82.17 per cent livability) in indigenous chicken of Assam under deep litter system up to 5 week of age, whereas the mortality in desi chicken up to 4 or 6 week of age was 2.22 per cent (97.78 per cent livability) in cage system and in deep litter it was 2.77 per cent (97.23 per cent livability) or 5.55 per cent (94.45 per cent livability).

CONCLUSION

This study showed that feed conversion ratio was worked out commercial desi chicken (Aseel) reared in cage system had significantly (P≤0.05) higher body weight, weight gain, feed consumption and better feed conversion ratio compared to birds reared under deep litter system. At 14th week of age, birds reared in cage and fed with 18 per cent dietary crude protein gave significantly (P≤0.05) higher body weight (1299.47 g), body weight gain (1267.27 g), feed consumption (3730.37 g) and better feed conversion ratio (2.94) compared to desi chicken reared in all other treatments. The livability of birds reared in cage system (90 per cent) was higher compared to those reared under deep litter system (87.7 per cent) and maximum in 18 per cent crude protein in cage (93.34 per cent) system.

Thus, it is concluded that growth performance of deshi chicken is better in cage system than deep litter at 18% crude protein level in the diet.

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