

Effect of dietary addition of *ashwagandha* (*Withania somnifera*) and *guduchi* (*Tinospora cordifolia*) powder on broiler performance

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ABSTRACT

Experiments were conducted to evaluate the effects of dietary addition of *ashwagandha* (*Withania somnifera*) root powder and *guduchi* (*Tinospora cordifolia*) stem powder on growth performance, feed conversion ratio and economics of feeding in broilers. In experiment 1, treatments were T₁: basal diet; T₂: basal diet + *ashwagandha* (*Withania somnifera*) root powder @ 1 g/kg of feed; T₃: basal diet + *ashwagandha* (*Withania somnifera*) root powder @ 2 g/kg of feed. In experiment 2, treatments were T₁: basal diet; T₂: basal diet + *guduchi* (*Tinospora cordifolia*) stem powder @ 1 g/kg of feed; T₃: basal diet + *guduchi* (*Tinospora cordifolia*) stem powder @ 2 g/kg of feed. The chicks were fed with standard basal diets in three different growth phases i.e. pre-starter (0–10d), starter (11–21d) and finisher (22–42d). Supplementation of *Withania somnifera* and *Tinospora cordifolia* significantly increased the overall body weights, weekly gain in body weight of broilers compared to the control group. However, feed intake, feed conversion ratio and feed cost per kilogram of live broiler production were similar among the treatment groups. The dietary addition of *Withania somnifera* and *Tinospora cordifolia* reduced mortality rate compared to the control. Results indicated that *ashwagandha* (*Withania somnifera*) and *guduchi* (*Tinospora cordifolia*) powder improved growth performance and reduced mortality, but did not have any effect on feed conversion ratio and economics of feeding in broilers.

Key words: Broiler, Growth, *Tinospora cordifolia*, *Withania somnifera*

The researchers are looking for natural alternatives to feed additives due to the emergence of drug resistance, residual toxicity and other side effects of synthetic growth promoters and health maintaining drugs like antibiotics (Lee *et al.* 2004). 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, Pandey *et al.* 2013). 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) and immunity (Bhardwaj *et al.* 2011, Kumari *et al.* 2012).

The herb *Ashwagandha* (*Withania somnifera*) reportedly have antioxidative, antistress, anticoccidial, immunomodulatory and antilipidemic effect besides playing vital role in lowering blood sugar, serum cholesterol and stress induced gastric indigestion and ulcers (Mushtaq *et al.* 2012).

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The roots and leaves of *Withania* are used as drugs. Most of its biological activities have been attributed to the presence of group of compounds referred as withanolides. Another herb, *guduchi* (*Tinospora cordifolia*) belongs to a group of medicinal plants that grow in the tropical and subtropical regions of India (Sengupta *et al.* 2011). It is also well known for its immunomodulatory, antioxidant, antibacterial and antiviral properties (Srinivasan *et al.* 2008). Therefore, the two experiments were conducted to evaluate the effects of dietary addition of *ashwagandha* (*Withania somnifera*) root powder and *guduchi* (*Tinospora cordifolia*) stem powder on growth performance, feed conversion ratio and economics of feeding in broilers.

MATERIALS AND METHODS

Day-old unsexed broiler chicks (135), purchased from a local hatchery, were weighed on arrival and randomly assigned to one of 3 treatments (45 chicks/treatment) with 3 replicates of the 15 chicks based on a completely randomized design. In experiment 1, treatments were T₁: basal diet; T₂: basal diet + *ashwagandha* (*Withania somnifera*) root powder @ 1 g/kg of feed; T₃: basal diet + *ashwagandha* root powder @ 2 g/kg of feed. In experiment 2, treatments were T₁: basal diet; T₂: basal diet + *guduchi* (*Tinospora cordifolia*) stem powder @ 1 g/kg of feed; T₃: basal diet + *guduchi* (*Tinospora cordifolia*) stem powder

Table 1. Ingredients and nutrient composition of basal diet used during feeding experiments 1 and 2

Ingredients (%)	Pre-starter	Starter	Finisher
Yellow maize	51.28	52.05	57.00
Soybean meal	40.21	38.43	33.03
Vegetable oil	4.56	5.6	6.38
Dicalcium phosphate	1.93	1.97	1.71
Common salt	0.35	0.35	0.35
Limestone	0.97	1.01	0.93
Maduramycine	0.05	0.05	0.05
Lipocare ¹	0.10	0.10	0.10
L-Lysine	0.17	0.15	0.14
DL-Methionine	0.15	0.15	0.07
Vitamin premix ²	0.05	0.05	0.05
Mineral premix ³	0.20	0.20	0.20
Total	100.02	100.01	100.01
<i>Nutrient composition (%)</i> *			
Dry matter	94.63	94.71	94.32
Crude protein	23.21	21.64	19.62
Ether extract	2.75	3.46	4.20
Crude fibre	4.98	5.03	5.01
Total ash	5.72	6.63	5.07
ME (kcal/kg)	2998.2	3075.1	3185.6

*Analysed values as fed basis. ¹Lecithin treated with co-enzyme. ² Provides per kg of diet: 12,500 IU vitamin A; 2,500 IU vitamin D₃; 12 mg, vitamin E; 1.5 mg, vitamin K; 1.5 mg, vitamin B₁; 5 mg, vitamin B₂; 2 mg, vitamin B₆; 15 mcg, vitamin B₁₂; 15 mg, niacin; 10 mg, pantothenic acid; 0.5 mg, folic acid. ³Provides per kg of diet: 50 mg iron, 10 mg copper, 50 mg zinc, 80 mg manganese, 1 mg iodine and 0.2 mg selenium.

@ 2 g/kg of feed. The standard basal diets were made with available feed ingredients for three different growth phases i.e. pre-starter (0–10d), starter (11–21d) and finisher (22–

42d). The ingredients and nutrient composition of basal diet used during both the experimental feeding is given in Table 1.

Broilers were raised on deep-litter housing system for 6 weeks. Feed and water were provided *ad lib*, throughout the experiment. Chicks were individually weighed at arrival and at weekly intervals. Feed intake was measured throughout the experiment and feed conversion ratio (FCR=feed intake/weight gain) was calculated at the same intervals. Feed cost involved in production of one kg live broiler was calculated. All the pens were checked for mortality twice a day. The data pertaining to various parameters were analyzed statistically (Snedecor and Cochran 1994). The significant mean differences were tested as per Duncan's multiple range test and significance was declared at P<0.05.

RESULTS AND DISCUSSION

The average weekly body weights (g/bird) and body weight gain (g) of broiler chicks under different treatment groups during experiments 1 and 2 are given in Table 2. In experiment 1, the overall body weight (g/bird) of broilers was significantly (P<0.05) higher in T₃ group compared to T₁ group and comparable to both the groups in T₂ group. The average weekly body weight gains were also higher in *Withania somnifera* supplemented groups than the control at week first, third and for overall experimental period. In experiment 2, highest overall body weight (g/bird) was recorded in T₂ group followed by T₃ and T₁ groups. The higher weekly body weight gains were observed in *Tinospora cordifolia* supplemented groups compared to the control. The positive effect on growth performance of broilers may be attributed to active principles of *Withania*

Table 2. Average weekly body weights (g/bird) and body weight gain (g) of broiler chicks under different treatment groups during experiments 1 and 2

Weeks	Experiment 1				Significance	Experiment 2			Significance
	Treatments			Treatments					
	T ₁	T ₂	T ₃	T ₁		T ₂	T ₃		
Average weekly body weights (g/bird)									
Day old	47.04±0.56	46.69±0.63	46.27±0.62	NS	42.93±0.45	42.76±0.36	42.53±0.23	NS	
I	129.49 ^a ±2.48	148.13 ^b ±1.88	149.56 ^b ±1.85	**	128.60 ^a ±1.9	150.85 ^c ±4.42	138.12 ^b ±2.25	**	
II	394.36±5.53	404.51±5.76	411.20±5.80	NS	357.05 ^a ±2.54	376.78 ^b ±1.91	372.98 ^b ±1.77	**	
III	699.73 ^a ±8.48	734.36 ^b ±14.18	776.11 ^c ±12.28	**	756.16 ^a ±1.83	785.44 ^b ±2.86	780.43 ^b ±2.40	**	
IV	1101.50 ^a ±14.58	1145.38 ^a ±17.34	1207.07 ^b ±19.12	**	1168 ^a ±10.14	1198.38 ^b ±9.07	1191.43 ^{ab} ±6.93	*	
V	1583.20 ^a ±20.43	1669.50 ^b ±15.12	1744.00 ^c ±16.07	**	1592.70 ^a ±7.77	1679 ^c ±9.28	1649.40 ^b ±8.24	**	
VI	2076.26 ^a ±22.27	2138.86 ^{ab} ±34.5	2199.30 ^b ±40.20	*	2192.89 ^a ±7.34	2298.97 ^c ±9.11	2251.46 ^b ±23.28	**	
Average weekly weight gain (g)									
I	82.44 ^a ±2.41	101.44 ^b ± 1.75	103.29 ^b ±1.89	**	85.83 ^a ±2.25	108.02 ^c ±4.44	95.44 ^b ±2.29	**	
II	263.04±6.28	256.38±5.58	261.64±6.07	NS	227.72±3.47	225.80±4.87	235.28±2.09	NS	
III	305.36 ^a ±8.13	329.84 ^{ab} ±15.12	364.91 ^b ±13.78	**	399.13 ^a ±3.02	408.82 ^b ±3.58	407.45 ^{ab} ±3.04	*	
IV	411.43±15.09	411.02±20.25	430.96±26.27	NS	411.84±10.42	412.95±9.17	410.28±7.11	NS	
V	481.70±22.33	524.11±23.23	551.27±28.34	NS	425.67 ^a ±13.94	480.59 ^b ±12.80	458.23 ^{ab} ±10.89	**	
VI	493.09±25.45	494.07±42.38	455.27±40.17	NS	600.17±10.94	620.00±13.61	602.03±25.19	NS	
0–VI	2029.30 ^a ±22.33	2092.02 ^{ab} ±34.63	2152.98 ^b ±40.27	*	2150.19 ^a ±7.26	2256.18 ^c ±9.16	2208.95 ^b ±23.34	**	

^{abc}Means in a row with different superscripts differ significantly. P<0.05; **P<0.01; NS, nonsignificant.

somnifera (withanolides) and *Tinospora cordifolia* (tinoporone) which limits the metabolic signs of stress and alleviate the physiological consequences of stress. Also, these active principles have anabolic effect which might have contributed to improved gain in body weights of broilers. Our findings were in line with earlier works of Pedulwar *et al.* (2007), Jadhav *et al.* (2008), Shisodiya *et al.* (2008), Bhushan *et al.* (2013) and Pandey *et al.* (2013), who reported increase in body weights in broilers supplemented with *Withania somnifera*, *Tinospora cordifolia* and/or herbal mixture. In contrast, dietary addition of *Withania somnifera* (Thange *et al.* 2009) and *Tinospora cordifolia* (Kulkarni *et al.* 2011, Bhardwaj *et al.* 2011) at various doses did not have any effect on body weights in broilers.

The overall feed intake (g/bird) and feed conversion ratio

were without any significant ($P>0.05$) difference in broilers fed *Withania somnifera* root powder (Table 3). Similarly, non-significant difference in overall feed intake and feed conversion ratio were recorded by Shisodiya *et al.* (2008) and Thange *et al.* (2009); however Biswas *et al.* (2012), Mushtaq *et al.* (2012) and Srivastava *et al.* (2013) reported improved feed intake in broilers fed *Withania somnifera* root powder. In the present study, supplementation of *Tinospora cordifolia* stem powder did not have any significant effect on overall feed intake and feed conversion ratio. Similar observations were reported by Sarag *et al.* (2001), Vidyarthi *et al.* (2008) and Bhardwaj *et al.* (2011). In contrast to present findings, Kulkarni *et al.* (2011) and Bhushan *et al.* (2013) reported significant increase in feed intake when birds were supplemented with either *Tinospora cordifolia* stem powder alone or in form of poly-herb. So,

Table 3. Average weekly feed intake (g/bird), feed conversion ratio and cost of feeding of broilers under different treatment groups during experiments 1 and 2

Weeks	Experiment 1				Experiment 2			
	Treatments			Significance	Treatments			Significance
	T ₁	T ₂	T ₃		T ₁	T ₂	T ₃	
Average weekly feed intake (g/bird)								
I	113.90 ^a ±3.12	138.87 ^b ±2.75	141.13 ^b ± 3.10	**	111.88±3.46	119.58±0.25	122.0±3.11	NS
II	396.53±9.23	374.27±12.19	369.07±3.32	NS	293.13±11.91	283.58±7.91	292.19±8.02	NS
III	501.57 ^a ±9.45	531.37 ^a ±8.52	580.30 ^b ±9.11	**	527.33±3.42	502.33±0.97	515.31±12.86	NS
IV	693.30±3.10	699.50±23.26	731.20±1.96	NS	593.62±28.30	583.82±6.87	590.59±17.09	NS
V	898.47±19.30	940.40±34.19	956.20±47.08	NS	660.78±35.15	780.20±8.48	758.63±21.63	NS
VI	1018.20 ^b ±15.60	940.37 ^a ±29.50	911.70 ^a ±4.69	**	1035.80±32.69	1079.60±8.86	1097.80±11.21	NS
0–VI	3622.10±38.54	3624.80±31.48	3689.70±44.98	NS	3222.60±56.37	3349.70±20.10	3316.30±33.85	NS
Average weekly feed conversion ratio								
I	1.38±0.028	1.37 ±0.009	1.37±0.012	NS	1.30 ^b ±0.01	1.11 ^a ±0.01	1.28 ^b ±0.01	**
II	1.49±0.035	1.46 ±0.015	1.41±0.012	NS	1.29±0.05	1.26±0.01	1.24±0.07	NS
III	1.64 ±0.015	1.61 ±0.026	1.59±0.020	NS	1.32 ^b ±0.03	1.23 ^{ab} ±0.01	1.26 ^a ±0.04	*
IV	1.72 ±0.003	1.70 ±0.021	1.69±0.003	NS	1.44±0.01	1.41±0.02	1.44±0.02	NS
V	1.86 ^b ±0.02	1.80 ^a ±0.015	1.78 ^a ±0.007	*	1.55±0.03	1.62±0.03	1.66±0.01	NS
VI	2.06 ±0.026	2.01 ±0.025	2.00±0.020	NS	1.73±0.03	1.74±0.03	1.82±0.04	NS
0–VI	1.80±0.018	1.76±0.030	1.73±0.024	NS	1.50±0.02	1.48±0.01	1.50±0.01	NS
Feed cost/kg live broiler production								
	47.03±0.42	46.82±0.77	46.72±0.60	NS	46.84±0.34	46.68±0.19	47.28±0.36	NS

^{ab}Means in a row with different superscripts differ significantly. * $P<0.05$; ** $P<0.01$; NS, nonsignificant.

Table 4. Mortality rate of broilers under different treatment groups during experiments 1 and 2

Weeks	Experiment 1				Experiment 2			
	Treatments			Total	Treatments			Total
	T ₁	T ₂	T ₃		T ₁	T ₂	T ₃	
Chicks at start	45	45	45	135	45	45	45	135
I	0	0	0	0	2	0	1	3
II	1	0	0	1	0	1	0	1
III	0	0	0	0	0	0	0	0
IV	1	0	0	1	1	0	1	2
V	0	0	1	1	0	0	0	0
VI	0	1	0	1	0	0	0	0
Total mortality	2	1	1	4	3.0	1.0	2.0	6.0
Mortality (%)	4.4	2.2	2.2	3.0	6.7	2.2	4.4	4.4

it can be inferred that dietary addition of both the herbs *Withania somnifera* and *Tinospora cordifolia* either at rate of 1 or 2 g/kg of feed did not have any adverse effect on feed intake of broilers. Furthermore, their supplementation also had not improved feed intake. Non-significant effect on feed conversion ratio was reported in both the experiments due to similar feed intake among all the treatment groups. The feed cost per kilogram of live broiler production was calculated on the basis of current market price of feed ingredients used and sale price of broilers, which was reported to be nonsignificant among the treatment groups in both the experiments.

In experiment 1, at the end of the experimental period total mortality rate was 4.4, 2.2 and 2.2% in T₁, T₂ and T₃ groups, respectively (Table 4). The mortality rate in experiment 2 was 6.7, 2.2 and 4.4% in T₁, T₂ and T₃ groups, respectively. This indicated that supplementation of *Withania somnifera* and *Tinospora cordifolia* reduced mortality rate compared to the control. The reduced mortality rate in present experiments may be due to antioxidative, antistress, anticoccidial, immunomodulatory, antibacterial and antiviral properties of *Withania somnifera* and *Tinospora cordifolia*; which may have attributed to good health in the supplemented groups. These findings are in line with previous reports of Biswas *et al.* (2012), Pandey *et al.* (2013) and Srivastava *et al.* (2013).

Based on the results, it was concluded that dietary addition of *ashwagandha* (*Withania somnifera*) and *guduchi* (*Tinospora cordifolia*) powder improved growth performance and reduced mortality, but did not have any effect on feed conversion ratio and economics of feeding in broilers.

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