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Effect of Reduced Dietary Crude Protein with Balanced Limiting Amino Acids on Egg Weight and Reproductive Performance of Swarnadhara Layers

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Abstract

A study was conducted in Swarnadhara (SD) layers to find out the effect of reducing crude protein (CP) with supplementation of limiting amino acids to compensate the deficiency of CP. Egg weight and reproductive parameters such as fertility, hatchability, number of saleable chicks and day one old chick weight were studied in 240 SD layers in a completely randomized design in 5 treatments with 6 replications of 8 birds in each. The control diet (T1) was based on corn soy bean meal formulated with 16% CP and 2700 Kcal ME following the ICAR (2013) specifications recommended for improved native chicken breeds. The diets T2 to T5 were made isocaloric to control and composed with 15.5, 15.0, 14.5 and 14.0% CP, respectively. The levels of limiting amino acids namely methionine, lysine, threonine and tryptophan were met as that of control by adding synthetic preparation wherever necessary. Egg weight showed similar effects in all treatments at 32, 36 and 40 weeks of age. Reproductive parameters were recorded in four consecutive hatches and were statistically analyzed. Results showed similar performances in T1, T2, T3 and T5, but were different in T4 in terms of fertility, hatchability and number of saleable chicks. There was no significant difference in progeny chick weight among different treatment groups indicating amino acid supplementation supported equal performance in low CP diets in all the reproductive parameters.

Key Words: Swarnadhara layers, Dietary Crude Protein, Limiting amino acids, Egg weight, Reproductive performance

Introduction

Animal nutritionists all over the world are putting efforts to reduce the CP content of the feed in order to lower cost of formulated feed and to reduce the nitrogen excretion into the environment. Ospina-Rojas *et al*. (2012) reported that supplementation of synthetic amino acids in low CP diets is an effective method to reduce feed cost and minimize N_2 excretion in birds and swine. The recent environmental constraints have forced to base protein/amino acid feeding not only in terms of N retained in animal products, but also in terms of non-utilized fraction of N ingested (Applegate *et al*., 2008). There are reports indicating negative effects of reduction of CP content of broiler diets tried with different combination of essential and nonessential amino acid supplementation (Bregendahl *et al.,* 2002; Kamran *et al*., 2008), but reports on growth and reproductive parameters like fertility and hatchability in layers with low CP amino acid supplemented diets are few yet they have shown positive response in the trials supporting the global acceptance of low crude protein

(LCP). Kingori *et al*. (2010) reported that maternal dietary protein level had no effects on hatchability and chick weight in indigenous chicken breeds of Kenya. Although numerous studies on reduced CP diets in commercial layers are reported in the poultry nutrition research sector, there is little research regarding the supplementation of amino acids in low CP diets in Indian native improved breeds.

Swarnadhara (SD) is a backyard poultry strain developed and released by Veterinary College, KVAFSU, Bengaluru, and hence this study was undertaken to assess whether supplementing the deficiency of limiting amino acids in reduced CP diets can perform equally with control diet having no CP reduction in the peak production stage of Swarnadhara layers.

Material and Methods

The experiment was conducted in the Department of Poultry Science, Veterinary College, Bengaluru. A total of 240 Swarnadhara layers were distributed in a completely randomized design into five treatments with six replications of eight birds. Birds of 20 weeks age were randomly housed in 30 pens in deep litter system with one cock in each pen. The experimental period started from 28 weeks to 40 weeks dividing into three cycles of 28 days (4 weeks) each.

Diet Formulation

The treatments consisted of a control diet (T1) based on corn soy bean meal formulated with 16% CP and 2700 Kcal ME satisfying the ICAR (2013) requirements of first four limiting amino acids at the levels of Methionine-0.35%, Lysine-0.75%, Threonine-0.52%, and Tryptophan-0.16%. The other treatment diets T2 to T5 were made isocaloric to the control reducing CP content to 15.5, 15.0, 14.5 and 14.0 %, respectively, meeting the amino acid levels as that of control using synthetic amino acids, purchased from Quadragen Vethealth Pvt Ltd, Bengaluru.

Eggs were collected daily three times and marked according to replicates to assess the performance based on the treatments. All eggs collected replicate wise were individually weighed in electronic balance with 0.01 mg precision at the end of 32, 36 and 40 weeks of age. In the last cycle of 28 day, the eggs were collected for 10 days each, graded and set in an incubator. Candling was done on the 7^{th} and 18^{th} day and the eggs were transferred into a hatcher on the 18^{th} day. Harvesting of chicks was done on the 22^{nd} day. Dead in shells, pipped and weaklings were counted and separated. Quality chicks were counted for appearance, activity and down conditions replicate wise and individual chick hatch weights were recorded. Four hatches were taken in a similar way for assessing the various reproductive parameters.

Results and Discussion

Result on period wise egg weight depicted in Table 1 revealed that there were no significant differences among treatments in attaining optimum egg size during the peak production phase. This is contradictory to the finding of Ji *et al*. (2014) in which feeding Hyline W 36 layer strains with decreased-CP diets from 18% to 16% supplemented with AA resulted in lowered egg weight (P<0.01) during 21 to 28 wk, 29 to 34 wk, and the overall period, and similar were the findings of previous studies also (Novak *et al*., 2006; Keshavaraz and Austic, 2004). Leeson and Caston (1996) reported that egg weight was lower with diets containing 14.4% protein compared with 16.8% protein, although both diets had equal levels of Met and Lys. They attributed the lower egg weight to an inadequate level of total N. In contrast to this, feeding different levels of CP (16, 14, 12, and 10%), supplemented with synthetic lysine and methionine in order to maintain constant lysine and TSAA levels revealed that up to 2% reduction of CP dietary protein had no effect in egg weight (Lopez and Leeson, 1995). Results in the present study also agree with the finding that egg weight is not affected by 2% CP reduction because of the supplementation of limiting amino acids as that of control.

Statistical analysis on various reproductive parameters in different treatments revealed similar

Table 1: Results on egg weight and other reproductive parameters of Swarnadhara layers as influenced by reduced crude protein (CP) balanced with limiting amino acids (LAA)

Parameters	T1 (control) CP-16.0%	T2 CP-15.5%	T3 CP-15.0%	T4 CP-14.5%	T5 CP-14.0%
EW32 weeks (g)	58.63±0.86	58.22±0.77	57.60±0.81	57.03±0.74	57.60±0.71
EW36 weeks (g)	60.92±0.87	60.84±0.88	59.18±0.91	60.84±0.73	59.76±0.62
EW40 weeks (g)	62.58±0.95	63.73±0.85	61.97±0.72	62.79±0.97	61.52±0.72
Fertility (%)	95.82[a]	95.63[a]	94.12[ab]	91.95[b]	96.08[a]
Hatch on TES (%)	90.02±1.05[a]	88.09±2.06[a]	87.51±.1.56[a]	81.07±.1.67[b]	89.57±1.29[a]
Hatch on FES (%)	94.08±0.63[a]	92.24±1.18[a]	93.57±0.98[a]	88.24±0.99[b]	93.73±0.94[a]
Saleable chicks (%)	93.45±0.70[a]	91.76±1.22[a]	93.17±1.06[a]	87.44±1.11[b]	93.38±0.98[a]
Progeny chick wt (g)	47.11±0.40	44.02±0.43	42.39±0.39	42.60±0.40	42.5±0.38

Means in a row bearing at least one common superscript do not differ significantly (*P* **e"** 0.05).

EW- Egg Weight; TES- Total Eggs Set; FES- Fertile Eggs Set.

results (P> 0.05) in T1, T2, T3 and T5 groups indicating that the crude protein reduction of 2% from control diet did not affect the fertility percentage in the group, at the same time the birds under group T4 (1.5% CP reduction) was performing inferior to all other groups in the pooled data. The reason for not performing equally to the other groups is not exactly known, may be because of the cocks with low fertility potential housed in those replicate pens. In the fertility factor, the performance of T3 was comparable with T4 though it was numerically higher. Since the semen quality of individual cocks was not ascertained prior to housing, the fertility level could not be estimated. However, the difference cannot be attributed to the dietetic factor, since 2% reduction of CP with supplementation of limiting amino acids supported the same performance level as that of control indicating the amino acid levels are adequate to obtain similar results as that of control on hatchability on total eggs set, % hatchability on fertile eggs set and number of saleable chicks. These results are in agreement with the findings of Lopez and Leeson (1995), Hocking *et al.* (2002) and Kingori *et al.* (2010). Since the fertility and hatchability rates of T4 group were significantly lower, it invariably resulted in lower performances in other related parameters also.

In the study by Lopez and Leeson (1995), eggs from birds fed 10 and 12% CP were consistently smaller (*P*<0.01), and this resulted in reduced chick weight at hatching but birds which consumed reduced CP up to 2% performed equally as that of control. The results of this study on day one progeny chick weight under different treatments showed that there is no significant difference between any of the treatments (P>0.05) indicating that CP reduction upto 2% with supplementation of limiting amino acids in the breeder diet will not affect the chick hatch weight in the peak production phase, i.e., 36-40 weeks of age in Swarnadhara layers agreeing to the results of previous studies.

Since the recent findings on low CP diets are not widely followed in India with improved native chicken breeds, this study puts more emphasis on the improvement of nutritional standards of Indian crossbreds meeting the limiting as well as essential amino acids requirements in the diet rather than the CP levels.

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Conflict of Interest: All authors declare no conflict of interest.

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