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Effect of Ashwagandha (*Withania somnifera*) root powder supplementation on growth of kuroiler chicks

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Abstract
An experiment was conducted to find the effects of Ashwagandha (*Withania somnifera*) root powder on growth performance in Kuroiler chicks. One hundred and twenty, day-old Kuroiler chicks were divided into four treatment groups used on a completely randomized design (group T_1, T_2, T_3 and T_4) with 30 chicks in each group with three replicates consisting10 chicks in each. The dietary treatments consisted of one basal control (T_1) had standard ration as per BIS 2007 and others T_2, T_3 and T_4 supplemented with 0.5%, 1.0% and 1.5% Ashwagandha root powder. The chicks were reared in brooder house under standard management practices throughout the investigation period of 8 weeks. Weekly recorded of feed intake and body weight of chicks for further analysis. Statistically analyzed data shown that the average body weight, body weight gain were significantly higher and feed conversion ratio was significantly lower in T_3 group than all other treatment groups. It can be concluded that Kuroiler chicks treated with 1.0% Ashwagandha root powder may exhibit improved body weight and a lower feed conversion ratio.

Keywords: Ashwagandha, body weight, feed efficiency, Kuroiler chicks

1. Introduction
In India, poultry is currently one of the agricultural sectors with the quickest growth. Scientific poultry keeping was first initiated by Christian missionaries. Poultry farming is profitable in both rural and urban locations since it requires less space and less financial investment. It also has a quick payoff and evenly distributed turnover throughout the year. Meat production from poultry is 4.78 million tonnes contributing about 51.44% of total meat production i.e. 9.29 million tonnes with 8th rank in the world's meat production (Anonymous, 2022) [5]. Kuroiler is a dual purpose hybrid breed of chicken developed by the Kegg farms group in Gurgaon, Haryana. The popularity of poultry egg and meat is growing due to its great nutritional content, all-encompassing appeal, lack of religious stigma, and relative affordability. Poultry meat contains high quality protein for optimum human nutrition and easy to digest. Since feed is the largest cost in chicken production, it is crucial. In the past, antibiotics were commonly used to enhance growth in chicken, which helped to increase growth performance (Izat *et al*., 1990; Dibner and Buttin, 2002 and Miles *et al.*, 2006) [15, 12, 23]. Many herbal growth boosters are utilized as an alternative feed addition in poultry rations due to the negative effects of synthetic feed additives. Herbal growth promoter consumption improves broiler performance by boosting live weight gain and lowering feed conversion ratio. (Prasad and Sen, 1993 and Samarth *et al.*, 2002) [34, 37]. One of these a herbal plant of solanaceae family is Ashwagandha (*Withania somnifera*) also called as Indian ginseng, winter cherry, poison gooseberry. It is widely cultivated in arid areas of tropical and subtropical regions and has advantageous medicinal qualities. (Mirjalili *et al*., 2009) [24]. Bioactive substances such with anolides, alkaloids, polyphenols, and flavonoids are present in ashwagandha. (Mishra *et al*., 2000) [25]. The main alkaloid found in the plant's roots and leaves is withanine. In addition to being essential in decreasing serum cholesterol, blood sugar, stress-induced stomach indigestion, and ulcers, the herb Ashwagandha is said to have anti-stress, antioxidant, anticoccidial, immunomodulatory, and antilipidemic effects. (Mushtaq *et al*., 2012) [27], beside anti-fungal

and antibacterial properties (Punetha *et al*., 2010) [35]. The goals of this study were to assess potential improvements in overall performance and to identify natural growth promoters that are safe, effective, and affordable that can suitable for use in the poultry industry in substitution of artificial growth enhancers.

2. Materials and Methods

To examine the impact of ashwagandha feeding on performance of Kuroiler chicks from day old to 56 days of age, a total of 120, day old Kuroiler chicks were separated into four treatment groups, each consisting of 30 chicks and three replicate groups, each consisting of 10 chicks. As indicated for various treatments, ashwagandha root was sun-dried, then ground into a fine powder and combined at the proper concentration in feed.

Table 1: Treatments detail

Groups	Treatment
T_1	Control (Standard chick Ration)-as per BIS (2007) Specifications
T_2	T_1 + Ashwagandha root powder (ARP) in feed @ 0.5%
T_3	T_1 + Ashwagandha root powder (ARP) in feed @ 1.0%
T_4	T_1 + Ashwagandha root powder (ARP) in feed @ 1.5%

At the college's poultry farm, in the brooder house, the chicks were raised in rigorous, hygienic conditions. To prevent the gathering of chicks, the corners of the brooder house were rounded with cardboard. On the first two experiment days, the thickness of the bedding material (sawdust) was kept at 2 inches, and then it was raised by 0.5 inches on 15th and 30th experiment's day. All of the crumbled chick feed was given to the chicks on a regular basis ad-libtum according to the standards of BIS (2007). Newspapers were initially employed and the feed was provided by laying newspapers on the ground, but the chicks were fed using horizontal feeder after three days, until they were two weeks old. Two weeks later, the chick feeder was used and was kept up throughout the entire duration of the experiment. The feeders were placed at the birds' shoulder level and were only partially filled (two third) to reduce feed waste. Throughout the whole study period, chick waterers were used to provide free access to clean, fresh drinking water to the chicks. On the fifth and twelfth days of the trial, the chicks administered intra-ocular vaccinations against NCD (F1 strain) and IBD. Standard management procedures, including brooding, appropriate lighting, litter raking, cleaning of feeders and waterers, etc., were implemented. Using an electronic balance, the chicks were individually weighed at the beginning of the experiment and again at weekly intervals to determine the weekly gain in body weight. During the experimental period of 8 weeks, the each experimental group and its replicate's, weekly feed intake, feed delivered and feed weigh back, were recorded. This allowed for the computation of feed consumption and feed conversion ratio. The feed conversion ratio measures how efficiently feed is used for body weight gain and it calculated by using formula as FCR = Total feed consumed/Body weight gain.

2.1 Statistical analysis

The obtained data were statistically analyzed using Completely Randomized Design (CRD) according to Snedecor and Cochran (1994) [39]. ANOVA was performed on all of the data using the General Linear Models technique. Duncan's multiple range tests were used to isolate the mean difference between treatments. The standard for statistical significance was set at a level of (p<0.05).

3. Results and Discussion

3.1 Body weight

In present investigation day old chicks of Kuroiler chicken were selected. The data of mean body weight of Kuroiler chicks fed on Ashwagandha supplemented diet with 0, 0.5, 1.0 and 1.5% Ashwagandha recorded at weekly interval are presented in table 2. The initial body weight of one day old chicks were recorded as 44.65, 44.70, 45. 13, 44.84 g in T_1, T_2, T_3 and T_4, respectively. In all groups, initial mean body weight of chicks (day old) was 44.83 g (44.65 to 45.13). The average body weight of Kuroiler chicks on Ashwagandha diet supplementation exhibited statistically significant (p≤0.05) differences from control in all Ashwagandha supplemented groups. At 56 days old, Kuroiler chick's corresponding final body weights were recorded as 1132.56, 1159.73, 1205. 55, 1141.57 g in T_1, T_2, T_3 and T_4 respectively. The body weight of experimental chicks was significantly (p≤0.05) higher under treatment T_3 (ARP @ 1.0%) over rest of treatments in first, second, third, fourth, fifth, sixth, seventh and eighth week of experimentation. However, treatment T_2 (ARP @ 0.5%) was found at par to treatment T_3 in first, second, third, fourth, fifth and sixth week of experiment. The body weight findings of the current study are in agreement with Abdallah *et al*. (2016) [1], who found that the body weight of chicks given diets containing 0.5 and 1% Ashwagandha root powder was significantly (p≤0.05) greater than that of chicks fed the control diet. Similar outcomes were also observed by Mishra and Singh (2000) [25], Akotkar *et al*. (2007) [3], Pedulwar *et al*. (2007) [32], Ansari *et al*. (2008) [7], Jadhav *et al*. (2008) [16] and Rohatash *et al*. (2012) [36]. The findings are similar to Srivastava *et al*. (2012) [40], Nath *et al*. (2012) [28] Tripathi *et al*., (2013) [41] Valliolahi *et al*., (2014) [42] and Omar *et al*. (2016) [29] hey found that the body weight of the chicks given the growth-promoting diet was significantly (p≤0.05) greater than the body weight of the chicks fed the control diet.

Table 2: Treatment means of average body weight (g/chick) during different growth periods

Age	Treatments			
(days)	T_1	T_2	T_3	T_4
0	44.65 ^{a} ± 00.88	44.70 ^{a} ± 0.71	45.13^{a}± 00.71	44.84^{a}± 00.22
7	77.26 ^{b} ± 00.70	84.60 ^{a} ± 00.95	85.60^{a}± 00.41	73.19^{c}± 00.46
14	131.79 ^{b}±00.51	145.60^{a}±00.57	146.84^{a}±00.68	133.49^{b}±00.63
21	216.24 ^{b}±02.66	226.76^{a}± 00.44	228.79^{a}±02.92	223.44^{a}±00.57
28	351.92^{b}±00.69	355.75^{a}± 01.01	357.29^{a}±00.43	350.78^{b}±00.33
35	537.75^{bc}±05.81	554.15 ^{a}±03.10	548.64^{ab}±05.12	530.86^{c}±02.48
42	736.07^{b}± 02.52	755.59^{a}± 01.66	757.86^{a}±01.12	727.45^{c}±00.50
49	935.86^{c}± 00.91	961.06^{b}± 01.29	989.33^{a}±00.16	938.83^{c}±00.79
56	1132.56^{d}±00.30	1159.73^{b}±01.74	1205.55^{a}±01.10	1141.57^{c}±02.08

Each value represents the three replicate's mean.
Means with different superscripts vary significantly ($P \leq 0.05$) row wise.

3.2 Weekly body weight gain

The average weight gain (g) per chick per week for Kuroiler chickens raised in various treatments is shown in table 3. At all ages, difference in the average body weight gain (g)/chick/week under varied treatments were statistically significant ($p \leq 0.05$). At one week of age, the weight gain in T_3 (ARP @ 1.0%) group was found significantly ($p \leq 0.05$) higher than control and T_4 treatments. However, it was higher than the control and all other treatments at the end of the second week. During the third week only the T_4 (ARP @ 1.5%) treatment group's chicks gained significantly ($p \leq 0.05$) greater body weight perhaps due to their first and second week's growth being stunted. While in 6th, 7th and 8th week T_3 gain significantly ($p \leq 0.05$) higher body weight than all other treatments. The highest weekly weight gain was seen at 7th week range from 199.79 (T_1) to 231.47 (T_3) grams. The finding are in agreement with Biswas *et al.* (2012) [9], Ansari *et al.* (2013) [6], Joshi *et al.* (2015) [17], Ottalwar *et al.* (2015) [30], Kale *et al.* (2016) [19], Mishra and Singh (2000) [25], Samarth *et al.* (2002) [37], Pedulwar *et al.* (2007) [32], Ansari *et al.* (2008) [7], Shisodiya *et al.* (2008) [38], Choudhari *et al.* (2008) [10], Jadhav *et al.* (2008) [16], Rohatash *et al.* (2012) [36] and Jyotsana *et al.* (2018) [18] they found that broiler chicks given the herb *Withania somnifera* gained higher body weight significantly ($p \leq 0.05$) than the control group.

Table 3: Effect of Ashwagandha on Mean Weekly Weight Gain (g)/ chick of Kuroiler Chicken

Week	Treatments			
	T_1	T_2	T_3	T_4
1	32.61 ^{b} ±0.37	39.90 ^{a} ±0.70	40.47 ^{a} ±0.83	28.35 ^{c} ±0.63
2	54.53 ^{b} ±0.75	61.00 ^{a} ±0.44	61.25 ^{a} ±1.09	60.3 ^{a} ±1.06
3	84.45 ^{ab} ±2.52	81.16 ^{b} ±0.71	81.94 ^{b} ±3.56	89.96 ^{a} ±1.10
4	135.68 ^{a} ±3.33	128.99 ^{ab} ±0.87	128.51 ^{ab} ±3.15	127.34 ^{b} ±0.89
5	185.83 ^{ab} ±5.62	198.41 ^{a} ±2.18	191.35 ^{ab} ±5.54	180.07 ^{b} ±2.16
6	198.32 ^{a} ±7.11	201.44 ^{a} ±4.74	209.22 ^{a} ±5.60	196.59 ^{a} ±2.36
7	199.79 ^{c} ±2.76	205.47 ^{c} ±1.41	231.47 ^{a} ±1.22	211.38 ^{b} ±0.67
8	196.7 ^{c} ±0.69	198.67 ^{bc} ±0.65	216.22 ^{a} ±0.94	202.74 ^{b} ±2.89

Each value represents the three replicate's mean.
Means with different superscripts vary significantly ($p \leq 0.05$) row wise.

3.3 Feed consumption

The average amount of feed consumed by each chick at weekly intervals under various treatments is shown in table 4. The mean feed intake of Kuroiler chicks over the duration of the experiment's 8 weeks was significantly lower ($p \leq 0.05$) in the treatment group T_3 (ARP @1.0%) as compared to control group. However in the 2nd, 3rd, 7th and 8th weeks of age the highest weekly feed consumption was found in T_4 as compare to all treatment groups. The average weekly feed intake values during the eighth week of the experiment ranged from 708.33 (T_3) to 764.43 (T_4) grams. Similar findings were obtained by Srivastava *et al.* (2012) [28], who found that broilers offered indigenous herbal drugs (*Withania somnifera*, *Asparagus racemosus*, and *Mucuna pruriens*) had a significant ($p \leq 0.05$) impact on reduced feed intake. Demir *et al.* (2003) [11] also found that broilers fed with herbal and antibiotic growth enhancers consumed significantly ($p \leq 0.05$) less feed than the control group. Anurag *et al.* (2018) [8] examine the impact of adding Ajwain (*Trachyspermum ammi* L.) to the diet on the growth of Pratapdhan chicks, and found that the lowest total feed intake (g) in T_3 supplemented with 0.2% Ajwain. The same outcomes were reported by Shisodiya *et al.* (2008) [38], Mane *et al.* (2012) [22].

Table 4: Effect of Ashwagandha on Mean Weekly Feed Intake (g/ chick) of Kuroiler Chicken

Week	Treatments			
	T_1	T_2	T_3	T_4
1	56.47^{a} ±0.32	56.37 ^{a} ±0.15	56.47 ^{a} ±0.59	49.70 ^{b} ±0.59
2	112.13 ^{a} ±0.78	105.4 ^{b} ±.1.50	98.90 ^{b} ±1.58	113.63 ^{a} ±3.19
3	182.60 ^{b} ±1.39	161.50 ^{c} ±1.21	155.70 ^{c} ±1.39	197.67 ^{a} ±3.18
4	322.07 ^{a} ±2.24	294.93 ^{b} ±3.12	288.20 ^{b} ±3.03	316.10 ^{a} ±3.98
5	504.57 ^{a} ±6.32	484.20 ^{b} ±5.36	477.20 ^{b} ±6.24	491.57 ^{ab} ±4.96
6	609.83 ^{a} ±2.17	581.90 ^{b} ±3.36	575.00 ^{b} ±2.84	609.83 ^{a} ±4.78
7	686.73 ^{b} ±6.17	679.97 ^{bc} ±3.09	666.00 ^{c} ±3.06	702.03 ^{a} ±3.33
8	734.70 ^{b} ±3.09	714.80 ^{c} ±1.93	708.33 ^{c} ±3.09	764.43 ^{a} ±3.24

Each value represents the three replicate's mean.
Means with different superscripts vary significantly ($p \leq 0.05$) row wise.

3.4 Feed conversion ratio

Ashwagandha supplemented chick feed was given to Kuroiler chicks, and table 5 shows the chicks' average weekly feed conversion ratio (FCR). In comparison to the control group (T_1) and all other treatments during all weeks of age, the weekly mean FCR values of T_3 (ARP @ 1.0%) were significantly lower ($p \leq 0.05$). The data of FCR for T_1 (control) were 1.73, 2.06, 2.17, 2.38, 2.72, 3.08, 3.44 and 3.74 however these were 1.40, 1.62, 1.91, 2.24, 2.5, 2.75, 2.88 and 3.28 for T_3 at 1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th weeks of age, respectively. There was a progressive increase in FCR in all the groups. Groups of *Withania somnifera* studied in this study produced outcomes that closely resemble those of Samarth *et al.* (2002) [37] Akotkar *et al.* (2007) [3] Ansari *et al.* (2013) [6], Kale *et al.* (2014) [19] and Kale *et al.* (2016) [20]. Similarly, Aghazadeh *et al.* (2015) [2] revealed that chicory

root powder (CRP) supplementation in feed resulted in a significant ($p \leq 0.05$) drop in the FCR of broilers compared to the control group. Earlier reports from Tripathi *et al.* (2013) [41] and Omar *et al.* (2016) [29] were favorably compared to this. Jyotsana *et al.* (2018) [18]. Similarly, it was found that the feed conversion ratio was significantly ($p \leq 0.05$) lower in the control group than in the groups supplemented with 0.75% and 1% Ashwagandha.

Table 5: Effect of Ashwagandha on Mean Feed Conversion Ratio of Kuroiler Chicks

Week	Treatments			
	T_1	T_2	T_3	T_4
1	1.73 ^{a} ±0.027	1.41 ^{b} ±0.020	1.40 ^{b} ±0.038	1.76 ^{a} ±0.058
2	2.06 ^{a} ±0.038	1.73 ^{c} ±0.035	1.62 ^{c} ±0.045	1.89 ^{b} ±0.055
3	2.17 ^{a} ±0.081	1.99^{ab} ±0.033	1.91 ^{b} ±0.101	2.20 ^{a} ±0.042
4	2.38^{ab} ±0.073	2.29 ^{b} ±0.009	2.24 ^{b} ±0.049	2.48 ^{a} ±0.022
5	2.72 ^{a} ±0.102	2.44 ^{b} ±0.045	2.50^{ab} ±0.075	2.73 ^{a} ±0.022
6	3.08 ^{a} ±0.116	2.89^{ab} ±0.067	2.75 ^{b} ±0.079	3.10 ^{a} ±0.020
7	3.44 ^{a} ±0.018	3.31 ^{b} ±0.017	2.88 ^{c} ±0.003	3.32 ^{b} ±0.026
8	3.74 ^{a} ±0.029	3.60 ^{b} ±0.015	3.28 ^{c} ±0.018	3.77 ^{a} ±0.039

Each value represents the three replicate's mean.
Means with different superscripts vary significantly ($p \leq 0.05$) row wise.

4. Conclusions

Based on the findings of the experiment, it can be concluded that supplementing chick feed with 1.0% Ashwagandha root powder increased body weight, enhanced feed efficiency, and lowered feed conversion ratio. In order to prevent the negative effects of chemical growth promoters, it may also be concluded that the alternative to synthetic growth boosters, herbal ones can be used for producing chicken meat. The benefits of adding ashwagandha to the diet of Kuroiler chicks vary on a number of variables, including the type (powder, gel, or polysaccharide extract) and dosage. Therefore, more research is needed to find the best Ashwagandha dosage and type to use in order to assess the influence on performance as well as economic suitability in Kuroiler chicks.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

6. References

1. Abdallah O, Killany O, El Gharib H, Mohamed R. Hematological and growth performance studies after *Withania somnifera* supplementation in broilers. Suez Canal Veterinary Medical Journal. 2016;21(1):173-183.
2. Aghazadeh AM, Nabiyar E. The effect of chicory root powder on growth performance and some blood parameters of broilers fed wheat-based diets. Journal of Applied Animal Research. 2015;43(4):384-389.
3. Akotkar NS, Sarag AN, Rekhate DH, Dhok AP. Effect of supplementation of *Withania somnifera* (Ashwagandha) on growth performance of broiler. Indian Journal of Poultry Science. 2007;42(1):92-94.
4. Alcicek Ahmet, Bozkurt M, Cabuk Metin. The effect of a mixture of herbal essential oils, an organic acid or a probiotic on broiler performance. South African Journal of Animal Science. 2004;34(4):217-222.
5. Anonymous, Basic Animal Husbandry Statistics. Ministry of Fisheries, Animal Husbandry and Dairying, Government of India; c2022.
6. Ansari J, Khan SH, Haq AU, Ahmad T, Abbass MI. Effect of supplementation of *Withania somnifera* (Linn.) dunal roots on growth performance, serum biochemistry, blood hematology and immunity of broiler chicks. Journal of Herbs, Spices and Medicinal Plants. 2013;19(2):144-158.
7. Ansari JZ, Haq A, Yousaf M, Ahmad T, Khan S. Evaluation of different medicinal plants as growth promoters for broiler chicks. Sarhad Journal of Agriculture. 2008;24(2):323-329.
8. Anurag Kumari S, Uddin A. Effect of Supplementation of Ajwain (*Trachyspermum ammi* L.) on the Growth of Pratapdhan Chicken. International Journal of Current Microbiology and Applied Sciences. 2018;7(5):2319-7706.
9. Biswas P, Sharma RK, Biswas A. Effect of dietary supplementation of Ashwagandha (*Withania somnifera*) and ascorbic acid on production performance of broiler birds. Indian Journal of Poultry Science. 2012;47(3):403-405.
10. Choudhari AJ, Deshmukh GB, Ramteke BN, Zanzad AA, Patankar RB. Effect of different levels of Ashwagandha (*Withania somnifera*) with Vitamin C on the performance of Japanese quails. Indian Journal of Field Veterinarians. 2008;4(1):35-38.
11. Demir E, Sarica S, Ozcan MA, Sui Mez M. The use of natural feed additives as alternatives for an antibiotic growth promoter in broiler diets. British Poultry Science. 2003;44(S1):44-45.
12. Dibner JJ, Buttin P. Use of organic acids as a model to study the impact of gut microflora on nutrition and metabolism. Journal of applied poultry research. 2002;11(4):453-463.
13. Duncan DB. Multiple range and multiple F tests. Biometrics. 1955;11:1-42.
14. Hinton MH. Antibiotics, poultry production and public health. World's poultry science journal. 1988;44(1):67-69.
15. Izat AL, Colberg M, Reiber MA, Adams MH, Skinner JT, Cabel MC, *et al*. Effects of different antibiotics on performance, processing characteristics, and parts yield of broiler chickens. Poultry Science. 1990;69(10):1787-1791.
16. Jadhav SS, Mandlekar SM, Choudhari AJ, Shinde SV, Kharkar KP. Effect of supplementation of Ashwagandha and Ascorbic acid as antistress agents on growth performance and immune status of broilers during hot

weather. Royal Veterinary Journal of India. 2008;4(1):60-63.
17. Joshi SS, Ingle PB, Bhagwat SR, Pawar MM, Prajapati KB, Kulkarni RC. Effect of dietary addition of Ashwagandha (*Withania somnifera*) and guduchi (*Tinospora cordifolia*) powder on broiler performance. Indian Journal of Animal Sciences. 2015;85(12):1358-1361.
18. Jyotsana RS, Singh S, Chhikara S, Sheoran N. Dietary inclusion of Ashwagandha (*Withania somnifera*) root powder on growth performance and metabolizability in broilers. The Pharma Innovation Journal. 2018;7(6):425-430.
19. Kale VR, Wankhede SM, Karle SD. Effect of dietary supplementation of Ashwagandha (*Withania somnifera*) on carcass quality of broiler chicken. Indian Journal of Animal Nutrition. 2014;31(1):81-85.
20. Kale VR, Wankhede SM, Patil CS, Share AA. Effect of supplementation of *Withania somnifera* (Ashwagandha) root powder as feed additive on performance and blood biochemicals of broilers. Indian Journal of Animal Research. 2016;50(1):53-56.
21. Kayath P, Datt M, Kumar L, Chopra G, Tetarwal JM. Effect of neem (Azadirachta indica) supplementation on performance and mortality rate of kuroiler chicks. The Pharma Innovation Journal. 2022;11(2):1821-1824.
22. Mane AG, Kulkarni AN, Korake RL, Bhutkar SS. Effect of supplementation of Ashwagandha (*Withania somnifera*) and Shatavari (*Asparagus racemosus*) on growth performance of broilers. Research Journal of Animal Husbandry and Dairy Science. 2012;3(2):94-96.
23. Miles RD, Butcher GD, Henry PR, Littell RC. Effect of antibiotic growth promoters on broiler performance, intestinal growth parameters, and quantitative morphology. Poultry Science. 2006;85(3):476-485.
24. Mirjalili MH, Moyano E, Bonfill M, Cusido RM, Palazón J. Steroidal lactones from *Withania somnifera*, an ancient plant for novel medicine. Molecules. 2009;14(7):2373-2393.
25. Mishra LC, Singh BB, Dagenais S. Scientific basis for the therapeutic use of *Withania somnifera* (Ashwagandha): A review. Alternative Medicine Review. 2000;5(4):334-346.
26. Mishra SJ, Singh DS. Effect of feeding root powder of *Withania somnifera* (L.) Dunal. (Ashwagandha) on growth, feed consumption, efficiency of feed conversion and mortality rate in broiler chicks. Bioved. 2000;11(1,2):79-83.
27. Mushtaq M, Durrani FR, Imtiaz N, Sadique U, Hafeez A, Akhtar S, *et al*. Effect of administration of *Withania somnifera* on some hematological and immunological profile of broiler chicks. Pakistan Veterinary Journal. 2012;32(1):70-72.
28. Nath DD, Rahman MM, Akter F, Mostofa M. Effects of tulsi, black pepper and cloves extract as a growth promoter in broiler. Bangladesh Journal of Veterinary Medicine. 2012;10(1, 2):33-39.
29. Omar JA, Hejazi A, Badran R. Performance of broilers supplemented with natural herb extract. Open Journal of Animal Sciences. 2016;6(1):68-74.
30. Ottalwar T, Ratre HK, Roy M, Roy S, Ali SL. Ameliorative potential of *Withania somnifera* in induced cadmium toxicity in broiler birds. Int J Pharmacol Toxicol. 2015;5(3):209-215.
31. Owens B, Tucker LCMA, Collins MA, McCracken KJ. Effects of different feed additives alone or in combination on broiler performance, gut microflora and ileal histology. British poultry science. 2008;49(2):202-212.
32. Pedulwar SN, Zanzad AA, Choudhari AJ, Ramteke BN, Deshmukh GB. Effect of dietary supplementation of Shatavari (*Asparagus racemosus*) on broilers. Indian Journal of Field Veterinarians. 2007;3(1):28-29.
33. Pedulwar SN, Choudhari AJ, Zanzad AA, Ramteke BN, Deshmukh GB. Effect of dietary supplementation of Ashwagandha (*Withania somnifera*) on broilers. Veterinary World. 2007;6(2):37-38.
34. Prasad CM, Sen AK. Study of the effect of four different growth promoter on performance of broiler. Poult. Advisor. 1993;26(7):49-51.
35. Punetha A, Muthukumaran J, Hemrom AJ, Arumugam N, Jayakanthan M, Sundar D. Towards understanding the regulation of rubber biosynthesis: insights into the initiator and elongator enzymes. Journal of Bioinformatics and Sequence Analysis. 2010;2(2):1-10.
36. Rohatash KB, Bhardwaj A, Gangwar SK. Effect of *Withania somnifera* supplementation on Japanese quails. International Journal of Science and Nature. 2012;3(2):476-478.
37. Samarth VR, Jagtap DG, Dakshinkar NP, Nimbulkar MV, Kothekar MD. Effect of Ashwagandha root powder (*Withania somnifera*) on performance of broilers. Indian Veterinary Journal. 2002;79(7):733-734.
38. Shisodiya JM, Chpoade SS, Rajput AB, Chandankhede JM, Ingale KS, Kolte BR. Comparative Study of Ashwagandha and commercial synthetic compound on performance of broilers during hot weather. Veterinary World. 2008;1(10):310-311.
39. Snedecor GW, Cochran WG. Statistical method 8th edition. Oxford and IBG Publication co. New Dehli, India; c1994.
40. Srivastava SB, Singh DP, Niwas R, Paswan VK. Effect of herbal drugs as a feed additive in broiler ration. The Bioscan. 2012;7(2):267-269.
41. Tripathi D, Ashoka K, Mondal BC, Anshu R, Jyoti P. Effect of Ajwain, hot red pepper and black pepper on the performance of Japanese quail. Indian Journal of Animal Nutrition. 2013;30(2):431-433.
42. Valiollahi MR, Gholami M, Namjoo AR, Rahimian Y, Rafiee A. Effect of using sumac (*Rheus coriaria* L.) and Ajwain (*Trachyspermum ammi* L.) powders on performance and intestinal microbial population in broiler chicks. Research Veterinary Science. 2014;4(10):545-549.