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Effect of Supplementation of Black Soybean on Production Parameters in White leghorn Layers

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Abstract: *Black soybean is traditionally grown in hill area of Uttarakhand to meet protein requirement of local people. This experiment was conducted to study effect of supplementation of black soybean on production parameters in poultry layers. Hundred (20 weeks age) layers were selected for conducting feeding trial for 12 weeks in completely randomized design .Layers were divided into five treatment groups viz T_1: control;T_2:0.2% raw black soybean;T_3 0.2%germinated black soybean;T_4:0.2% roasted black soybean and T_5:0.2% cow urine treated black soybean supplemented groups. Production parameters were studied in three different phases, viz. Phase I (20-24 weeks), Phase II (25-28 weeks) and Phase III (29-32 weeks).Highest Egg Production was recorded in T_5. Highly significant ($P<0.01$) difference was observed in feed intake in phase II, III and overall phase. Significant differences ($P<0.05$) was observed among different treatment groups in egg production in phase III and feed intake in phase I. It was concluded that black soybean @ 0.2% can be recommended for improving egg production in poultry layers.*

Keywords: *black soybean, production performance, white leghorn*

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I. Introduction

Enormous efforts have been carried out for the progress of poultry sector in India[1]. Our country ranks third in egg production (88 million in 2016) after China and USA. The annual growth rate of egg production is 6-8%. India accounts for 4.95% of world's egg production. Incorporation of local feed ingredients has shown to reduce total feed cost. Active principles in the feed further help in increasing health status of poultry bird. Black soybean is used in hill region of Uttarakhand by local people but its use in poultry diet still remains unrecognized. Black soybean is rich in macro and micronutrients and can be used as feed ingredient for poultry diet formulation. They are grown mainly in the kharif season (month of June) and are ready to harvest by the month of October. It is an excellent meat substitute. It has medicinal properties as it contains anthocyanins and isoflavones which act as natural antioxidants and also help in managing diseases like beriberi, lockjaw etc. The anthocyanins in black soybean seed coats have an anti-obesity effect, which can reverse the effects of high fat diet (HFD) on body weight, adipose tissue weight and serum lipid contents [2].In this study scope of incorporating black soybean in diet of poultry layers has been tried to increase egg production.

II. Materials And Methods

In order to study effect of supplementation of black soybean on production performance hundred layers(20 weeks age)belonging to same hatch were selected from Instructional Poultry Farm, Nagla, College of Veterinary and Animal Sciences, Pantnagar (Uttarakhand) for feeding trial which was conducted in completely randomized design. All the birds were individually weighed and randomly allocated into 5 treatment groups each with two replicates of 10 laying hens each. Feed used for experimental layer was per BIS specification[3]. Black soybean was collected from the market of Haldwani. Black soybean was divided into 4 groups and then treated individually. The group T_1 served as control in which feed was provided with no supplementation of black soybean while T_2, T_3, T_4 and T_5 were the treated groups in which raw black soybean, germinated black soybean, roasted black soybean and cow urine treated black soybean was added respectively in ground form at 2g/kg to layer ration. The experimental birds from different treatment groups were reared in individual cages in California cage system under similar housing and managemental conditions.16 hours light was provided to the birds during the experimental period.

Daily egg production was recorded cage wise and divided by total number of hens available in the cage during the experimental period in the group. Eggs were collected twice in a day. Data on daily egg production was summarized and divided into three phases, the first phase was between 20^{th}-24^{th} weeks, second phase was

25^{th}-28^{th} weeks and the third phase lasted during 29^{th}-32^{th} weeks. Hen housed egg production was calculated by the given formula:

$$\text{Egg production (\%)} = \frac{\text{Number of eggs laid in replicate}}{\text{Number of hens in replicate}} \times 100$$

Daily record of experimental feed offered to different groups was maintained. Left over feed was weighed daily and feed intake in different groups was enumerated by subtracting the weight of left over feed from the weight of total feed provided to each group.

Total number of eggs produced in two weeks and feed consumed in two weeks were recorded. Feed conversion ratio was calculated from feed intake and egg production data as below:

$$\text{Feed conversion ratio} = \frac{\text{Feed consumed in g}}{\text{Dozen eggs}}$$

All birds were weighed individually from each group fortnightly and average value of body weight gain under each treatment group was then calculated**.** Proximate analysis of feed ,egg and faeces was done using AOAC[4]**.**All the statistical analysis was done with the help of SPSS procedure and the data obtained during the experiment was further evaluated using one way analysis of variance (ANOVA)[5] .

III. Results And Discussion

The chemical composition of experimental diets fed to layers is presented in Table 1. The dry matter contents of layer diet in treatment groups T_1, T_2, T_3, T_4 and T_5 were 89.38, 89.08, 89.00, 89.18 and 89.45 percent, respectively. The crude protein content of layer diet of different treatment groups T_1, T_2, T_3, T_4 and T_5 was 20.82, 22.17, 22.09, 22.47 and 22.67 percent, respectively. The Crude Protein % of T_1 group differed significantly ($P\leq0.05$) from T_4 and T_5 group, while non-significant difference was found between T_1, T_2 and T_3; T_2, T_3 and T_4; T_2, T_3, T_4 and T_5.The ether extract of layer diet of different treatment groups T_1, T_2, T_3, T_4 and T_5 was 3.12, 3.01, 2.49, 3.50 and 2.69 percent, respectively. The ether extract of T_4 group differed significantly ($P\leq0.05$) from T_2, T_3, T_5 and that of T_3 from T_1, T_2 and T_4. The ash content of layer diet of different treatment groups T_1, T_2, T_3, T_4 and T_5 was 16.37, 15.95, 16.80, 18.28 and 18.67 percent, respectively. Ash content of T_4 and T_5 differed significantly ($P\leq0.05$) from T_1, T_2 and T_3. No significant difference was found among different experimental diets in terms of Dry Matter and Crude Fibre%.

Table no.1: Proximate composition of experimental diets

	T_1 (Control)	T_2 (0.2% RBS)	T_3 (0.2% GBS)	T_4 (0.2% RoBS)	T_5 (0.2% CUTBS)	SEm	P value (0.05)
Dry matter (%)	89.38±0.39	89.08±0.31	89.00±0.25	89.18±0.44	89.45±0.48	0.142	0.900
Crude protein (%)**	20.82^{b}±0.18	22.17^{ab}±0.60	22.09^{ab}±0.39	22.47^{a}±0.27	22.67^{a}±0.24	0.248	0.086
Ether extract (%)*	3.12^{ab}±0.17	3.01^{bc}±0.01	2.49^{d}±0.17	3.50^{a}±0.05	2.69^{cd}±0.03	0.122	0.009
Ash (%)*	16.37^{bc}±0.04	15.95^{c}±0.01	16.80^{b}±0.01	18.28^{a}±0.01	18.67^{a}±0.48	0.364	0.001
Crude fibre (%)	5.59±0.08	5.64±0.05	5.52±0.01	5.57±0.05	5.59±0.02	0.020	0.665

Means bearing different superscript in a row differ significantly ($P\leq0.05$)

The average egg production of laying hens during phase I, II, III and overall periods are depicted in Table 2. The average egg production in various treatments during phase I, phase II and overall phase were non-significantly different from each other while significant difference ($P<0.05$) was found in phase III. The average egg production during phase I (20-24 weeks) in groups T_1, T_2, T_3, T_4 and T_5 was 15.53, 18.69, 17.85, 17.62 and 19.64 per cent respectively with maximum egg production recorded in T_5 (19.64 per cent) group and minimum in control group (15.53 per cent).The average egg production during phase II (25-28 weeks) of different groups were 51.13, 50.05, 51.84, 55.30 and 54.16 per cent, respectively with maximum egg production recorded in T_4 (55.30)) group and minimum in T_2 (50.05per cent) group of laying hens. The average egg production during phase III (29-32 weeks) in treatment groups T_1, T_2, T_3, T_4 and T_5 were 78.21, 77.56, 78.86, 80.12 and 82.56 % respectively. Maximum average egg production was observed in the cow urine treated black soybean group T_5 (82.56 per cent) while minimum egg production was observed in the group T_2 (77.56 per cent). Significant ($P\leq0.05$) differences were observed between T_5 and T_2, T_1 and T_5 and also between T_4 and T_5, whereas non-

significant differences were observed between T_1, T_2 and T_3; T_1, T_3 and T_4.The average egg production during overall period (20-32 weeks) was 48.29, 48.76, 49.51, 51.01 and 52.12 per cent in groups T_1, T_2, T_3, T_4 and T_5 respectively. The maximum egg production during the overall feeding trial was observed in cow urine treated black soybean incorporated group i.e.T_5 (52.12 per cent) and the lowest value was obtained in control group i.e. T_1 (48.29 per cent) group.

Table no 2: Mean ± S.E. of production performance of hens during experimental period

	Period	T_1	T_2	T_3	T_4	T_5
Egg production (%)	Phase I	15.53±4.11	18.69±1.54	17.85±2.38	17.62±0.95	19.64±0.59
	Phase II	51.13±0.65	50.05±0.65	51.84±2.91	55.30±1.13	54.16±1.79
	Phase III *	78.21^{bc}±0.35	77.56^{c}±0.29	78.86^{bc}±0.89	80.12^{b}±0.59	82.56^{a}±0.18
	Overall	**48.29±1.70**	**48.76±0.20**	**49.51±1.47**	**51.01±0.89**	**52.12±0.45**
Feed intake (g)	Phase I *	70.83^{a}±1.03	65.78^{b}±0.13	63.14^{b}±0.73	61.99^{b}±0.99	71.33^{a}±2.40
	Phase II **	90.55^{a}±0.30	80.56^{c}±0.25	76.54^{d}±0.22	77.19^{d}±0.26	86.26^{b}±0.07
	Phase III **	87.47^{b}±0.52	86.97^{b}±0.77	85.71^{b}±0.41	83.88^{c}±0.26	94.51^{a}±0.37
	Overall **	**82.95^{a}±0.61**	**77.77^{b}±0.30**	**75.13^{c}±0.30**	**74.35^{c}±0.33**	**84.03^{a}±0.94**
FCR	Phase I	5.48±1.16	4.12±0.67	4.16±0.68	4.57±0.12	4.16±0.13
	Phase II	1.92±0.16	1.81±0.25	1.79±0.04	1.96±0.17	1.77±0.07
	Phase III	1.28±0.01	1.13±0.05	1.08±0.04	1.30±0.12	1.23±0.06
	Overall	**2.89±0.43**	**2.35±0.32**	**2.34±0.23**	**2.61±0.05**	**2.38±0.01**
Body weight gain (g)	overall	43.82±6.11	39.47±2.39	36.92±2.76	33.76±8.73	25.02±11.92

Means bearing different superscript in a row differ significantly (P≤0.05)

The result of the present investigation thus suggests that supplementation of cow urine treated black soybean causes increase in egg production. Bhadauria reported that urine is not a toxic base product[6]. 95% of urine is water, 2.5% consist of urea and the remaining 2.5% is a mixture of minerals, salt, hormones and enzymes. Similar results have been reported by Garg *et al.* [7]. Cow urine has capabilities to potentiate the egg production of the birds and it can be used as a feed additive for layer birds in order to get good quality eggs. The lowest egg production was recorded in the group fed raw black soybean which is similar to the findings of Petričević *et al.* who reported that the share of raw soybean grains in the mixtures significantly reduces the number of eggs laid[8].

The average feed consumption of laying hens during phase I, II, III and overall period are presented in Table 2. Significant differences (P≤0.05) were noted in all the three phases including the overall phase (20-32 weeks).The feed consumption in phase I was significantly different in treated groups. The T_5 group differed significantly (P≤0.05) with T_2, T_3, T_4, whereas no significant difference was observed among group T_2, T_3 and T_4 and also between T_1 and T_5. The average feed consumption during phase I in T_1, T_2, T_3, T_4 and T_5 groups were 70.83±1.03, 65.78±0.13, 63.14±0.73, 61.99±0.99 and 71.33±2.40g respectively. Mean feed intake of T_4 was minimum (61.99 g) and maximum value was obtained in T_5 (71.33 g) group of laying hens. In phase II highly significant differences in feed consumption were observed between T_1, T_2, T_3, T_4 and T_5 but no significant difference was found between T_3 and T_4. The mean values of feed intake during phase II were 90.55, 80.56, 76.54, 77.19 and 86.26 gm respectively. The minimum mean value of feed intake was noted in group T_3 (76.54 g) and maximum in T_1 (90.55 g) group. In phase III group T_1, T_2 and T_3 differed non significantly whereas highly significant difference was observed between the group T_4 and T_5. The mean values of feed intake during phase III were 87.47, 86.97, 85.71, 83.88 and 94.51g respectively. The maximum mean value was observed in T_5 group (94.51g) and minimum in T_4 (83.88 g) group of laying hens. In phase III highly significant differences were observed between the group T_5 and T_1, T_2, T_3, and T_4. The mean values of feed intake for overall period were 82.95, 77.77, 75.13, 74.35 and 84.03 g respectively. The highest feed intake was recorded in T_5 group (84.03g) with minimum recorded in T_4 group (74.35g) of laying hens. Non-significant differences were found between T_1 and T_5 and also between T_3 and T_4. Increased feed intake in T_5 was noted throughout trial which has also been reported by Garg *et al.*[9].

The lowest feed intake was recorded in the group fed roasted black soybean which goes with the study of Leeson *et al.* who concluded that birds fed toasted soybeans consumed less feed in the 0 to 21 days starter period[10]. It also goes with the study of Senkoylu *et al.* who reported that laying hens receiving the FFSB (Full Fat Soybean) diets showed significantly less feed intake than those of control diet[11]. In contrast to our result, Odiba reported that soybean seed meal toasted for 30 minutes increased the feed intake[12].

The feed conversion ratio of various treatment groups are presented in Table 2. The average feed conversion ratio of laying hens during phase I were recorded as 5.48±1.16, 4.12, 4.16, 4.57and 4.16 in T_1, T_2, T_3, T_4 and T_5 groups respectively. The average FCR values during phases II and III in T_1, T_2, T_3, T_4 and T_5 were

1.92, 1.81, 1.79, 1.96, 1.77 and 1.28, 1.13, 1.08, 1.30, 1.23 respectively. The average FCR values of T_1, T_2, T_3, T_4 and T_5 during the entire course of study were 2.89, 2.35, 2.34, 2.61 and 2.38 respectively. The average FCR values of T_1 (2.86) was highest whereas minimum FCR was recorded in T_3 (2.34) group. Sese and Berepubo, have also reported non-significant difference in feed conversion in rabbits due to incorporation of raw soybean in diet.[13]

The overall body weight gain of different treatment groups are depicted in Table 2. The body weight gain in various groups T_1, T_2, T_3, T_4 and T_5 were 43.82, 39.47, 36.92, 33.76 and 25.02. The body weight gain differed non-significantly ($P \geq 0.05$) among various treatment groups. Similar to our results, Leeson and Atteh reported non-significant effects on weight gain in broiler chicks in soybean treated groups[14].

IV. Conclusion

Black soybean can be included in diet of poultry layers @ 0.2% to increase egg production. The supplementation of treated black soybean has effect on feed intake, egg production and feed conversion ratio in layers. Further research may be conducted to study other effects of treatment on black soybean to include in diet of other animals as unconventional feed.

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