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Effect of Supplementation of Ashwagandha (*Withania somnifera*) Root Powder on Body Weight Gain and Egg Quality in Layers

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: As the demand for natural and sustainable solutions in poultry production continues to rise, ashwagandha root powder presents itself as a promising avenue for improving egg quality while aligning with consumer preferences for wholesome and nutritious products. Therefore, research trial was conducted to study the effect of supplementation of ashwagandha root powder on body weight gain and egg quality in layers during a period of 10 weeks.
Methodology: One hundred and twenty White Leghorn layers were randomly divided into four treatments and reared on standard managemental conditions. The Ashwagandha root powder was supplemented with the basal diet at 0.5% level (T_1), 1% (T_2), 1.5 % (T_3) while T_0 was kept as control i.e**.** basal diet without ashwagandha root powder. The feed and water were offered ad libitum to experimental birds.
Design used: The design of the experiment was a completely randomized design. Duncans multiple range test was used to determine significant difference among means for different treatments.
Results: The result noted that the body weight change was not affected by ashwagandha root powder supplementation. Egg quality parameters *viz*., egg shape index, shell weight, yolk weight, yolk height, albumen weight and albumen index were not influenced by the addition of ashwagandha root powder. However, a significant ($p<0.05$) effect was observed on yolk index. No significant ($p>0.05$) difference was seen in the sensory attributes of the egg. It may be suggested that inclusion of ashwagandha root powder in the diets of layer can be improve yolk index without affecting sensory attributes of eggs in layer.

Keywords: Layers; egg quality; yolk index; Withania somnifera; sensory evaluation.

1. INTRODUCTION

In recent years, utilization of herbal feed additives in poultry has been growing to enhance the health and productivity of birds. Among these, ashwagandha (*Withania somnifera*) has gained attention for its potential benefits in improving egg quality in layer hens. Ashwagandha, also known as Indian ginseng or winter cherry, is an adaptogenic herb renowned in traditional Ayurvedic medicine for its various health-promoting properties. Ashwagandha contains bioactive compounds such as withanolides (witanopherin A, withanolides A-Y, witanone), alkaloids (somnin, witanin, anaferin and somniferinin), flavonoids (3-O-rutinoside, quercetin), organic acid and its glycosidic derivatives. [1,2] which possess antioxidant, anti-bacterial, anti-inflammatory and immunomodulatory properties [3,4,5]. Ashwagandha is contains mineral such as Ca, Cd, Al, K, Mn, Fe, Ni, Cu and Zn. Moreover, it also contains crude fiber (21-25 %), starch (6.09-9.46 mg/g), tannins (0.39-0.82), reducing and non-reducing sugars [6]. These compounds are believed to contribute to ashwagandha's potential to positively impact on production performance and egg quality in layers [7]. Understanding the effects of ashwagandha on layer egg quality is not only pertinent to the poultry industry's quest for sustainable and natural solutions but also holds significance for consumers who prioritize the nutritional quality of eggs. Therefore, we delve into the effect of supplementation of Ashwagandha (*Withania somnifera*) root powder on body weight gain and egg quality in layers.

2. MATERIALS AND METHODS

The study was conducted at Poultry unit, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar (Maharashtra). The research trial was carried out on 120 white leghorn layers of 40 weeks of age for period of 10 weeks (40-50 weeks) and randomly assigned into four treatment groups. Four treatments include T_0 (control): fed basal diet; T_1: fed basal diet incorporated with 0.5 percent ashwagandha root powder; T_2: fed basal diet incorporated with 1 percent ashwagandha root powder; T_3: fed basal diet incorporated with 1.5 percent ashwagandha root powder. The basal diet of laying hens was formulated as per BIS (2007). The laying hens were kept in cages under identical management condition during experimental period. Feeding and watering was done in identical feeders and waterers specified for the cage system. The hens under all treatment groups had ad-libitum access to feed and water throughout the experimental period. To calculate body weight gain of birds initial and final body weights of the

laying hens were recorded. After every two weeks of experiment, 30 eggs were collected randomly from each dietary treatment groups for studies egg quality parameters with respect to shape index, shell weight, egg specific gravity, albumen index and yolk index. The maximum length and maximum width or breadth of egg was measured by vernier calliper and shape index was expressed as the ratio of the maximum width and a maximum length of eggs in percentage.

$$Shape\ index\ = \frac{Width\ of\ egg\ in\ mm}{Length\ of\ egg\ in\ mm} X\ 100$$

The weight of shell along with shell membrane was measured in grams on an electronic balance after proper drying of egg shell. Specific gravity was tested using the floatation method [8]. Yolk and albumen were separated with a separating spoon and weighed with an electronic balance in grams. The length of albumen and yolk diameter was measured with the help of Vernier Calliper in millimetres. The height of yolk and albumen were recorded with spherometer. Albumen index was measured using formula,

$$Albumin\ index = \frac{Average\ height\ of\ albumin\ in\ mm}{Albumin\ width\ of\ albumin\ in\ mm} X\ 100$$

Yolk index was calculated using following formula [9].

$$Yolk\ index = \frac{Height\ of\ yolk\ in\ mm}{Diameter\ of\ yolk\ in\ mm} X\ 100$$

At the end of study, eggs were evaluated for different sensory attributes. Eggs were placed in potable water and boiled by bringing the water to a boil and then kept simmering for 12 min. After boiling, eggs were allowed to cool in water for few min. Cooled eggs then shelled and cut into four pieces along the major axis. Samples were coded with random number and presented randomly to the panellists. Organoleptic evaluation was done using nine-point hedonic scale with 9 for like extremely and 1 for dislike extremely.

2.1 Statistical Analysis

The data obtained on various egg quality parameters during experiment were statistically analyzed using Completely Randomized Design (CRD) as per procedure described by [10]. The significant differences among the means were tested with Duncan's multiple range test [11].

3. RESULTS AND DISCUSSION

3.1 Effect on Body Weight Gain

The average body weight gain in T_0, T_1, T_2 and T_3 treatment groups were presented in Table 1. The average values of body weight changes of laying hens were 52.06, 51.51, 51.14 and 52.20 gm in T_0, T_1, T_2 and T_3 treatments, respectively. There was no significant difference ($p>0.05$) was recorded in the gain in body weight of white leghorn layers in different treatment groups. The results of body weight gain are similar with the findings [7] noted that there is no significant effect of ashwagandha root powder supplementation at 0.25, 0.50, 0.75 and 1.00 per cent on gain in body weight in laying hens. There was no significant difference in body weight gain between the groups on addition of ashwagandha and Nigella sativa powder at 0.5 % level in diets [12].

3.2 Effect of Feeding Ashwagandha root Powder on Egg Quality Parameters of White Leghorn layers

The mean values of egg shape index, egg shell weight and specific gravity were depicted in Table 2. Numerically higher average egg shape index was reported in group T_2 (1 % ARP) followed by T_3, T_1 and T_0 however, the statistical analysis revealed no significant differences ($p>0.05$) in all treatment groups over entire period of experiment. The results are in close agreement [4] examined egg shape index were not significantly differ between treatment groups.

Table 1. Body weight changes of layers

Treatment	Initial Body weight	Final Body weight	Body Weight Gain
T_0	1307.77	1359.83	52.06
T_1	1307.06	1358.57	51.51
T_2	1312.63	1363.77	51.14
T_3	1312.03	1364.23	52.20

Table 2. Effect of ashwagandha root powder on external egg qualities of white leghorn layers

	Weeks	Treatment				SE (±)	CD @ 5 %
		T_0	T_1	T_2	T_3		
Egg Shape index (%)	40-42 Weeks	73.34	75.33	76.97	73.97	0.81	NS
	42-44 Weeks	73.84	74.94	75.94	74.73	0.71	NS
	44-46 Weeks	71.76	73.91	74.25	73.60	0.91	NS
	46-48 Weeks	72.62	75.75	77.37	75.82	1.08	NS
	48-50 Weeks	72.90	74.62	75.23	74.72	0.61	NS
Shell weight (g)	40-42 Weeks	6.15	6.28	6.34	6.36	0.10	NS
	42-44 Weeks	6.29	6.23	6.41	6.33	0.15	NS
	44-46 Weeks	6.25	6.31	6.36	6.28	0.17	NS
	46-48 Weeks	6.42	6.34	6.30	6.35	0.13	NS
	48-50 Weeks	6.33	6.37	6.45	6.35	0.10	NS
Specific gravity	40-42 Weeks	1.089	1.088	1.090	1.086	0.0011	NS
	42-44 Weeks	1.090	1.091	1.085	1.087	0.0018	NS
	44-46 Weeks	1.091	1.088	1.088	1.090	0.0012	NS
	46-48 Weeks	1.088	1.089	1.090	1.089	0.0011	NS
	48-50 Weeks	1.091	1.088	1.085	1.090	0.0020	NS

The mean values in same row with different superscripts (a, b and c) differ significantly (p< 0.05).
SE: Standard error; CD: Critical Difference; NS: Non-Significant

Table 3. Effect of ashwagandha root powder on egg yolk height, width and index of white leghorn layers

	Weeks	Treatment				SE (±)	CD @ 5 %
		T_0	T_1	T_2	T_3		
Yolk height (mm)	40-42 Weeks	17.96	17.88	17.64	17.88	0.30	NS
	42-44 Weeks	18.19	17.94	18.51	18.15	0.25	NS
	44-46 Weeks	18.49	18.38	18.82	18.59	0.26	NS
	46-48 Weeks	17.85	18.39	18.47	17.92	0.28	NS
	48-50 Weeks	18.01^{b}	18.26^{b}	19.12^{a}	18.61^{ab}	0.19	0.60
Yolk diameter (mm)	40-42 Weeks	36.32	38.81	40.19	39.92	1.18	NS
	42-44 Weeks	39.64	38.38	40.34	40.14	0.89	NS
	44-46 Weeks	39.25	38.54	39.61	39.15	0.44	NS
	46-48 Weeks	37.74	38.65	38.67	37.88	0.69	NS
	48-50 Weeks	39.15	37.45	39.49	39.71	0.78	NS
Yolk index (%)	40-42 Weeks	46.50	45.84	44.92	46.52	0.77	NS
	42-44 Weeks	47.69	46.92	45.83	45.33	1.38	NS
	44-46 Weeks	46.98^{b}	47.58^{a}	48.03^{a}	47.78^{a}	0.18	0.60
	46-48 Weeks	48.14^{b}	48.63^{ab}	49.05^{a}	48.89^{a}	0.20	0.65
	48-50 Weeks	46.11^{b}	47.03^{b}	48.52^{a}	46.91^{b}	0.33	1.06

The mean values in same row with different superscripts (a, b and c) differ significantly (p< 0.05)
SE: Standard error; CD: Critical Difference; NS: Non-Significant

Statistical analysis of data on shell weight was shown in Table (2) were noted no significant difference (p>0.05) among the treatment throughout the trial period. Adding of herbal extracts of garlic, thyme and caraway to drinking water of quails were no significant effect on shell weight [13]. The Uttara layers fed 1gm, 2gm and 4gm/kg arjun bark powder produced eggs with unchanged egg shape index and shell weight [14]. Regarding egg specific gravity values, no significant differences (p>0.05) were found in all treatment groups throughout the experimental period. These results are parallel to the findings of [15] who noticed that specific gravity was not significantly affected by feeding of turmeric powder at 0.0, 0.50, 1.0, 1.5 and 2.0 g/kg of feed to the laying hens.

From Table 3, it can be revealed that during 40 to 48 weeks of age, different levels of ashwagandha root powder showed non-significant effect on yolk height (YH). During the fifth biweekly (48-50 weeks) of experiment, T_2 (1 % ashwagandha root powder) had significantly

($p<0.05$) higher yolk height as compared with T_3, T_1 and T_0 (control) groups. Concerning yolk diameter, no significant differences were observed among treatments throughout the experimental trial (Table 3). Our results corroborate well with those of [16] pointing out yolk height did not significantly change by inclusion of plant extracts to the bird's diet.

During 40 -44 biweekly of age, yolk index was not affected on inclusion of ashwagandha root powder in the basal diet of layer. However, from III biweekly (44-46 weeks) onwards of experiment surprisingly observed a significant ($p<0.05$) difference in the yolk index of eggs of white leghorn layers. At 44-48 of bird age, T_2 group had significantly ($P<0.05$) higher yolk index as compared to other treated groups. Significantly ($p<0.05$) superior yolk index was observed in treatment T_2 (1 % ARP) than in the T_1 (0.5% ARP), T_3 (1.5 % ARP) and T_0 (Control) groups between 48- 50 weeks of experimental trial. Similar findings were noted [17] on feeding *Withania somnifera* roots in powdered form in diet of heat stressed Japanese quails. As yolk index is ratio of the height and diameter of the yolk so, an improvement in yolk index could be due to numerically high values of yolk height and yolk diameter as recorded. The increased diameter and height of the yolk indicated that more vitellogenin might be synthesized by hepatocytes and deposited in the ovarian follicles [18].

Biweekly data pertaining to albumen weight, height and albumen index are set out in Table 4. The average albumen height and albumen index did not differ significantly among treatment groups during progressive weeks of age of white leghorn layers as well as with respect to whole period. Results are in agreement [7] who discovered that albumen index had not been affected significantly due to dietary supplementation of ARP. Also, [17] examined *Withania somnifera* supplements had non-significant effect on albumen height.

Data related to albumen weight of eggs of white leghorn layers are represented in Table 4. It was notified that the difference in albumen weight was non-significant during different weeks of age during period of trial except at beginning of experiment. At first bi-weekly (40-42 weeks) of experiment, significant difference observed in albumen weight. The mean significant higher value was observed in T_3 (35.22 g) treatment group followed by T_1 (34.39), T_2 (33.86) and T_0 (32.67), respectively. It can be concluded; dietary supplementation of ashwagandha root powder at different levels had no effect on the albumen weight. The findings of study were parallel with [19] demonstrated albumen weight and albumen index did not significantly affect on addition of *Withania somnifera* to Japanese quail ration. Additionally, [20] determined that egg albumin index had not influenced on the addition of *Withania somnifera* and *Emblica officinalis* to feed in laying hens.

Table 4. Effect of ashwagandha root powder on egg albumen height, weight and albumen index of white leghorn layers

	Weeks	Treatment				SE (±)	CD @ 5%
		T_0	T_1	T_2	T_3		
Albumen height (mm)	40-42 Weeks	7.25	7.53	7.54	7.73	0.28	NS
	42-44 Weeks	7.60	7.96	7.75	7.80	0.24	NS
	44-46 Weeks	7.61	7.83	8.06	7.50	0.28	NS
	46-48 Weeks	7.65	7.76	7.80	7.87	0.14	NS
	48-50 Weeks	7.29	7.73	7.40	7.23	0.37	NS
Albumen weight (g)	40-42 Weeks	32.67^{c}	34.39^{ab}	33.86^{bc}	35.22^{a}	0.39	1.27
	42-44 Weeks	35.04	33.05	32.80	32.75	0.87	NS
	44-46 Weeks	34.42	32.85	33.58	33.26	0.78	NS
	46-48 Weeks	33.09	33.76	34.15	33.94	1.19	NS
	48-50 Weeks	33.95	34.08	33.38	34.30	0.84	NS
Albumen index (%)	40-42 Weeks	12.19	13.33	12.79	12.57	0.65	NS
	42-44 Weeks	12.16	12.67	12.07	11.58	0.47	NS
	44-46 Weeks	12.69	12.61	12.98	12.51	0.41	NS
	46-48 Weeks	13.12	13.60	12.93	13.07	0.70	NS
	48-50 Weeks	11.41	12.55	11.57	11.18	0.60	NS

The mean values in same row with different superscripts (a, b and c) differ significantly ($p< 0.05$)
SE: Standard error; CD: Critical Difference; NS: Non-Significant

Table 5. Effect of dietary supplementation of ashwagandha root powder on sensory score of eggs

Treatments	Sensory evaluation of Eggs			
	Appearance & Colour	**Flavour**	**Aroma**	**Overall acceptability**
T_0	7.89	7.89	8.07	7.95
T_1	7.83	8.04	8.06	7.98
T_2	7.84	7.99	7.98	7.93
T_3	7.80	8.02	7.81	7.88
SE (±)	0.12	0.09	0.08	0.06
CD @ 5 %	NS	NS	NS	NS

SE: Standard error; CD: Critical Difference; NS: Non-Significant

3.3 Sensory Evaluation of Eggs

Regarding sensory attributes of eggs sample *viz*., their appearance & colour**,** flavour, aroma and overall acceptability showed in Table 5. It was observed that there was no significant distinction in appearance & colour**,** flavour, aroma and overall acceptability of eggs among the treatment groups of white leghorn layers fed diets supplemented with Ashwagandha root powder at different levels. Likely, [21] revealed that addition of Phyto herbal feed additives at levels 4, 8 and 12 gm per kg in laying hens' diet didn't impact on egg aroma, flavour and all eggs were accepted by panelists. Inclusion of herbal feed additives with feed in laying hens did not affect on organoleptic parameters of eggs [22].

4. CONCLUSION

In conclusion, the present results showed that supplementation of ashwagandha root powder in the diets of layer as herbal feed additives leads to significant improvement in yolk index without affecting egg shape index, shell weight, albumen index and sensory characteristics of eggs.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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