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Effect of Supplementing Eucalyptus (*Eucalyptus globulus*) Leaf Powder on Average Weekly Feed Intake and Egg production of Commercial Laying Hens

MANVEEN KAUR[1], RUKKIYA SIDDIQUI[2], RIPUSUDAN KUMAR[1], B.C. MONDAL[1] and MEESAM RAZA[4]*

Department of Animal Nutrition, College of Veterinary and Animal Sciences, GB Pant University of Agriculture and Technology, Pantnagar- 263145, US Nagar, (Uttarakhand), India

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ABSTRACT

The present experiment was designed to study the effect of dietary incorporation of eucalyptus leaf powder on the average weekly feed intake and egg production of commercial laying hens. A 12-week feeding experiment was conducted on 72 White Leghorn laying chickens of 28 weeks of age. Hens were randomly assigned to one of four treatment groups, each having 18 birds and three replicates of six birds. Four treatments were included as a control (T_1): basal diet, (T_2): Incorporation of 0.3% eucalyptus leaf powder in the basal diet containing phytase, (T_3): Incorporation of 0.45% eucalyptus leaf powder in the basal diet containing phytase, (T_4): incorporation of 0. 6% eucalyptus leaf powder in the basal diet containing phytase. Daily feed intake and egg production were recorded. The results revealed that Supplementing Eucalyptus (*Eucalyptus Globulus*) Leaf powder did not affect the cumulative performance of laying hens in terms of feed intake and egg production ($P>0.05$). Based on the above findings, it was determined that adding 0.3 percent eucalyptus leaf powder to the basal diet containing phytase improves egg production. Furthermore, because Eucalyptus leaves can be procured at no cost, their incorporation is cost-effective and can help reduce feed expenditures.

Key words: Egg production, Eucalyptus leaf powder, Feed intake, Laying hens, Performance

Poultry is one of the most well-organized and fastest-growing agricultural sectors in India. In terms of structure and operation, it has undergone a paradigm change. Poultry production has evolved from a simple household/backyard pastime to a full-fledged industry as a result of the rising demand for poultry products. India has the highest rate of poultry growth at 10%, followed by Brazil at 7 percent, the United States at 2.1 percent, and China at 2 percent. According to the 20th Livestock Census, India produces 88.139 billion eggs, ranking third in the world. The majority of egg production (about 75%) comes from commercial poultry farms, with the remainder coming from household/backyard fowl. In India, the layer market grows at a pace of 6-7 percent per year, whereas the broiler market grows at an annual rate of 8-10 percent. According to the National Institute of Nutrition, per capita egg and meat consumption should be 180 eggs and 11 kg meat per year, however actual consumption is 71 eggs and 4.1 kg of meat per year. As a result, India's poultry industry has a lot of scope for growth. To meet this increased demand, poultry producers must attain high production efficiency while remaining sustainable. Most producers supplement poultry rations with one or more natural additives as a safe and inexpensive alternative source and an acceptable way to increase production performance[7]. These additives are made up of a wide range of

1. Dept. of Animal Nutrition, CoVAS, GBPUAT, Pantnagar
2. Division of Animal Nutrition, IVRI, Izzatnagar
3. Dept. of LPM, CSKHPKV, Palampur
4. Dept. of LPM, CoVAS, GBPUAT, Pantnagar

* Corresponding author: rukkiya1995@gmail.com

components, the majority of which are extracts from plant materials such as flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits, and roots[6]. Furthermore, phytogenic active components may help in poultry digestion and promote immunity[15]. They also have antibacterial, antiviral, anti-oxidant, and immunostimulatory properties [2,9,12,23].

Eucalyptus (*Eucalyptus globulus*) is the most extensively grown evergreen tree in subtropical and Mediterranean regions. The flowering tree *Eucalyptus globulus* belongs to the Myrtaceae family. It can be grown in a wide range of climatic and environmental circumstances; however the best recognised ideal conditions are in countries with a warmer climates. It contains various significant chemicals such as p-cymene, 1, 8-cineole, -phellandrene, spathulenol, cryptone aldehydes, cuminal, phellandral, and -phellandrene, which have antibacterial, anti-inflammatory, and antioxidative activities [4]. Eucalyptus leaves also contain essential oils as well as other chemicals like tannin and citronol. Eucalyptol (1,8-cineole) is a terpene oxide that is utilised as a flavouring agent in food products and is the main constituent of eucalyptus essential oil (EEO) [11]. [17]indicated antibacterial activity of *Eucalyptus globules* against pathogens such as *Salmonella*, *Klebsiella* sp, *Streptococcus* A, *Proteus* sp., and *Staphylococcus aureus.* Furthermore, *Eucalyptus globulus* leaves are used as an astringent in the form of cigarettes to treat asthma. [10] discovered that Eucalyptus species, particularly *Eucalyptus globules*, had antibacterial properties against *E. coli*. Because of the phytoconstituents borneol, linalool, cineol, geranyl acetate, anethol, and saffrol, *E. globulus* oil has anthelmintic potential. [22] observed that intradermal delivery of essential oils from the leaves of Eucalyptus hybrid and seeds of Seseli indicum increased cutaneous capillary permeability in Evan's blue-treated rabbits. This has a positive impact on their wound-healing abilities.

However, studies to evaluate the effect of Eucalyptus leaf powder on growth performance and egg production of laying hens are very limited. In this view, the present experiment was designed to study the effect of dietary incorporation of eucalyptus leaf powder on the average weekly feed intake and egg production of commercial laying hens.

MATERIALS AND METHODS

Procurement and processing of feed additives: The requisite amounts of Eucalyptus (*Eucalyptus globulus*) leaves were obtained from CRC, Pantnagar. It was air-dried in shade followed by drying in hot air oven at the temperature of 60º C for 3-4 days and using a laboratory mill finely ground to powder and stored in closed and dry container.

Experimental design and treatments: The trials were conducted on 72 white leghorn laying hens at the Instructional Poultry Farm, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar. All the hens were individually weighed and assigned to one of four treatment groups, each with three replicates of 6 hens. A completely randomised design (CRD) was used in the research trial. A feeding trial of 12 weeks duration was conducted on White Leghorn laying hens. Seventy -two white leghorn laying hens were randomly distributed into four treatment groups with 18 hens per treatment having three replicates of 6 birds in each. Four treatments were included as a control (T_1): basal diet, (T_2): Incorporation of 0.3% eucalyptus leaf powder in basal diet containing phytase, (T_3): Incorporation of 0.45% eucalyptus leaf powder in the basal diet containing phytase, (T_4): incorporation of 0. 6% eucalyptus leaf powder in the basal diet containing phytase. Daily feed intake, body weight gain and the effect of dietary treatments on nutrient retention, egg production and egg quality were recorded. The experiment was carried out in strict conformity with the guidelines of 'The Institutional Animal Ethics Committee (IAEC)', GBPUAT, Pantnagar, India.

Group	No. of birds	Description
T_1	18 (3 replicates)	Basal diet (control)
T_2	18 (3 replicates)	Incorporation of 0.3% eucalyptus leaf powder in the basal diet
T_3	18 (3 replicates)	Incorporation of 0.45% eucalyptus leaf powder in the basal diet
T_4	18 (3 replicates)	Incorporation of 0.6% eucalyptus leaf powder in the basal diet

Housing and Management: During the feeding trial, the birds were housed in a deep litter system with good management standards. Before being assigned to each treatment group, the birds were individually weighed and wing banded for identification. During the experiment, enough light, temperature, and ventilation were maintained at the facility for 24 hours. The hens were given *ad libitum* feed and fresh water as well as proper ventilation with no dust in the environment throughout the experiment. During the experiment, all of the birds had access to clean, fresh drinking water in appropriate troughs. Individual bird body weight and residual feed were measured fortnightly and at the end of every week in replicates respectively. The management conditions were the same for different treatment groups.

Experimental diet: Standard basal diets for laying hens were formulated by combining ingredients to suit the nutrient requirements of the birds as recommended by [5]. The [3] technique was used to determine the proximate composition of the experiment feed. Table 1 shows the approximate ingredient makeup of standard laying bird basal diets.

Feed intake: Record of feed provided to different groups was recorded daily whereas left over feed was weighed and recorded weekly. During the experimental feeding period, the feed intake in various groups was estimated by subtracting the weight of left-over feed from the weight of the total feed supplied each week.

Egg production: Egg production in all the replicates of each treatment group was recorded daily for 12 weeks. Eggs were collected twice a day, in the morning and evening, in all replicates of each treatment group. Each treatment group's

Table 1: Parts composition of ingredients of basal diets used for experimental White Leghorn laying hens.

Ingredients	Percent
Yellow Maize	57
Deoiled Rice bran	6.5
Rice polish	4.5
Groundnut cake-solvent extracted	09
Soybean meal	18
Marble powder	03
Dicalcium Phosphate	01
DL- methionine	0.15
Choline Chloride	0.10
Mineral mixture	0.10
Common salt	0.40
Hepatocare	0.10
Vitamin Premix	0.10
Toxin binder	0.05
Total	**100**

Phytase enzyme added in all treatments @250 FTU/kg feed

weekly average egg production was reported. The following formulae were used to calculate the egg production % for each treatment group, replicate wise:

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

Statistical methods: The statistical analysis of the experimental data obtained in this study was performed using the general linear model approach of the SPSS software [24]. Duncan's Multiple Range Test was used to compare the differences between treatment means [18].

RESULTS AND DISCUSSION

Chemical composition: Eucalyptus leaf powder contains 7.88% crude protein (CP), 7.88% ether extract (EE), 15.78% crude fibre (CF), 4.36% total ash and 67.03 % nitrogen-free extract (NFE) on dry matter basis as shown in Table 2. According to BIS (2007) a basal diet was formulated for White Leghorn laying hens to meet their nutritional needs. Table 3 shows the chemical composition of the experimental diet provided to the laying hens. The proximate analysis of the meal was carried out using standard methods [3]. In terms of crude protein and crude fibre content, the experimental diets for laying hens in the layers phase were almost identical to the [5] standards.

Average weekly feed intake: The data on the weekly average feed intake of laying hens of different groups fed experimental diets are presented in Table 4. It was observed that the T_1 treatment showed significantly higher values whereas T_2 and T_3 were found to show significantly lower values in average feed intake during the first week of the experimental period. The average feed intake during 2nd week showed that hens fed control and diet containing 0.6% eucalyptus leaf powder were significantly higher than the group fed diet containing 0.3 and 0.45 % eucalyptus leaf powder. During 3rd week, the average feed intake was significantly ($P<0.05$) improved in the control (109.82 g) and hens fed the basal diet supplemented with 0.6% eucalyptus leaf in T_4 (109.94 g) group compared with T_3(107.37 g) group. The average feed intake in 4th week was significantly ($P<0.05$) higher in treatment group T_1(110.56 g) compared to treatment group T_3(107.72 g). No significant differences were observed among treatment groups from the 5th to 10th week. During the 11th week, the average feed intake in T_2 and T_3 treatment group was significantly lower ($P\leq0.05$) from the T_1 group. Overall, eucalyptus leaf powder supplementation did not have any adverse effect on the feed intake of laying hens. The above results are as per the findings of **[8]** who found no statistical differences in feed consumption of laying hens on adding polyphenols obtained from eucalyptus leaves. Similarly, there were no differences in feed intake (FI) between all groups fed eucalyptus leaf powder and eucalyptus oil in broiler chicken [20,21]**.** The incorporation of eucalyptus leaves did not affect the feed intake and FCR of Japanese quail [13]**.** Also, there was no effect seen on FCR when the diet of rabbit was supplemented with varied levels of eucalyptus [14].

On the contrary**, [19]** found that feed consumption decreased significantly in laying hens fed a diet containing eucalyptus leaf powder and improved the FCR significantly. Similarly, [25] reported a decrease in feed consumption by growing white rabbits when their diet incorporated with dried eucalyptus leaves and its aqueous extract thus improving FCR. [1] found higher feed consumption by growing rabbits when diet supplemented with eucalyptus leaves as the presence of volatile oil improves palatability.

Egg production per cent: The weekly average egg production of White Leghorn laying hens is depicted in Table 5. The average egg production during the 1st, 2nd and 3rd weeks was not significant ($P\geq0.05$). However, during the fourth week significantly ($P<0.05$) higher egg production was observed in the T_2 group compared to the T_1, T_3 and T_4 treatment groups of dietary supplementation of eucalyptus leaf powder. The average egg production during the

Table 2: Chemical composition of Eucalyptus (*Eucalyptus globulus*) leaf powder (% on dry matter basis)

Nutrients (%)	Eucalyptus leaf powder
Crude Protein	7.88
Crude Fibre	15.78
Ether extract	7.88
Ash	4.36
Nitrogen free extract	67.03

Table 3: Chemical composition of the diet (% on dry matter basis) of different treatment groups fed to laying hens during the experimental period

Particulars	Treatments/Groups			
	T_1	T_2	T_3	T_4
	Basal diet (control)	Basal diet+0.3% Eucalyptus leaf powder	Basal diet+0.45% Eucalyptus leaf powder	Basal diet+0.6% Eucalyptus leaf powder
Crude Protein	17.92	17.77	17.63	17.87
Ether extract	3.82	3.80	3.86	3.83
Crude Fibre	4.21	4.49	4.51	4.52
Ash	8.02	8.03	8.09	8.07
Nitrogen free extract	66.15	65.86	65.89	65.69

5th to 8th week, did not show any significant difference (P≥0.05) among different treatment groups due to dietary supplementation of eucalyptus leaf powder. Significantly (P<0.05) higher egg production was observed in the T_2 group (88.09 %) compared to the T_4 (74.60%) group among the treatment groups of dietary supplementations of eucalyptus leaf powder during the 9th week. The average egg production in the 11th week significantly (P<0.05) higher in the T_2 (92.05%) group, compared to T_4 (77.77 %) due to dietary supplementation of different levels of eucalyptus leaf powder in the diet. Overall egg production was significantly improved in groups fed 0.3% eucalyptus leaf powder.

The results are relevant to a study by [19] who reported significantly higher egg production by laying hens on supplementing eucalyptus leaf powder in their diet. [8] also showed that polyphenols in eucalyptus leaves increase significantly egg laying rate when supplemented in the diet of laying hens. Similarly, egg number significantly increased upon adding eucalyptus leaf powder to the diet of Japanese quail[16].

CONCLUSION

Based on the above findings, it was determined that adding 0.3 percent eucalyptus leaf powder to the basal diet containing phytase improves egg production without adversely affecting the feed intake in White Leghorn laying hens. Furthermore, since Eucalyptus leaves can be procured at no cost, their incorporation is cost-effective and can help reduce feed expenditures.

Table 4: Weekly average feed intake (in gm) of White Leghorn laying hens fed diet supplemented with Eucalyptus leaf powder

Period (week)	Treatments/Groups				SE_m	CD at 5%
	T_1	T_2	T_3	T_4		
	Basal diet (control)	Basal diet+0.3% Eucalyptus leaf powder	Basal diet+0.45% Eucalyptus leaf powder	Basal diet+0.6% Eucalyptus leaf powder		
1	110.37±0.14^{a}	107.55±0.69^{b}	107.83±0.53^{b}	109.31±0.37^{ab}	0.48	1.60
2	109.62±0.54^{a}	107.28±0.79^{b}	107.34±0.54^{b}	109.31±0.29^{a}	0.57	1.89
3	109.82±1.39^{a}	107.57±1.72^{ab}	107.37±0.84^{b}	109.94±0.74^{a}	0.71	2.34
4	110.56±1.62^{a}	108.09±1.15^{ab}	107.72±0.56^{b}	109.10±0.66^{ab}	0.62	2.07
5	110.04±0.38	107.34±1.98	107.29±0.60	109.65±0.66	1.10	3.56
6	109.41±0.42	107.58±2.12	107.34±0.14	109.11±0.35	1.09	3.56
7	109.93±0.17	107.41±1.93	107.32±0.37	109.20±0.28	0.99	3.24
8	109.06±0.24	107.59±1.89	107.28±0.38	109.59±0.59	1.01	3.30
9	110.01±1.39	106.80±1.18	107.44±0.44	110.05±0.11	0.94	3.07
10	110.63±1.15	107.01±1.80	107.75±0.36	109.08±0.29	1.09	3.56
11	110.29±0.12^{a}	107.50±1.43^{b}	107.68±0.50^{b}	108.89±0.12^{ab}	0.76	2.49
12	111.03±0.46^{a}	106.86±1.72^{b}	106.41±0.18^{b}	108.91±0.22^{ab}	0.90	2.98
Overall	**110.04±0.13**	**107.16±1.60**	**107.75±0.30**	**109.15±0.42**	**0.85**	**2.79**

Note: Mean values bearing different superscripts in a row differ significantly, (P≤0.05)

Table 5: Weekly average egg production percent of White Leghorn laying hens fed diet supplemented with Eucalyptus leaf powder during the experimental period

Period (week)	Treatments/Groups				SE_m	CD at 5%
	T_1	T_2	T_3	T_4		
	Basal diet (control	Basal diet+0.3% Eucalyptus leaf powder	Basal diet+0.45% Eucalyptus leaf powder	Basal diet+0.6% Eucalyptus leaf powder		
1	58.01±2.07	61.90±3.64	61.90±3.63	56.34±2.86	3.12	10.15
2	62.69±1.58	60.31±2.86	60.31±0.79	56.34±1.58	1.86	6.05
3	67.48±3.48	65.08±2.86	62.69±1.58	58.72±2.09	2.61	8.49
4	57.93±2.09^{b}	66.66±1.37^{a}	58.72±2.86^{b}	56.35±2.09^{b}	2.17	7.19
5	65.86±3.45	74.60±1.58	68.24±2.09	70.63±4.20	3.02	9.83
6	80.95±2.38	80.93±1.37	72.22±3.45	71.42±6.29	3.84	12.51
7	66.66±1.37	79.36±3.46	72.21±4.20	73.03±6.91	4.45	14.48
8	67.45±4.42	80.15±2.86	67.47±2.87	69.85±4.20	4.45	14.48
9	83.33±3.63^{ab}	88.09±3.64^{a}	80.95±2.38^{ab}	74.60±4.19^{b}	3.52	11.47
10	78.57±2.74^{b}	92.85±1.37^{a}	80.95±1.37^{ab}	73.01±6.78^{b}	3.78	12.53
11	80.95±1.37^{ab}	92.05±1.58^{a}	82.53±1.58^{ab}	77.77±6.78^{b}	3.63	11.83
12	88.09±5.98	84.91±2.09	83.33±3.63	76.98±5.55	4.59	14.93
Overall	**66.82±0.73^{b}**	**72.00±1.03^{a}**	**66.20±0.95^{b}**	**63.39±1.70^{b}**	**1.16**	**3.84**

Note: Mean values bearing different superscripts in a row differ significantly, (P≤0.05)

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