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Influence of dietary supplementation of Shatavari (*Asparagus racemosus*) and Ashwagandha (*Withania somnifera*) root powder on feed intake and body weight performance in caged broilers

Abhishek Nagar, Neeraj, Ramesh Pandey and Amit Kumar Singh

Abstract
Use of antibiotics has been found to have negative effects on broiler health and its production therefore; there is a need for supplementation of herbal ingredients in broiler feed. An experiment was conducted on herbal dietary supplementation of Shatavari (*Asparagus racemosus*) and Ashwagandha (*Withania somnifera*) root powder to study its effect on growth performance in caged broilers. A total of 48 Day old broiler chicks of same hatch were procured and randomly divided into four groups with three sub groups comprising of 3 chicks in each to serve as replicates T_0 (control) had standard ration as per NRC; T_1 ration was supplemented with 5g Shatavari root powder /kg feed; T_2 ration was supplemented with 5g Ashwagandha powder /kg feed and T_3 ration was supplemented with 2.5g Shatavari + 2.5g Ashwagandha powder/ kg feed. The birds were reared in battery type cages under standard management practices from day-old to five weeks of age. Statistically analyzed data shown that the average body weight was significantly ($p< 0.05$) highest in T3 group followed by T2, T0 and T1 group. Similar trend was seen in the case of feed intake where significantly higher ($p< 0.05$) feed intake was found in T3 group followed by T2, T0 and T1 group. From this study it can be concluded that caged broilers supplemented with 2.5g Shatavari + 2.5g Ashwagandha powder/ kg feed may perform well in caged conditions in terms of improved body weight and feed intake.

Keywords: Ashwagandha, body weight, broilers, feed intake, Shatavari

Introduction
Poultry production is one of the areas in livestock production with significant contribution to human food production. Poultry products in recent years become important and popular food for non-vegetarian population (Adbhai *et al.*, 2019) [1]. Chicken are widely kept in India and total population of poultry in India is estimated to be about 851.81 million (BAHS, 2019) [2]. They are an important source of animal protein and can be kept in situation with limited feed and housing resources. Due to its easier and economic availability coupled with rising demand of cheap animal protein source has attracted almost every age group human being in most of the parts of the world. Furthermore, there has been a great advancement in nutritional technology for poultry birds in recent two decades thereby improving meat and egg production per kg of feed consumed by the poultry birds especially broilers (Thakur *et al.*, 2020) [19].
Feed additives are commonly described as non-nutrient substances that accelerate growth, efficiency of feed utilization, beneficial for health or metabolism of the animals (Church and Pond, 1998) [5]. Use of antibiotics has negative effects on animal health and its production such as residue in tissues, withdrawal period and development of resistance in microorganism (Wadoum *et al.*, 2016) [20]. Therefore, the use of antibiotic growth promoter has been banned in many countries; especially European Union has banned use of antibiotic growth promoters in 2006.
Moreover, there has been increased interest in the herbal feed additives for growth promoters and health maintenance of broilers in recent decades (Srivastava *et al.*, 2012) [18]. These herbal additives are economical and improve the digestibility and palatability of the feed hence improves both nutrient intake as well as nutrient utilization in the body of chickens (Thakur *et al.*, 2020) [19]. These herbal feed additives have been used since long back for humans for improved appetite, health and other beneficial effects.

Pandey *et al.* (2013) [13] reported that medicinal plants such as Ashwagandha (*Withania somnifera*), Shatavari (*Asparagus racemosus*) and kapikachhu (*Mucuna pruriens*) can be used as feed additives in broiler. The herbal feed additives such as Ashwagandha and Shatavari showed improvement in terms of body gain, feed consumption, feed conversion ratio (FCR), hemoglobin, serum glucose and protein in broiler chicks while serum cholesterol was not influenced by administering herbal growth promoter in broilers (Mishra and Singh, 2000; Mihir *et al.*, 2003; Chitra *et* al., 2004; Bhardwaj *et al.*, 2009; Rekhate *et al.*, 2010; Kumari *et al.*, 2012; Mane *et al.*, 2012) [10, 9, 4, 3, 14, 6, 7]. Use of individual herbal feed additives have been studies in abundance and several studies are still conducted to investigate the effect of different herbs on health, growth and feed efficiency and other important parameters in broiler chicken. However there are vey less conducive studies done on the combination of these herbals feed additives in the diet of chicken to observe the different parameters of growth and feed efficiency in them.

Considering above all points, the present study was aimed with objectives to determine weekly feed consumption of caged broilers fed on different levels of Shatavari and Ashwagandha root powder supplementation for their growth and to find out the feed efficiency of caged broilers fed on different levels of Shatavari and Ashwagandha root powder supplementation in ration.

Materials and Method

The present experiment was carried out in the small animal laboratory of Department of animal husbandry & dairying, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, India- 211007, Latitudinal and longitudinal Coordinates being 25°27′N 81°51′E.

A total of 48 Day old broiler chicks of same hatch were procured and randomly divided into four groups with three sub groups comprising of 3 chicks in each to serve as replicates, as per following dietary regimes:

T_0: (Control): Standard ration as per NRC
T_1: Ration supplemented with 5g Shatavari root powder /kg feed
T_2: Ration supplemented with 5g Ashwagandha powder /kg feed
T_3: Ration supplemented with 2.5 Shatavari + 2.5 Ashwagandha powder/ kg feed

The birds were reared in battery type cages under standard management practices from day-old to five weeks of age. Shatavari and Ashwagandha were supplemented as per dietary regimes of treatments. Broiler starter ration containing CP: 22 per cent and, ME:2900 k.cal./kg. feed was fed (Table 1) up to three weeks of age and broiler finisher ration containing CP: 19 percent and ME: 3000 kcal/kg fed up to five weeks. The ration was fed *ad-libitum* to the birds. Initial weight of each chick was recorded on arrival and then weekly to obtain the growth rate. The feed consumption was also recorded weekly to determine the feed conversion ratio.

Table 1: Ingredient and nutrient composition of experimental diet (%DM)

Ingredients (%)	Broiler starter (0 – 21 day)	Broiler finisher (22 – 42 days)
Corn	53.55	59.57
Soyabean meal (44%CP	38.93	33.34
Monodibasic Phosphate	1.43	1.21
Limestone	1.35	1.38
Vegetable oil	3.84	3.51
Salt	0.41	0.43
DL- Methionine	0.207	0.214
L-Lysine- HCL	0.129	0.197
Cho line HCL (60%)	0.06	0.05
Mineral- Vitamins premix	0.01	0.01
Total	100	100

Calculated Nutrients

Crude protein%	**22**	**20**
ME, Kcal/kg	3,050	3,100
Calcium%	0.9	0.85
Available phosphorus%	0.4	0.35
Sodium%	0.2	0.21
Chloride%	0.27	0.29
Digestible Lys.%	1.15	1.07
Digestible Met.%	0.49	0.48
Digestible Met+ Cys%	0.81	0.77
Digestible Thr,%	0.78	0.71
Choline, mg/kg	1,420	1,300

Parameters studies

Day Old Chicks (DOC) housing management

Housing condition which promotes better growth and health is necessary for livestock species in broad terms (Singh *et al.*, 2020a; Singh *et al.*, 2020b; Mishra *et al.*, 2017) [16, 15, 11]. It is more important for poultry birds as they are more susceptible for climatic change. Before arrival of broilers chicks, the experimental pens, waterers, feeders and floor were cleaned, washed, disinfected and fumigated by using formaldehyde and potassium permanganate.

Chicks were housed (Figure 1) in battery type cages providing 0.75 sq. ft/bird space. However, the space was increased to 1 sq. ft/bird after 4th week of experiment to avoid discomfort to the chicks. Cages, feeders, waterers, and other equipments were properly cleaned, disinfected and sterilized before use. The waterers were disinfected with 0.02% KMnO4 solution every day and water was supplied *ad lib* to the birds. One bulb of 100 watt was left on for light in each cage to maintain the temperature in the laboratory.

Fig 1: Day old chicks

Feed consumption

The daily feed consumption of each group was estimated as differences between the total quantity of feed offered and quantity of feed left over during 24 hours period. Feed consumptions recorded were added together for seven days of the week and was considered as weekly feed consumption.

Live weight gain

The growth rate of the birds is reflected through the weekly live weight gain. Individual body weight of the birds from each group was taken at weekly interval, starting from the day old stage. The birds were weighted during morning hours before feeding. Electronic weighing balance with a least count of 0.5g was utilized for weekly weighing of body weight of chicks as well as the amount of feed supplied and consumed by the chicks. However, the separate weighing scales were used for weighing. The average weekly weight gain of the birds of the different groups was calculated by subtracting the previous week average weight of the group of the birds from the present weekly average weight of the group of birds. During start of the experimentation, the weights of day old chicks were statistically similar. The data regarding average body weight of day old chicks randomly distributed into control (T_0) and three different treatment (T_1, T_2,T_3) presented in Table 2.

In general, the body weight of day old chicks ranged from 40.66 – 48.66g. The body weight of day old chicks in different treatments *viz.* T_0, T_1, T_2 and T_3 ranged from 41.33-48.66, 40.66- 47.33, 42.66-46.66, 47.33-42.66 g. respectively. The different mean body weight of day old chicks in different treatments *viz.* T_0, T_1, T_2 and T was 44.33, 44.66, 44.66 and 45.00 g respectively. The differences in the body weight of day old broiler chicks between different groups (treatment) were found non-significant. From the perusal of the data on the body weight f day old chicks randomly distributed in different treatments**,** it was observed that irrespective of treatment the body weight of day old chicks in general ranged from 40.66-48.66g The highest mean body weight of day old chicks was recorded in T_3 (45.00), and followed by T_2 (44.66), T_1 (45.66), T_0 (44.33). The differences in those values between the treatments were found to be non-significant. It indicates that random distribution of chicks into different treatment was proper and unbiased.

Table 2: Average body weight (g) of day old chicks in different treatments

Replication	Body weight of DOC (g)				
	T_0	**T_1**	**T_2**	**T_3**	**Mean**
R1	41.33	47.33	42.66	47.33	44.66 [a]
R2	42.66	40.66	44.66	45.33	43.83 [a]
R3	44.66	44.66	44.00	42.66	44.00 [a]
R4	48.66	46.00	45.33	44.66	46.66 [a]
Mean	44.33 [a]	44.66 [a]	44.66 [a]	45.00 [a]	

Means bearing similar superscripts are similar (p>0.05) under different rows and columns

Feed conversion ratio

The amount of feed consumed per unit gain (feed conversion ratio) was calculated as the ratio of feed consumed to weight gain (Maurya *et al*., 2016) [8] during the experimental period feed consumption and weight gain for each week worked out for each treatment separately.

Feed conversion ratio = Quantity of feed consumed (g) in week / Gain in body weight (g) in week

Statistical analysis

Data on various parameters were recorded, tabulated on subjected to statistical analysis by comparing Analysis of variance (ANOVA) technique as per Snedecar and Cocharan (1994) [17]. Microsoft Excel 2013 software was utilized for the completion of statistical analysis of this experiment.

Table 3: Structure of analysis of variance (ANOVA) table

Sources of variation	d. f	S.S	M.S.S	F. cal	F. table	Result	CD
Treatment	t-1	SS(t)	MSS(t)	R1		S/NS	
Replication	r-1	SS(t)	MSS(r)	R2			
Error	(r-1) (t-1)	ESS	MESS				
Total	Rt-1						

D.f - Degree of freedom
SS - Sum of squares
MSS - Mean sum of square
R1 - MTSS/MESS
R^2 - MRSS/MESS
C.D - Critical differences
S - Significant
NS - Non-significant
T - Treatment
ANOVA - Analysis of variance

Critical Differences

The critical difference was calculated with the help of following formula:

$$CD = \frac{\sqrt{2MSS(E)}}{r} \times t\ error$$

Where

SE – Standard error
CD – Critical differences
R – No. of replication
T error - Treatment error

Results and Discussion

Feed Intake in Caged Broilers

Average weekly feed intake (g) of broilers of different treatments

The data regarding average feed intake of broilers randomly distributed into control (T_0) and three different treatments (T_1, T_2, T_3) are presented in Table 4 with its ANOVA table 5. At first week of age the highest average feed intake of broilers was recorded in T_0 (145.50g) and followed by T_3 (144.25g), T_2 (140.33g), T_1 (136.33g) as shown in Figure (2). At second weeks of age the highest average feed intake of broilers was recorded in T_3 (509.16g) and followed by T_0 (491.33g), T_1 (483.08g), T_2 (473.50g). At third weeks of age the highest average feed intake of broilers was recorded in T_2 (608.33g) and followed by T_3 (569.91g), T_0 (543.33g), T_1 (542.50g) At fourth weeks of age the highest average feed intake of broilers was recorded in T_3 (867.00g) and followed by T_0 (838.25g), T_1 (828.92g), T_2 (822.75g). At fifth weeks of age the highest average feed intake of broilers was recorded in T_2 (529.25 g) and followed by T_3 (525.00g), T_0 (519.16g), T_1 (464.17g). Irrespective of weekly the mean feed intake per broiler in first, second, third, fourth and fifth week of age was 141.60, 489.26, 566.01, 839.23 and 509.39 g respectively. Irrespective of treatment the mean feed intake per broiler in T_0, T_1, T_2 and T_3 was 507.51, 491.00, 514.83 and 523.06 g respectively. The differences in the mean feed intake of broiler, due to treatment were found significant. From the perusal of data on weekly feed intake of broilers, it may be noted that mean feed intake of broilers, irrespective of weekly at one, two, three, four and five week of age was 141.60, 489.26, 566.01, 839.35 and 509.39 g respectively.

When treatment wise feed intake of broilers of observed, it was noted that highly weekly treatment mean feed intake of broiler was recorded in T_3 (523.06) followed by T_2 (514.83), T_0 (507.51) and T_1 (494.00).

Broilers of T_3 registered significantly highest (523.06) feed intake to compared control and T_1. However the feed intake of T_3 was found that at par with the feed intake of broilers in T_2. The differences in these values of treatment were found significant ($p< 0.05$). The results suggest that there was positive effect of adding Shatavari and Ashwagandha powder in the ration of chicks which increased the feed intake in them. Results of this study are in line with the results that were reported by earlier studies (Niwas *et al*., 2013; Srivastava *et al*., 2012) [12, 18]. Pandey *et al.* (2013) [13] reported that medicinal plants such as Ashwagandha (*Withania somnifera*), Shatavari (*Asparagus racemosus*) and kapikachhu (*Mucuna pruriens*) can be used as feed additives in broiler. Mishra and Singh (2000) [11] reported that the effect of feeding root powder of *Withania somnifera* (Ashwagandha) improved growth rate, feed consumption, feed conversion efficiency and lowered mortality rate in broiler chicks. Bhardwaj *et al.* (2012) evaluated the efficacy of Ashwagandha root powder in Japanese quails by supplementing in feed at 0%,0.5%,1% and 1.5% and concluded that 41 1% Ashwagandha (*Withania somnifera*) root powder significantly improved body weights and feed efficiency.

Table 4: Average weekly mean feed intake of broiler (g) of different treatment

Treatments	W1	W2	W3	W4	W5	Mean
T0	145.50	491.33	543.33	838.25	519.16	507.51 ^{bc}
T1	136.33	483.08	542.50	828.92	464.17	491.00 ^{c}
T2	140.33	473.50	608.33	822.75	529.25	514.83 ^{ab}
T3	144.25	509.16	556.58	867.00	525.00	520.40^{a}

Means bearing similar superscripts are similar (p>0.05) under different rows

Table 5: ANOVA for data on weekly feed intake of per broiler contained in Table 4

Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
Treatments	4	989204.543	247301.136	578.940	3.26	**S**	13.072	29.5698
Week	3	2444.418	814.806	1.907	3.49	**NS**	13.072	29.5698
Error	12	5125.939	427.162	-	-	-	-	-
Total	19	996774.901	-			-	-	-

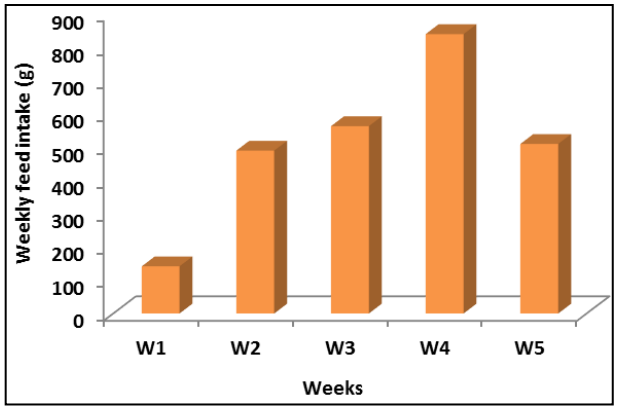

Fig 2: Average weekly feed intake of caged broilers on diet supplemented with different level of Shatavari and Ashwagandha root powder.

Body weight of Broilers

Average Weekly Body weight of day old chicks (g)

The data regarding average body weight of broilers randomly distributed into control (T_0) and three different treatments (T_1, T_2, T_3) are presented in Table 6 and ANOVA of the same is given in Table 7.

At first week of age the highest body weight of broilers was recorded in T_3 (185.41g) and followed by T_2 (182.83g), T_0 (179.50g), T_1 (172.50g) as shown in figure (3). At second weeks of age the highest body weight of broilers was recorded in T_3 (466.50g) and followed by T_0 (482.17g), T_1 (438.08g), T_2 (419.50g). At third weeks of age the highest body weight of broilers was recorded in T_3 (739.33g) and followed by T_2 (731.33g), T_1 (730.41g), T_0 (727.83g). At fourth weeks of age the highest body weight of broilers was recorded in T_3 (1285.00g) and followed by T_2 (1278.00g), T_1 (1184.33g), T_0

(1180.66g). At fifth weeks of age the highest body weight of broilers was recorded in T_3 (1565.83 g) and followed by T_2 (1532.00g), T_0 (1454.66g), T_1 (1419.00g). Irrespective of weekly the mean body weight broiler in one, second, third, fourth and fifth week of age was 180.06, 440.31, 732.22, 1231.99 and 1875.87 g respectively. Irrespective of treatment the mean body weight of broiler in T_0, T_1, T_2 and T_3 was 796.96, 787.86, 828.73 and 848.41. The differences in the mean body weight of broilers, both due to treatment were found significant. From the perusal of data on weekly body weight of broilers contained in Table 4.13, It may be noted that mean body weight of broilers, irrespective of weekly at one, two, three, four and five week of age was 180.06, 440.31, 732.22, 1231.99 and 1875.87 g respectively. When treatment wise body weight of broilers of observed, it was noted that highly weekly treatment mean body weight of broiler was recorded in T_3 (848.41) followed by T_2 (828.73), T_0 (796.96) and T_1 (787.86). Broilers of T_3 registered significantly highest body weight (848.41g) to compared control and T_1. However the body weight of T_3 was found that at par with the body weight of broilers in T_2. The differences in these values of treatment were found significant, indicating thereby a significant effect Shatavari and Ashwagandha root powder treatment on body weight of broilers.

Statistically analyzed data showed that due the effect of adding Shatavari and Ashwagandha root powder there was an increase in the feed intake thereby its assimilation in the body of chicks as shown by significantly better (p<0.05) body weight in treatment group as compared to control group chicks. Results of this study are in line with the results that were reported by Niwas *et al*. (2013) [12] and Srivastava *et al.* (2012) [18]. Pandey *et al.* (2013) [13] reported that medicinal plants such as Ashwagandha (*Withania somnifera*), Shatavari (*Asparagus racemosus*) and kapikachhu (*Mucuna pruriens*) can be used as feed additives in broiler. Mishra and Singh (2000) [11] reported that the effect of feeding root powder of *Withania somnifera* (Ashwagandha) improved growth rate, feed consumption, feed conversion efficiency and lowered mortality rate in broiler chicks. Bhardwaj *et al.* (2012) evaluated the efficacy of Ashwagandha root powder in Japanese quails by supplementing in feed at 0%, 0.5%, 1% and 1.5% and concluded that 41 1% Ashwagandha (*Withania somnifera*) root powder significantly improved body weights and feed efficiency.

Table 6: Average weekly mean body weight of broiler chicks (g) in different treatment.

Treatments	W1	W2	W3	W4	W5	Mean
T0	179.50	442.17	727.83	1180.66	1454.66	796.96 ^{bc}
T1	172.50	433.08	730.41	1184.33	1419.00	787.86 ^{c}
T2	182.83	419.50	731.33	1278.00	1532.00	828.73 ^{ab}
T3	185.41	466.50	739.33	1285.00	1565.83	848.41^{a}

Means bearing similar superscripts are similar (p>0.05) under different rows

Table 7: ANOVA for data on weekly body weight of broilers contained in Table 7

Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
Week	4	4735155.540	1183788.885	1082.980	3.26	S	20.910	47.302
Treatments	3	11828.546	3942.849	3.607	3.49	S	23.378	52.8853
Error	12	13117.022	1093.085	-	-	-	-	-
TOTAL	19	4760101.108	-	-		-	-	-

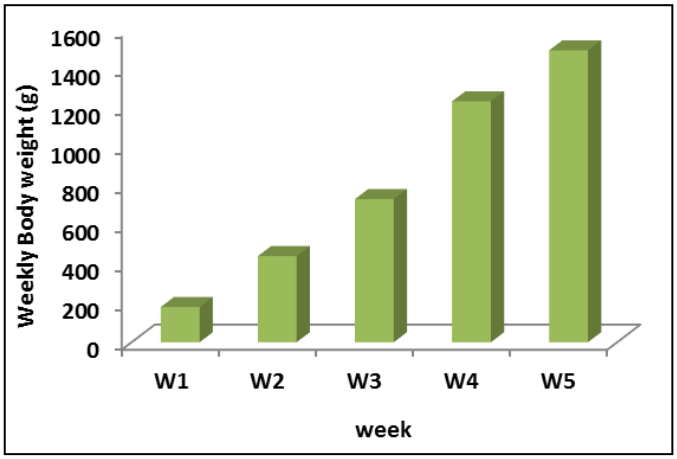

Fig 3: Average weekly body weight (g) per broiler in for different treatment with different level of Shatavari and Ashwagandha root powder.

Conclusion

Use of antibiotics has been found to have negative effects on broiler health and its production therefore; there is a need for supplementation of herbal ingredients in broiler feed. This study provides the information about the feed intake and body weight of caged broilers on individual as well as combined supplementation of Shatavari and Ashwagandha root powder. Results from this study suggest that improved feed intake and body weight was obtained from individual as well as combined supplementation of Shatavari and Ashwagandha root powder. Hence, from this study it can be concluded that caged broilers supplemented with 2.5g Shatavari + 2.5g Ashwagandha powder/ kg feed may perform well in caged conditions in terms of improved feed intake and body weight. Herbal additives such as Ashwagandha and Shatavari powder may be added in caged broiler feeds for better growth performance and there remains scope for future researches to know about the effect of Ashwagandha and Shatavari powder on blood, immunity levels, and muscular attributes of caged broilers.

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Conflict of Interest

Authors declare that they do not have any conflict of interests. Every author participated and approved in drafting this manuscript.

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