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# Influence of supplementing ashwagandha (*Withania somnifera*) root powder in the dietary regimen of layers on production performance: A review

**Sandeep Kumar, Ramsawroop and Ravi Kumar**

**Abstract**
Over the last few years, the global poultry industry has seen a lot of ups and downs to meet expanding demand. On the other hand, in recent years, there has been a significant growth in both public demand and scientific interest in organic poultry production, notably feeding with medicinal herbs. The herb Ashwagandha (*Withania somnifera*) is well-known for its numerous health benefits. The plant's principal active ingredients are steroidal alkaloids and lactones. Adaptogenic, liver-tonic, anti-carcinogenic antioxidant, immunological modulator, immuneadjuvant, anti-depressant and anti-metastatic are some of its qualities. Feed intake, body weight gain, feed conversion ratio, haematological profile, immunological status, neuroprotective, rejuvenate muscles, lipid profile, gut microbiota, and intestinal morphometry all improves when Ashwagandha is added to the diet of poultry birds. Birds fed a meal supplemented with Ashwagandha at various levels enhanced feed intake, body weight, feed efficiency, and nutrient metabolizability over time.

**Keywords:** ashwagandha, poultry, production, metabolizability

## Introduction
Poultry farming is an important component of the agricultural sector worldwide. Modern intensive poultry production has achieved phenomenal gains in the efficient and economical production of high quality and safe chicken meat, eggs and poultry by-products. At the same time as making gains in production and efficiency, the industry has to maximize the health and well-being of the birds and minimize the impact of the industry on the environment. The use of feed additives has been an important part of achieving this success. Common feed additives used in poultry diets include antimicrobials, antioxidants, emulsifiers, binders, pH control agents, phytobiotics and enzymes. The discovery of the growth promoting property of antibiotics led to their use as antibiotic feed additives (AFAs) in animal feed at sub-therapeutic doses. Although this has been beneficial for animal health and productivity, it has been, essentially, a double-edged sword. The continued and non-judicious use of AFAs has led to the selection and dissemination of antibiotic-resistant strains of poultry pathogens such as Salmonella, Campylobacter and Escherichia coli. The rapid spread of drug-resistant pathogens as well as emergence of antibiotic-related environmental pollutants is of global concern (Suresh *et al*., 2018) [35]. In order to find substitutes for AFAs, different natural additives have been evaluated (Sethiya, 2016) [30]. Currently, such alternatives are the addition of phytobiotics in poultry diets. Phytobiotics are natural growth promoters, which have been growing in popularity as feed additives, due to their beneficial effect on gut health and immunity and growth performance. Various herbs contain growth promoter, antimicrobial, coccidiostats, antioxidants, enzymes, hormones, probiotics, buffers; organic acids and mould inhibitors and thus can be used as feed additive. Herbal preparations are widely used as feed additives for enhancing growth, reducing feed cost by improving feed conversion ratio and for building better immunity in broiler production (Biswas *et al*., 2012 and Pandey *et al*., 2013) [11, 22]. Furthermore, these herbal feed additives have no side effects on the health of birds and increase the performance of broiler by increasing live weight gain, feed conversion ratio (Samarth *et al*., 2002) [27] and immunity (Bhardwaj *et al*., 2011 and Kumari *et al*., 2012) [9, 15]. Realizing this, a number of herbs have been identified for their use as feed additive including Ashwagandha which in turn may improve the performance of birds.
*Withania somnifera*, commonly known as Ashwagandha, Indian ginseng, poison gooseberry, or winter cherry is a plant in the solanaceae or nightshade family.

Ashwagandha root has a strong pungent smell like horse ("ashwa"), that is why it is called Ashwagandha and it is bitter to taste and contains several alkaloids (0.13 to 4.30%), which offer medicinal usages. The biologically active chemical constituents of *Withania somnifera* (WS) include alkaloids, steroidal lactones (withanolides, withaferins) and saponins (Mishra and singh, 2000) [18]. Sitoindosides and acylsterylglucosides in Ashwagandha are anti-stress agents. Active principles of Ashwagandha, for instance the sitoindosides VII-X and Withaferin-A, have been shown to have significant anti-stress activity against acute models of experimental stress (Bhattacharya *et al*., 1987) [10]. Many of its constituents support immunomodulatory actions (Ghosal *et al*., 1989). The aerial parts of *Withania somnifera* yielded 5-dehydroxy withanolide-R and withasomniferin-A (Atta-ur-Rahman *et al*., 1991) [6]. It contains many active principles such as withanolides, withanone, somnitalglucose, rutinosides, inorganic salt and di-hydroxy kaempferol-3 (Murthy *et al*., 2009 and Pal *et al*., 2012) [20, 21]. These active principles have been reported to possess immunomodulatory, general tonic, hepato-protective, anti-stress, growth promoter and antioxidant properties (Ansari *et al*., 2008; Kushwaha *et al*., 2012 and Varma *et al*., 2012) [5, 16, 37] beside antibacterial and anti-fungal properties (Punetha *et al*., 2010) [24]. Moreover, it has also been reported to play vital role in lowering blood sugar, serum cholesterol and stress induced gastric indigestion and ulcers (Javed *et al*., 2009) [13]. Ashwagandha is one of the well-known medicinal plants which is widely used in herbal medicine for the management of inflammation, stress, arthritis, conjunctivitis and tuberculosis and also improves body weight gain, feed intake, FCR, immunological status, hematological profile, neuro-protective and rejuvenate muscles (Ansari *et al*., 2008) [5]. The root of Ashwagandha is regarded as tonic, aphrodisiac, narcotic, diuretic, anthelmintic, astringent, thermogenic and stimulant (Singh *et al*., 2011) [33]. It has been studied that Ashwagandha significantly increases the erythrocyte counts and white blood cells (Gautam *et al*., 2004 and Senthilnathan *et al*., 2006) [12, 29]. Preparations obtained from this plant have been shown to enhance circulating antibody titer, increase the activity of lysosomal enzymes and increase phagocytosis (Agarwal *et al*., 1999) [1]. Hypocholesterolemic and hypolipidemic properties of *Withania somnifera* have been reported in laying hens (Pandey *et al*., 2014) [23].

The current review discusses the effects of Ashwagandha supplementation as a feed additive on various parameters of poultry birds, such as production performance and nutrient metabolizability, as well as their significance to the study's findings.

**Production performance**

A study was carried out on a total of one hundred and twenty (120) single comb hens of Synthetic White Leghorn strain of 22 weeks of age, in first phase of their production were randomly divided into five treatment groups i.e. $T_1$ (control), $T_2$ (0.25% Ashwagandha root powder), $T_3$ (0.50% Ashwagandha root powder), $T_4$ (0.75% Ashwagandha root powder), $T_5$ (1% Ashwagandha root powder) having four replications with six birds in each replication. Average feed intake of layers from 22 to 38 weeks of age were 115.24, 116.21, 118.50, 119.62 and 119.47 g per bird per day in treatment groups $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$, respectively. The results of study revealed that the feed intake was significantly ($P$<0.05) improved by supplementation of 0.75% and 1% Ashwagandha root powder in feed of layers. No significant effect on feed conversion ratio (feed consumption per dozen egg production and per kg egg mass production) was reported in response to dietary Ashwagandha root powder supplementation, compared to control diet. Egg mass production was significantly ($P$<0.05) increased in laying hens fed diets supplemented with different levels (0.75 and 1%) of Ashwagandha root powder as compared to laying hens fed control diet. Considerable ($P$<0.05) improvements in the hen day egg production values were observed in the hens supplemented with different levels (0.5%, 0.75%, 1%) of Ashwagandha root powder over the hens receiving control diet. However, the highest hen day egg production was attributed at 0.75% level of Ashwagandha root powder ($T_4$), followed by 0.5% ($T_3$) and 1% ($T_5$) Ashwagandha root powder, respectively (Sandeep *et al*., 2020) [28]. This improvement in the feed intake, hen day egg production and egg mass production of the layers in the above study was found accordance with work done by many researchers. Bhardwaj and Gangwar (2011) [8] conducted a study on laying quails to determine optimum dietary level of Ashwagandha supplementation on production performance. Hundred quails were randomly distributed in four treatments and reared on standard managemental conditions. The root powder of Ashwagandha was added over the basal ration at 0.5% level ($T_2$), 1% ($T_3$), 1.5% level ($T_4$), whereas the $T_1$ was control group. Cumulative feed intake (g/b) for 8-23 weeks feeding period was significantly ($P$<0.05) higher in $T_1$ and lower in the entire Ashwagandha treated groups. FCR (feed intake/egg mass) and net FCR were significantly ($P$<0.05) poor in $T_1$ group than other Ashwagandha supplemented groups. The results of present study on production performance of laying quails indicated that supplementing dietary level of 1.0 percent Ashwagandha (*Withania somnifera*) in diet to common feedstuffs is sufficient to support the optimum egg production, performance of laying quails under tropical climate and there is no need to supplement the diet with additional ingredients. Another experiment was carried out by Ahmed *et al*. (2014) [2] to assess the anti-stress efficacy of *Withania somnifera* root on productive performance of Japanese quail hens reared under high environmental temperature. Three hundred Quail hens, 6 weeks old were used which were fed with standard basal diet containing 20% crude protein and 2903Kcal/Kg metabolizable energy and reared under high environmental temperature(27-37°C)and relative humidity (40-50%) and were randomly allocated to five groups as follows: Treatment ($T_0$): control group without any supplementation; Treatment 1 and 2 ($T_1$, $T_2$) quails supplemented orally with a dose of 50 or 100 mg/kg body weight (b.wt)/day ethanolic extract of *Withania somnifera* roots, Treatment 3, 4 ($T_3$, $T_4$) quails received *Withania somnifera* roots as powder mixed with the diet at the rate of 1or 2g/kg diet respectively. The productive characteristics included: feed consumption, body weight gain and feed conversion ratio, in addition to total mortality percentage. Results showed that feed consumption increased significantly ($p \leq 0.01$) in quails received 1g/kg root powder ($T_3$) in comparison with all other treatments ($T_0$, $T_1$, $T_2$ and $T_4$) whereas $T_2$ group was the lowest in this character. The best ($p \leq 0.05$) feed conversion ratio was obtained when the quails supplemented with root ethanolic extract ($T_1$ and $T_2$) or with 2g/kg diet of root powder ($T_4$) in comparison with control. Shisodiya *et al*. (2008) [31] stated that supplementation of Ashwagandha and commercial synthetic compound resulted

in significant improvements in feed conversion ratio for all the supplemented groups compared to the control group. However, no significant difference in feed intake between treatment groups of broilers fed *Withania somnifera* root powder as herbal feed supplement.

Tahmasbi *et al*. (2012) [36] conducted a 6-week study to investigate the effects of phytase and hydroalcoholic extract of *Withania somnifera* root (WS) on productive performance and bone mineralisation of laying hens in the late phase of production. Diets were arranged factorially (3 × 2 × 2) and consisted of a positive control with adequate Ca (4.37%) and nonphytate P (NPP; 0.39%) and a negative control diet with Ca (4.06%) and NPP (0.36%); three concentrations of *Withania somnifera* (0, 65 and 130 mg/kg diet); and two concentrations of microbial phytase (0 and 300 U/kg diet). A total of 144 72-week-old Hy-Line W36 laying hens were randomly assigned to the 12 treatment groups. Each treatment was replicated 4 times (4 x 3 hens). *Withania somnifera* supplementation increased egg production only in the second two weeks of the experiment. Addition of phytase significantly depressed specific gravity of the eggs for the entire experiment period. *Withania somnifera* at 130 mg/kg did not affect feed intake. Singh *et al*. (2017) [32] performed a study to investigate the effect of dietary supplementation of Ashwagandha (*Withania somnifera*), selenium and their combination on production performance of broiler chicks A total of 360 day old, vaccinated commercial broiler chicks (Ven Cobb 400 strain) were individually weighed and divided randomly into six treatment groups *viz*., $T_0$-control group (without supplemental diet), $T_1$ - 250 mg ashwagandha /kg feed, $T_2$ - 0.15 mg selenium/kg feed, $T_3$ - 0.20 mg selenium/kg feed, $T_4$ - 0.15 mg selenium plus 250 mg ashwagandha/kg feed and $T_5$ - 0.20 mg selenium plus 250 mg ashwagandha/kg feed with three replication and each replication have 20 chicks used factorial randomized block design. The feed consumption did not significantly differ between treatment groups and within treatment groups. The overall feed conversion ratio significantly better in $T_5$ (1.66 ± 0.20) followed by $T_4$ (1.71 ± 0.20), $T_2$ (1.75 ± 0.18), $T_1$ (1.80 ± 0.18) and $T_0$ (2.00 ± 0.22), respectively.

Srivastava *et al*. (2013) [34] conducted an experiment to find out the effect of Indigenous herbal drug and market herbal drug (Livkey) on the performance efficiency of broiler chicks. They took 50 ml market herbal drug (Livkey) per kg feed and Indigenous herbal drug (*Withania somnifera*, *Asparagus racemosus* and *Mucuna pruriens* in the ratio of 50:25:25 respectively) @ 2%/kg diet in $T_2$ and $T_3$ treated groups respectively, while $T_1$ as control. The result showed that the cumulative feed conversion efficiency and cumulative performance efficiency factor in group $T_3$ at the end of experiment was greater than group $T_2$ followed by group $T_1$.

Joshi *et al*. (2015) [14] conducted experiments to evaluate the effect of dietary addition of Ashwagandha (*Withania somnifera*) and Guduchi (*Tinospora cordifolia*) powder on broiler performace. Supplementation of Ashwagandha (*Withania somnifera*) and Guduchi (*Tinospora cordifolia*) significantly increased overall body weights, weekly gain in body weight of broilers as compared to the control group. They also found that supplementation of Ashwagandha at 1% and 2% level of the feed had no significant difference on the overall feed intake.

Muhammad *et al*. (2009) [19] studied the effect of *Zingiber officinale*, *Carum apticum*, *Withania somnifera*, *Trigonella Foenum Graecum*, *Silybum marianum*, *Allium sativum* and *Berberis lyceum*, on the growth performance of broiler chicks. A total of 240 day old chicks were divided into four groups (A, B, C and D) each having 60 chicks. Each group was further subdivided into three groups (replicates) each having 20 chicks. Aqueous extract of these plants was mixed at the rate of 5, 10 and 15 ml/lit with water offered to group B, C and D, respectively while group A served as a control. Mean weight gain, dressing percentage, breast weight and leg weight were significantly higher ($P$<0.05) in group C with lower FCR (Feed Conversion Ratio) while mean feed intake was significantly high in control group. It was concluded from this study that these locally available plants if offered as supplement to broiler diet may result in improvement of feed efficiency. Biswas *et al*. (2012) [11] studied the effect of Ashwagandha powder alone or with ascorbic acid on production performance of broilers. The treatment groups were control (C), $T_1$ (1% Ashwagandha powder), $T_2$ (0.05% ascorbic acid) and $T_3$ (0.5% Ashwagandha powder and 0.025% ascorbic acid). Supplementation of Ashwagandha, ascorbic acid and their combination in broiler diet showed significant effect on feed intake and feed conversion ratio than control group. $T_1$ had higher body weight gain followed by $T_2$, $T_3$ and control group. Ansari *et al*. (2013) [4] observed that feed efficiency (weight gain/feed intake) was influenced by the 2.5% and 5% levels of *Withania somnifera* root used at both 28 and 42 days of age, improving the feed efficiency compared with the diets at lower (1.25%) level of *Withania somnifera* roots and control.

This improved performance in layers fed *Withania somnifera* root might be due to the improved nutrient digestibility as observed by Lilija (1983) [17], which was associated with the development of digestive tract and digestive organs. The improvement in body weight and FCR might be related to main active constituent withanine and withanolide of *Withania somnifera* root powder that could act not only as antibacterials and antioxidants but as a stimulant of digestive enzymes in the intestinal mucosa and pancreas that improved the digestion of dietary nutrients and feed efficiency, subsequently increasing the growth rate (Ali, 2011) [3].

**Nutrient metabolizability**

Results of the research carried out by Saini *et al*. (2017) [26] who observed that dry matter digestibility of broiler ration increased with increase in level of *Withania somnifera* up to 1.0% and thereafter decreased. Further, he also suggested that inclusion of *Withania somnifera* as feed additive at the rate of 1.0% in broiler ration, exerted maximum nitrogen retention and thereafter at 0.5% level of inclusion. These results are in consistent with the findings of Attia *et al*. (2017) [7] revealed that apparent digestibility coefficient of dry matter, crude protein and ether extract were significantly ($P$<0.01) increased by an average of 4.5%, 3.3% and 5.7% due to inclusion of plant extract blend at levels ranged from 100 to 2000 ppm, 500 to 2000 ppm and 500 to 2000 ppm, respectively when compared to control. Similarly, Raghavan *et al*. (2011) [25] also observed significant effect on nitrogen balance due to supplementation of herbs.

The findings of the study conducted are in agreement with review cited above. Supplementation at the rate of 0.75% and 1.0% Ashwagandha powder resulted in significantly ($P$<0.05) higher dry matter (DM) metabolizability, nitrogen metabolizability and gross energy metabolizability compared to all other dietary treatments.

## Conclusion

The purpose of this review study is to raise awareness about the use of herbal plants, particularly Ashwagandha, as poultry feed additive. The addition of Ashwagandha to a poultry diet as a herbal feed additive improved production performance and nutrient metabolizability. This improvement in performance might be due to its active constituents that stimulate digestive enzymes production which in turn improves digestion, subsequently increasing growth rate. So from this study we concluded that Ashwagandha can be used effectively as herbal feed supplement in diet of poultry for better performance.

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