Indian Journal of Poultry Science (2024) 59(3): 291–298, Research Article
https://doi.org/10.56093/ijps.v59i3.08

Effect of supplementation of ashwagandha (W*ithania somnifera*) root powder and synbiotic on growth performance, carcass characteristics and cost economics in broilers

P. VOOHA, C. ANIL KUMAR*, T. SUSMITA AND P. KAVITHA

NTR College of Veterinary Science, Gannavaram- 521102, Krishna District, Andhra Pradesh, India

(Received on April 22, 2024; accepted for publication on December 24, 2024)

ABSTRACT

*Vooha, P., Anil Kumar, C., Susmita, T. and Kavitha, P. 2024. Effect of supplementation of ashwagandha (W*ithania somnifera*) root powder and synbiotic on growth performance, carcass characteristics and cost economics in broilers. Indian Journal of Poultry Science, 59(3): 291-298.*

The study evaluated the effects of supplementing broiler diets with varying levels of ashwagandha root powder and synbiotic on growth performance, carcass traits, and cost efficiency. One hundred and eighty day old-chicks were randomly divided into six different treatment groups with three replicates of ten chicks each and were fed maize-soya based pre-starter, starter, and finisher broiler diets. The six treatment groups consisted of a negative control (T_1) without antibiotic, positive control group (T_2) with antibiotic, group (T_3) with ashwagandha root powder (ARP) 10g/ kg, group (T_4) with synbiotic (S) 0.5 g/ kg, group (T_5) with ARP 10 g/ kg and S 0.5 g/ kg (0.05%), group (T_6) with ARP 5 g/ kg + S 0.5 g/ kg (0.05%) in basal feed. Supplementing ashwagandha root powder in combination with synbiotic and synbiotic alone in basal diet of broiler resulted significant ($p \leq 0.01$) improvements in body weight gain (BWG), feed conversion ratio (FCR), performance index (PI), and protein efficiency ratio (PER). However, overall feed intake decreased in treatment groups T_3 and T_4 compared to control group T_1. Supplementation of ARP (10 g/kg feed) + 0.05% synbiotic significantly ($p \leq 0.05$) increased carcass characteristics parameters like carcass yield, ready-to-cook yield, breast meat yield and dressing percentage. However, no significance ($p \geq 0.05$) were observed in other parameters including weight of drumstick, breast meat giblet and relative organ weights. It was concluded that supplementing broiler diets with ashwagandha root powder and synbiotic led to reduced mortality and cost savings in feed/kg gain compared to the control group. This suggests that incorporating ashwagandha root powder at 10 g/kg feed alone or in combination with synbiotic at 0.05% in feed, could be a viable alternative to antibiotic growth promoters, optimizing feed cost and enhancing production performance in broilers.

Keywords: Ashwagandha, Synbiotic, Broiler chickens, Body weight gain, Phytobiotics, Growth promoter, Growth-promoting agents

INTRODUCTION

The poultry industry has become an important economic activity in many countries for the production of high-quality eggs and meat to balance the human diet. Among the meat from different species, poultry meat is an excellent source of high-quality protein, vitamins and minerals and is not subjected to any cultural and religious restrictions. The economic and nutritional demand of our modern society for food from poultry has necessitated the raising of poultry under intensive production system. Alternative strategies were developed to maintain poultry health and enhance productivity because antibiotics' overuse created problems including high production costs, meat residues, toxicity, antimicrobial resistance, and environmental/health hazards. In natural, traditional, and alternative health systems, phytobiotics, probiotics, prebiotics, and synbiotics have been used as a viable and safe alternative to antibiotic growth promoters.

Among the phytobiotics, ashwagandha root is used as a tonic, aphrodisiac, narcotic, diuretic, anthelmintics, astringent, thermogenic and stimulant. It has antioxidant, antistress, anticoccidial, immunomodulatory, and antilipidemic properties. Furthermore, it has an important function in decreasing blood sugar, serum cholesterol, and stress (Muhammad *et al.*, 2009). The active ingredients viz., withanolides found in ashwagandha root significantly improve the host's health. As it has broad-spectrum antibacterial and immunomodulatory properties, dietary inclusion increases the flocks' disease resistance level and lowers mortality. Similarly, synbiotic substances are known for their significant nutrient sparing effect in the gut of broilers and alters the growth performance of broilers. Synbiotic products also provide practical benefits, including improving resistance to bacterial infections in the digestive system and enhancing immune function in young broiler chickens.

Therefore, in the light of Ashwagandha as phytogenic source of growth promoter and its diverse pharmacological properties along with growth-stimulating effect of synbiotic substance, the present study was conducted to study the effect of varying amounts of ashwagandha root powder and synbiotic affect broiler chickens' growth performance, carcass characteristics, and economic costs.

MATERIALS AND METHODS

One hundred and eighty healthy day-old, commercial straight run broiler chicks of Ven Cobb strain

*Corresponding author E mail: anilmanas@gmail.com

were wing banded, weighed individually and they were distributed randomly into six treatment groups and reared under deep litter system. In this study, each treatment group consisted of three replicates, with ten birds randomly assigned to each replicate. All groups were managed uniformly, adhering to consistent practices in vaccination, feeding, watering, and lighting throughout the experiment. Fresh drinking water was provided daily on an *ad libitum* basis. The experiment was conducted from day old to forty-two days (6 weeks) of age of the birds.

The experiment was conducted from July 2022 to September 2022 at the poultry experimental station of NTR College of Veterinary Science, Gannavaram, India, latitude N 16° 32' 3", longitude E 80° 47' 34", approx. 22 meters above mean sea level. The average daily temperature and relative humidity during this period were 33°C and 60-70%, respectively. All procedures involving animal handling and experimentation were approved by the Institutional Animal Ethics Committee vide approval no. 05/IAEC/ NTRCVSc/22, dated 25.5.2022.

Diets

Ashwagandha roots were procured from the local market and were cleaned, cut into small pieces, dried and powdered in Willey's grinder for supplementing into broiler chicken diet and the commercially available synbiotic formulation "Bio-Org+® consisting of prebiotic and probiotic mixture, was procured from "M/s. My Agri Nutrition, Kesariyur, Murungai (PO), Thottiyam, Tiruchirappalli, India.". The treatment groups consisted of negative control group (T_1) without antibiotic, positive control group (T_2) with antibiotic, group (T_3) with ashwagandha root powder (ARP) at 10g/ kg, group (T_4) with synbiotic (S) at 0.5 g/ kg, group (T_5) with ARP at 10 g/ kg and S 0.5 g/ kg, group (T_6) with ARP at 5 g/ kg + S 0.5 g/ kg in basal feed. Diets were formulated for broiler pre-starter stage (0-2) weeks, broiler starter stage (2-4) weeks and broiler finisher stage (4-6) weeks separately as per ICAR (2013). The ingredient and nutrient composition of broiler basal diets was presented in Table 1.

Table 1: Ingredient and nutrient composition of experimental diets (100kg)

Nutrient and Parts	Pre-starter	Starter	Finisher
Maize	56	56.8	62
Soybean Meal	39	37.4	31.8
Oil	1.6	2.3	2.7
DCP	1.2	1.2	1.2
Shell grit	1.1	1.2	1.2
Trace Min. Mix	0.2	0.2	0.2
Salt	0.3	0.3	0.3
Lysine	0.3	0.3	0.3
DL-Methionine	0.12	0.12	0.12
Vitamin AB_2D_3K	0.05	0.05	0.05
Choline Chloride	0.1	0.1	0.1
Coccidiostat	0.03	0.03	0.03
Sub Total	100	100	100
Nutrient composition (analyzed values)			
ME^s (Kcal/kg)	3006.05	3053.43	3115.08
Protein energy ratio	1:137.8	1:140.9	1:159.7
CP%	21.81	21.54	19.52
Ca%	1.08	1.06	1.16
Total Phosphorus%	0.88	0.51	0.59

Pre-mix contains vitamin AB_2D_3 (0.05 kg): Vit-A 82,500 IU, Vit-B2 50 mg, Vit-D3- 12,000 IU, Vit-K 10 mg; Trace minerals (0.2 kg): manganese sulphate 55000 mg, ferrous sulphate 50000 mg, zinc sulphate 50000 mg, cobalt sulphate 500 mg, copper sulphate 3000 mg, potassium Iodide 3000 mg, sodium selenite 500 mg; Choline Chloride-60% (0.1 kg); Coccidiostat (0.02-0.03 kg). Antibiotic (Chemoxy 200-Oxytetracycline 0.01%) is added for only T_2 group.

Cost of antibiotic is Rs.697/- ; ^{s} calculated.

Growth performance, carcass parameters and cost economics

A six-week feeding trial was conducted and experimental diet was provided *ad libitum* to all replicates of chicks. Weekly records were maintained for feed consumption and body weight gain. Furthermore, feed conversion ratio (feed to gain ratio), performance index (gain relative to FCR), and protein efficiency ratio (protein intake relative to gain) were calculated.

At the end of the experiment at 6 weeks, three birds per replicate (totaling nine birds per treatment) were randomly selected, weighed and then slaughtered. Data on dressing percentage, carcass yield, ready-to-cook yield percentage, and the weights of drumstick, breast meat, heart, liver, gizzard, and giblet were recorded.

The economics of rearing broilers up to 6 weeks, supplemented with ashwagandha root powder and synbiotic at varying levels in the diets was assessed based on the actual feed cost in the current market. The cost of ashwagandha root powder and synbiotic were calculated at Rs. 210 per kg and Rs. 500 per kg, respectively, according to prevailing market prices.

Statistical analysis

Statistical analysis followed methods described by Snedecor and Cochran (1994) using SPSS software (version 24.0; SPSS, 2016). Data were analyzed through one-way analysis of variance using a generalized linear model, and treatment means were compared using Duncan's multiple range test, with differences considered significant at $p \leq 0.05$ (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition of ashwagandha root powder and Synbiotic

The percent dry matter (DM), organic matter (OM), Crude protein (CP), Ether extract (EE), Crude fiber (CF),

Nitrogen free extract (NFE), Total ash (TA and Acid insoluble ash (AIA) content of ashwagandha root powder and synbiotic were 97.88 and 98.99; 90.06 and 86.65; 5.41 and 5.04; 6.76 and 0.92; 21.82 and 0.83; 56.07 and 79.86; 9.94 and 13.35; 1.24 and 1.16 per cent, respectively. The calcium and phosphorus content of ashwagandha root powder was 2.45 and 0.41%, respectively, whereas for the synbiotic, it was 2.23 and 0.24%, respectively.

Growth performance

The findings of this study show that dietary supplementation with ashwagandha root powder and synbiotic in T5 group increased body weight gains in broiler chickens, correlating with previous research and highlighting the potential of these supplements as alternatives to traditional growth-promoting agents in poultry production. The observed growth-promoting benefits are most likely attributable to the antibacterial, antioxidant, and digestive enzyme-stimulating capabilities of the active ingredients found in ashwagandha roots, as well as the improved nutrient absorption and feed efficiency associated with this supplementation.

The current study found a substantial increase in body weight increases in broiler hens supplemented with ashwagandha root powder and synbiotics, especially in the T5 group (2082.33g), when compared to other groups (Table 2). This conclusion aligns with previous research by Swaroop et al. (2022), who examined nutritional supplementation of broiler chickens with a phytogenic formulation as an alternative to antibiotic growth promoters, and discovered that it improved body weight. Furthermore, Dwivedi et al. (2015) also observed that chicks treated with antibiotics and ashwagandha at 0.5% gained much more weight than the control group. Similarly, Joshi et al. (2015) found that chicks fed 2 g of Withania per kg of diet gained weight than control groups. Several studies on feeding ashwagandha and synbiotic supplementation on body weight gain in broiler chickens has been carried out by various researchers, yielded a range of outcomes. Kale et al. (2014) observed increased weight gain in broiler chicks when fed with 0.25% and 0.5% ashwagandha, although no significant differences were reported within the supplemented groups. In contrast to the current research observations, Thakur (2017) reported maximum body weight in broilers when supplemented with 0.5% W. somnifera in combination with 0.05% synbiotic. This finding aligns with a consistent trend seen in other studies, where the effects of synbiotic supplementation on body weight gain were found to be consistent with positive outcomes. Ashayerizadeh et al. (2009), Abdel-Raheem et al. (2011), Dizaji et al. (2012), Ghasemi and Taherpour (2013) and Sarangi et al. (2016) have also all reported similar positive effects of synbiotics on body weight gain in broiler chickens. However, in contrast to these findings, Raksasiri et al. (2018) did not observe a significant impact on average daily gain in either the control or the synbiotic-supplemented groups.

Feed intake, FCR, performance index (PI) and protein effeciency ratio (PER)

Feed consumption in the control group (T1) showed a significant increase ($p \leq 0.05$) in this study, while no significant differences were detected among the supplemented groups (Table 2). Supplementation with ashwagandha or synbiotic, either individually or together, resulted in reduced feed intake compared to the control group. This finding was consistent with Dwivedi et al. (2015), who observed a decrease ($p \leq 0.05$) in average feed consumption in all supplemented groups when ashwagandha root powder was incorporated at concentrations of 0.5%, 1.0%, and 1.5% in broiler diets, relative to the control group. Similarly, Pandey et al. (2013) also noted a significant ($p \leq 0.05$) decrease in feed consumption among broilers given a Withania-based diet compared to the control group. Raksasiri et al. (2018) observed that feed intake increased significantly ($p \leq 0.05$) in the control diet while no significant differences were found among the supplemented groups, which aligns with our current findings. In contrast, Vasanthakumar et al. (2015) reported that feed intake (g) in groups supplemented with ashwagandha root powder and root extract was significantly lower ($p \leq 0.05$) than in the control group. Joshi et al. (2015) did not find a significant difference in overall feed intake ($p \leq 0.05$) in broilers when W. somnifera root powder was supplemented at 1g or 2g/kg. The previous studies by researchers (Yalcinkaya et al., 2008; Ashayerizadeh et al., 2009; Bozkurt et al., 2009; Dizaji et al., 2012; Ghasemi and Taherpour, 2013; Li et al., 2019) have reported that no significant difference was observed in broilers supplemented with synbiotics in their basal diet.

In this study, the feed conversion ratio (FCR) was significantly lower ($p \leq 0.01$) in the T5 group (which received ashwagandha at 10 g/kg feed combined with 0.5 g/kg synbiotic) and significantly higher ($p \leq 0.01$) in the T1 (control) group (Table 2). The present finding aligns with Dwivedi et al. (2015), who observed improved FCR in a group supplemented with both antibiotic and ashwagandha at 0.5% in broilers compared to the control group. Bhardwaj and Gangwar et al. (2011) investigated the efficacy of ashwagandha root powder in Japanese quails feed supplemented at 0.5%, 1%, and 1.5% and concluded that 1% ashwagandha root powder significantly improved feed efficiency. Similar beneficial effects of ashwagandha supplementation on FCR were also demonstrated in the present study by various researchers, including Srivastava et al. (2013), Biswas et al. (2012), and Singh et al. (2017). Several other studies (Ashayerizadeh et al., 2009; Bozkurt et al., 2009; Abdel-Raheem et al., 2011; Dizaji et al., 2012; Ghasemi and Taherpour, 2013; Li et al., 2019) also reported that better

FCR in synbiotic-fed groups compared to the control group. In contrast to our present study, Vasanthakumar et al. (2015) did not find any significant difference in FCR ($p \geq 0.05$) in commercial broilers supplemented with root powder; however, a significant effect was observed with 0.15% ashwagandha root extract. Similarly, Joshi et al. (2015) found similar FCR among the treatment groups in broilers. Further, Sarangi et al. (2016) and Raksasiri et al. (2018) reported that the feed conversion ratio (FCR) did not show significant differences ($p \geq 0.05$) among the treatment groups during the experimental period.

In the current study, the highest Performance Index (PI) was observed in the group fed with a combination of ashwagandha (10 g/kg feed) and synbiotic (0.5g/kg feed) (Table 2). This ashwagandha supplemented group has shown superior PI compared to the other groups, which might have attributed to accelerated growth and enhanced nutrient absorption.

Biswas *et al.* (2012) reported that significant improvement in PI of broilers fed with ashwagandha powder and ascorbic acid at various levels, compared to the control group ($p \leq 0.05$). Similarly, Srivastava et al. (2013) reported that broiler chicks fed diets containing 50% ashwagandha at a 2% level exhibited a significant improvement in performance index. Additionally, Dwivedi et al. (2015) also observed that broilers had shown the highest PI when ashwagandha was included at 0.5% in their diets.

During the trial, the T5 group (10 g/kg fed ashwagandha in combination with 0.05% synbiotic) had the greatest ($p \leq 0.01$) protein efficiency ratio (PER) while the T1 (control) group had the lowest (Table 2). The higher PER noticed in broilers fed ashwagandha and synbiotics alone or in combination in broiler diets may be attributable to better body weight growth in these groups. According to the findings, the PER followed the same pattern as the FCR. Thakur (2017) found that supplementing with either individual feed additives or their combination significantly increased the protein efficiency ratio (PER) across all treatments. Notably, cumulative PI was highest ($p \leq 0.05$) in broilers fed with 1% and 1.5% ashwagandha root powder than those of control and synbiotic fed groups at the end of 42-day trial. These findings align with Ashayerizadeh et al. (2009), who reported a significantly higher ($p \leq 0.05$) PER in the synbiotic-treated group relative to the control, corroborating the current study's results.

Carcass characteristics

In the present study, the carcass yield was significantly ($p \leq 0.05$) highest in T_5 group compared to

Table 2: Effect of dietary supplementation of ashwagandha root powder and synbiotic on growth performance of broilers (Mean±SEM**)**

Treatment	Body Weight Gain (g)	Feed Intake (g)	Feed Conversion Ratio	Performance Index (g)	Protein Efficiency Ratio
T_1	1883.73^{a}±18.49	3455.85$^{b±}$24.63	1.83^{d}±0.02	1027.09^{a}±21.15	2.63^{a}±0.03
T_2	1978.67^{b}±15.31	3395.11^{ab}±18.72	1.72$^{bc±}$0.01	1153.20^{c}±12.69	2.81$^{bc±}$0.01
T_3	1915.77^{a}±15.48	3347.87^{a}±19.88	1.75^{bc}±0.01	1096.43^{b}±16.90	2.77^{bc}±0.02
T_4	1911.07$^{a±}$7.43	3366.20^{a}±37.97	1.76^{c}±0.01	1085.08$^{b±}$4.83	2.75^{b}±0.02
T_5	2082.33^{c}±15.36	3387.58^{ab}±7.01	1.63^{a}±0.02	1280.20^{d}±20.43	2.97^{d}±0.02
T_6	1985.33$^{b±}$9.84	3381.95^{ab}±16.39	1.70^{b}±0.02	1165.67^{c}±16.50	2.83^{c}±0.03
SEM	16.74	11.29	0.02	20.10	0.03
N	3	3	3	3	3
P	0.0001	0.016	0.0001	0.0001	0.0001
SS	**	*	**	**	**

^{abcd}Values within a column bearing different superscripts differ significantly *($p<0.05$), **($p<0.01$).

Table 3: Effect of dietary supplementation of ashwagandha root powder and synbiotic on carcass parameters (g) (Mean±SEM)

Treatment	Carcass yield (g)	Ready to cook yield (g)	Breast meat yield (g)	Drumstick weight (g)
T_1	1185.56^{a}±46.61	1277.22^{a}±48.94	417.33^{a}±17.68	93.11±2.54
T_2	1266.49^{ab}±30.50	1358.83^{ab}±31.60	451.44^{ab}±15.90	95.00±1.46
T_3	1217.44^{a}±19.68	1311.33^{a}±19.78	422.78^{a}±10.85	94.67±2.48
T_4	1286.44^{ab}±33.47	1380.89^{ab}±34.30	470.44^{bc}±12.10	94.89±2.16
T_5	1384.33$^{b±}$19.38	1480.00^{b}±18.91	503.33^{c}±14.77	96.33±1.09
T_6	1243.89^{a}±29.47	1357.56$^{ab±}$23.69	453.89^{ab}±10.89	95.00±1.54
SEM	14.89	14.95	6.72	0.77
N	9	9	9	9
P	0.050	0.020	0.015	0.923
SS	*	*	*	NS

^{abc}Values within a column bearing different superscripts differ significantly *($p \leq 0.05$), NS: Non-significant.

control group T_1 (Table 3). The results are also similar to the findings of Rindhe *et al.* (2012) and Vasanthakumar *et al.* (2015) who revealed that the hot carcass weight (un chilled weight of carcass) was significantly ($p \leq 0.05$) higher in ashwagandha supplemented groups compared to unsupplemented group. Abdel-Raheem *et al.* (2011) reported that synbiotic supplemented broilers had a significant increase ($p \leq 0.05$) in carcass weight as compared to the control group. In contrast to the present findings, no significant difference in carcass weight was observed by Ashayerizadeh *et al.* (2009), Bozkurt *et al.* (2009), Toghyani and Sayed (2011), Raksasiri *et al.* (2018) and Sarangi *et al.* (2016).

The present study also indicated that, feed supplemented with either antibiotic, ashwagandha, synbiotic alone or in combination of ashwagandha and synbiotic statistically ($p \leq 0.05$) increased the ready to cook yield as compared to control and highest ready to cook yield was observed at T5 group (Table 3). The results of the present findings were in agreement with Singh et al. (2017), who reported that, the cooking yield (percent) was significantly ($p \leq 0.05$) higher in the ashwagandha and selenium treated groups compared to the control group. Contrary to the present findings, Vasantha Kumar et al. (2015) and Kale et al. (2015) reported that no significant effect ($p \geq 0.05$) on ready to cook yield in broilers supplemented with ashwagandha as feed additive (phytobiotic) in the diet.

Breast meat yield was significantly ($p \leq 0.05$) higher in T5 group (ashwagandha 10 g/kg feed in combination with 0.5% synbiotic) compared to control (T1) group (Table 3). The meat yield as per cent of live weight from breast muscle part showed remarkably higher ($p \leq 0.05$) yield in broilers fed basal diet containing ashwagandha alone (T4) or combined with Synbiotic (T5) (Table 5). Thakur (2017) obtained highest percent breast yield in 0.5% ashwagandha combined with 0.05% Synbiotic in broiler. Rindhe *et al.* (2012) and Javed *et al.* (2009) observed that ashwagandha supplementation had a positive effect on broilers breast muscle content. Contrary to the present findings, several researchers (Ashayerizadeh *et al.*, 2009; Sarangi *et al.*, 2016; Raksasiri *et al.*, 2018) found no significant difference ($p \geq 0.05$) in carcass traits with respect to breast meat yield in synbiotic supplemented broilers compared to other treatment groups.

The present study indicated that no significance ($p \geq 0.05$) was observed in the weight of drumstick among the treatment groups (Table 3). In line with the current findings, found no significant difference ($p \geq 0.05$) in drumstick percentage among Cobb broilers fed a synbiotic supplemented diet. Contrary to the present findings, Singh et al. (2017) results showed that drumstick weight (g) of broiler chicks were considerably greater in the treatment group supplemented with ashwagandha and selenium compared to the control group. The findings of Vasantha Kumar et al. (2015) and Kale et al. (2015) indicated a significant increase ($p \geq 0.05$) in drumstick weight following ashwagandha supplementation.

Significantly ($p \geq 0.05$) higher heart weight in broilers were observed in broilers fed with diets containing ashwagandha powder (10 g/kg feed) in combination with 0.5% synbiotic compared to control group (Table 4). In contrast with the present findings, Sanjyal and Sapkota (2011) found that broilers treated with ashwagandha had numerically similar percent relative weight of heart as compared to control. Saiyed et al. 2015 and Sarangi et al. (2016) also observed that no significant ($p \leq 0.05$) difference in the weights of heart in Cobb broilers on synbiotic fed diet.

In the current study, the dressing percentage was significantly ($p \leq 0.05$) highest in T_5 and lowest in T_1 (Table 5). Similar to the current findings, Javed *et al.* (2009) observed that significantly higher ($p \leq 0.05$) dressing percentage in groups supplemented with 10ml ashwagandha contained herbal extract at 5, 10 and 20 percent levels in the diets when compared with control. Higher dressing percentage ($p \leq 0.05$) in *Withania* supplemented broiler group as compared with control was observed by Sanjyal and Sapkota. (2011). Similarly, Abdel-Raheem *et al.* (2011) and Sayied *et al.* (2015)

Table 4: Effect of dietary supplementation of ashwagandha root powder and synbiotic on visceral organs (Mean±SEM)

Treatment	Heart (g)	Liver (g)	Gizzard (g)	Spleen (g)	Giblet (g)
T_1	8.00^{a}±0.83	42.56±2.32	38.78±0.43	2.33±0.29	91.67±3.15
T_2	9.44^{ab}±0.38	42.89±0.84	37.89±0.77	2.11±0.20	92.33±1.4
T_3	9.56^{ab} ±0.56	44.11±0.89	38.11±0.95	2.11±0.11	93.89±1.01
T_4	10.56^{b} ±0.58	43.00±1.54	38.44±0.47	2.44±0.18	94.44±2.14
T_5	10.00^{ab}±0.47	43.89±0.86	39.00±1.2	2.78±0.22	95.67±1.81
T_6	10.33^{ab}±0.53	43.11±0.42	38.67±0.88	2.44±0.24	94.56±1.07
SEM	0.25	0.51	0.33	0.09	0.77
N	9	9	9	9	9
P	0.041	0.953	0.935	0.254	0.691
SS	*	NS	NS	NS	NS

^{ab}Values within a column bearing different superscripts differ significantly *($p \leq 0.05$), NS: Non-significant.

reported that synbiotic supplemented broilers had a significant increase (p≤0.05) in dressing percentage in synbiotic supplemented broiler group as compared to the control group. In contrast, Vasanthakumar *et al.* (2015) and Kale *et al.* (2015) observed no significant (p≤0.05) effect of ashwagandha root powder on dressing percentage. Ahmed *et al.* (2015) reported that no significant (p≤0.05) increase in dressing percentage in group fed with 1.5 g ashwagandha leaves per kg diet as compared to control. Sarangi *et al.* (2016) observed that no significant (p≤0.05) difference in the carcass traits with respect to dressing percentage in Cobb broilers under study.

The present study indicated that, the weight of liver, gizzard and giblet had no significance (p≥0.05) in broilers fed with diets containing antibiotic, ashwagandha, synbiotic and in combination of ashwagandha and synbiotic (Table 4). Similar results were reported by Vasantha Kumar *et al.* (2015) and Kale *et al.* (2015) for the giblet weight. In Cobb broilers fed a synbiotic-fed diet, Saiyed *et al.* (2015) and Sarangi *et al.* (2016) found no significant (p≤0.05) difference in the weights of the liver, gizzard, and giblets. In contrast with the present findings, Rindhe *et al.* (2012) reported that incorporation of ashwagandha in a polyherbal antistressor and antioxidant formulation enhanced giblet yield.

It is evidence from the data that no significance (p≤0.05) was observed in giblet per cent among the treatment groups (Table 5). Similar to the present findings, Sanjyal and Sapkota (2011) observed broilers fed with ashwagandha had numerically high percent relative weights of the liver and gizzard. However, Singh *et al.*(2017) reported that significantly highest giblet percentage in the ashwagandha and selenium treated groups compared to the control group. Similarly, Thakur. (2017) also obtained highest giblet percentage in broilers supplemented with combination of 0.5% *W. somnifera* and 0.05% synbiotic.

Table 5: Effect of dietary supplementation of ashwagandha root powder and synbiotic on carcass characteristics (%) (Mean±SEM)

Treatment	Dressing %	Breast meat %	Giblet %
T_1	70.11^{a}±0.22	22.96±0.76	4.75±0.12
T_2	72.26^{bc}±0.19	24.03±0.73	4.92±0.07
T_3	$71.99^{bc±}$0.65	23.20±0.47	5.16±0.07
T_4	71.06^{ab}±0.24	24.25±0.55	4.87±0.12
T_5	73.33^{c}±0.17	25.02±0.94	5.04±0.11
T_6	72.03^{bc}±0.29	24.19±0.89	5.03±0.09
SEM	0.19	0.30	0.04
N	9	9	9
P	0.018	0.297	0.083
SS	*	NS	NS

[abc]Values within a column bearing different superscripts differ significantly *(p≤0.05), NS: Non-significant.

Cost economics

The study indicated that supplementation of antibiotic or synbiotic alone or ashwagandha in combination of synbiotics inT5 and T6 groups had decreased (p≥0.01) the feed cost/kg gain (¹) in broilers as compared to the control group T_1. The feed cost / kg gain was lowest in T_5 and highest in T_1 (Table 6). Similar to the results of the present study, Mushtaq. (2007) who has reported a higher net return by supplementing broilers with 20% ashwagandha root extract. Incorporation of synbiotic yields more return than control and the present study is in accordance with Saiyed et al. (2015). Thakur (2017) also reported that the profit per bird was significantly (p≤0.05) highest in 0.5% ashwagandha combined with 0.05% synbiotic group with a profit of about 29.54%. In contrast, Kale et al. (2015) reported that the ashwagandha fed group had lesser net profit per bird than the control group. However, the gross return was considerably higher in 0.25% ashwagandha supplemented group than the control group of broilers. Kathirvelan et al. (2012) found feed cost per kg weight gain was lesser in synbiotic group than control group.

Table 6: Effect of dietary supplementation of ashwagandha root powder and synbiotic on feed cost per kg gain (¹)

Treatment	Cost of feed /bird	Body weight gain	Feed cost/ kg gain
T1	189.24^{ab}±1.20	1883.73^{a}±18.49	100.48^{d}±1.18
T2	186.48^{a}±0.89	1978.67^{b}±15.31	94.25^{ab}±0.39
T3	191.30^{bc}±0.97	1915.77^{a}±15.48	99.86^{d}±0.81
T4	185.93^{a}±1.72	$1911.07^{a±}$7.43	97.28^{c}±0.55
T5	194.07^{c}±0.31	2082.33^{c}±15.36	93.21^{a}±0.77
T6	190.26^{b}±0.76	$1985.33^{b±}$9.84	95.84^{bc}±0.83
SEM	0.77	16.74	0.71
N	3	3	3
P	0.001	0.0001	0.0001
SS	**	**	**

[abcd] Values within a column bearing different superscripts differ significantly ** (p≤0.01).

Note: The cost of ashwagandha root powder and synbiotic is Rs. 210 per kg and Rs.500 per kg respectively. Cost of antibiotic is Rs.697 per kg.

CONCLUSION

Based on the results of the present study, it is concluded that supplementing synbiotics and ashwagandha root powder in basal diet of broilers at different levels had no impact on feed intake. However, it was found that supplementing the diet with ashwagandha root powder (10g/kg feed) and synbiotic (0.5g/kg feed) improved FCR, carcass yield (g), and ensured lesser feed cost/kg gain in broilers compared to those fed with control diets. To minimize feed costs and to ensure higher broiler production performance, the diet of broilers can be supplemented with ashwagandha root

powder (10g/kg feed) and synbiotic (0.5g/kg) as an alternative growth promoter to antibiotics.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the financial support provided by Sri Venkateswara Veterinary University, Tirupati, and extend their appreciation to M/s. My Agri Nutrition, Kesariyur, Murungai (PO), Thottiyam, Tiruchirappalli, India, for supplying the essential feed additive which contributed to the success of this study.

CONFLICT OF INTEREST

The authors declare that this research was conducted with prior approval from both the university and a commercial private firm, and declare that there are no potential conflicts of interest, whether in conduct or financial relationships.

REFERENCES

Abdel-Raheem, S.M. and Abd-Allah, S.M. 2011. The effect of single or combined dietary supplementation of mannan oligosaccharide and probiotics on performance and slaughter characteristics of broilers. *International Journal of Poultry Science*, **10**(11): 854-862.

Ahmed, S.K., Abdul-Abass, M.H. and Al-Hammed, S.A. 2015. Effect of dietary supplementation of natural and synthetic antioxidants on broilers physiological and productive performance. *Egyptian Poultry Science Journal*, **35**(1): 93-105.

Ashayerizadeh, A., Dabiri, N., Ashayerizadeh, O., Mirzadeh, K.H., Roshanfekr, H. and Mamooee, M. 2009. Effect of dietary antibiotic, probiotic and prebiotic as growth promoters, on growth performance, carcass characteristics and hematological indices of broiler chickens. *Pakistan Journal of Biological Sciences*, **12**: 52-57.

Bhardwaj, R.K. and Gangwar, S.K. 2011. Effect of dietary supplementation of *Withania somnifera* on egg production and egg quality parameters in Japanese Quails. *International Journal of Advanced Biological Research*, **1**: 32-34.

Biswas, P., Sharma, R.K. and Biswas, A. 2012. Effect of dietary supplementation of ashwagandha (*Withania somnifera*) and ascorbic acid on production performance of broiler birds. *Indian Journal of Poultry Science*, **47**(3): 403-405.

Bozkurt, M., Çýnar, M., Çath, A.U. and Kucukyýlmaz, K. 2009. The effect of single or combined dietary supplementation of prebiotics, organic acid and probiotics on performance and slaughter characteristics of broilers. *South African Journal of Animal Science*, **39**(3): 197-204.

Dizaji, B.R., Hejazi, S. and Zakeri, A. 2012. Effects of dietary supplementations of prebiotics, probiotics, synbiotics and acidifiers on growth performance and organs weights of broiler chicken. *European Journal of Experimental Biology*, **2**(6): 2125-2129.

Duncan, D.B. 1955. Multiple range and multiple F-tests. *Biometrics*, **11**: 1-42.

Dwivedi, V.K., Singh, V.K., Tewari, D., Gautam, S. and Singh, S.P. 2015. Effect of ashwagandha (*Withania somnifera*) on performance, haemato-biochemical parameters and economics of broiler production. *Animal Nutrition and Feed Technology*, **15**(2): 207-216.

Ghasemi, H.A. and Taherpour, K. 2013. Comparative effects of probiotic, prebiotic and synbiotic supplements on performance, jejunal morphology, serum lipid profile and antibody response of broiler chicks. *Journal of Livestock Science and Technologies*, **1**(2): 20-27.

ICAR. 2013. *Nutrient Requirements of Poultry*. Published by Indian Council of Agricultural Research, New Delhi.

Javed, M., Durrani, F.R., Hafeez, A., Khan, R.U. and Ahmad, I. 2009. Effect of aqueous extract of plant mixture on carcass quality of broiler chicks. *Asian Research Publishing Network Journal of Agricultural and Biological Science*, **4**(1): 37-40.

Joshi, S.S., Ingle, P.B., Bhagwat, S.R., Pawar, M.M., Prajapati, K.B. and Kulkarni, R.C. 2015. Effect of dietary addition of ashwagandha (*Withania somnifera*) and guduchi (*Tinospora cordifolia*) powder on broiler performance. *Indian Journal of Animal Science*, **85**(12): 1358-1361.

Kale, V.R., Wankhede, S.M. and Karle, S.D. 2014. Effect of dietary supplementation of ashwagandha (*Withania somnifera*) on carcass quality of broiler chicken. *Indian Journal of Animal Nutrition*, **31**(1): 81-85.

Kale, V.R., Wankhede, S.M. and Amrutkar, S.A. 2015. Impact of dietary supplementation of ashwagandha (*Withania somnifera*) root powder on production efficiency of broiler chicks. *Indian Veterinary Journal*, **92**(6): 69-70.

Kathirvelan, C., Premchandar, D., Purushothaman, M.R., Vasanthakumar, P. and Chandrasekaran, D. 2012. Study on synergistic effects of non-starch polysaccharides NSP degrading enzyme, probiotic and prebiotics supplementation on broiler performance. *International Journal of Agriculture and Biosciences*, **1**(1): 20-22.

Li, J., Cheng, Y., Chen, Y., Qu, H., Zhao, Y., Wen, C. and Zhou, Y. 2019. Effects of dietary synbiotic supplementation on growth performance, lipid metabolism, antioxidant status, and meat quality in Partridge shank chickens. *Journal of Applied Animal Research*, **47**(1): 586-590.

Muhammad, Javed, Durrani, F.R., Hafeez, A., Khan, R.U. and Ahmad, I. 2009. Effect of aqueous extract of plant mixture on carcass quality of broiler chicks. *Asian Research Publishing Network Journal of Agricultural and Biological Science*, **4**(1): 37-40.

Mushtaq, M. 2007. Hematological hypolipidemic hypoglycemic anticoccidial hepatoprotective immunostimulant and growth promotant effect of *Withania somnifera* in broiler production. *M.Sc. Thesis*, North West Frontier Province Agricultural University, Peshawar, Pakistan.

Pandey, N.K., Singh, D.P. and Niwas, R. 2013. Broiler characteristics, sensory qualities, and economic efficiency in Vencobb-400 chicks supplemented with a conjugated herbal feed additive in diet. *Animal Science*, **7**(4): 128-132.

Raksasiri, B.V., Paengkoum, P., Paengkoum, S. and Poonsuk, K. 2018. The effect of supplementation of synbiotic in broiler diets on production performance, intestinal histo-morphology and carcass quality. *International Journal of Agricultural Technology*, **14**(7): 1743-1754.

Rindhe, S., Suryavanshi, S.U., Khose, K.K., Waghmare, R.N., Saxena, M.J., Ravikanth, K. and Maini, S. 2012. Role of polyherbal liquid antistressor product in improving meat quality attributes in broilers. *International Research Journal of Pharmacy and Pharmacology*, **2**(9): 209-214.

Saiyed, M.A., Joshi, R.S., Savaliya, F.P., Patel, A.B., Mishra, R.K. and Bhagora, N.J. 2015. Study on inclusion of probiotic, prebiotic and its combination in broiler diet and their effect on carcass characteristics and economics of commercial broilers. *Veterinary World*, **8**(2): 225-230.

Sanjyal, S. and Sapkota, S. 2011. Supplementation of broilers diet with different sources of growth promoters. *Nepal Journal of Science and Technology*, **12**: 41-50.

Sarangi, N.R., Babu, L.K., Kumar, A., Pradhan, C.R., Pati, P.K. and Mishra, J.P. 2016. Effect of dietary supplementation of prebiotic, probiotic, and synbiotic on growth performance and carcass characteristics of broiler chickens. *Veterinary World*, **9**(3): 313-318.

Singh, M.K., Singh, V.P., Sahu, D.S. and Jinu, M. 2017. Effect of dietary supplementation of ashwagandha (*Withania somnifera*) and selenium on growth performance and carcass quality of broilers. *Asian Journal of Animal Science*, **12**(2): 129-133.

Snedecor, G.W. and Cochran, W.G. 1994. *Statistical Methods.* 6th edn. Iowa State University Press, Ames, USA.

Srivastava, S.B., Niwas, R., Singh, D.P. and Bisen, B. 2013. Impact of herbal based diets on production efficiency of broiler. *The Bioscan*, **8**(1): 119-122.

Swaroop, N., Chitithoti, A., Kumar, A., Ganguly, B. and Thullimalli, S. 2022. Efficacy of a phytogenic formulation as a replacer of antibiotic growth promoters at improving growth, performance, carcass traits and intestinal morphology in broiler chicken. *Journal of Animal Science and Technology*, **64**(3): 567-578.

Thakur, S. 2017. Effect of single or combined dietary supplementation of *Withania somnifera* and synbiotic mixture (prebiotic and probiotic) on performance and carcass characteristics of broilers. *Ph.D. Thesis*, Rajasthan University of Veterinary and Animal Sciences, Bikaner.

Toghyani, M. and Sayed Tabeidian, S.A. 2011. Effect of probiotic and prebiotic as antibiotic growth promoter substitutions on productive and carcass traits of broiler chicks. *International Conference on Food Engineering and Biotechnology*, **9**: 82-86.

Vasanthakumar, P., Pangayarselvi, B., Sasikumar, P., Chandrasekaran, D., Doraisamy, K.A. and Purushothaman, M.R. 2015. Performance of broilers fed ashwagandha (*Withania somnifera*) incorporated diets during summer season for alleviating heat stress. *Indian Journal of Animal Research*, **49**(3): 1-3.

Yalcinkaya, I., Guengoer, T., Baºalan, M. and Erdem, E. 2008. Mannan oligosaccharides (MOS) from *Saccharomyces cerevisiae* in broilers: Effects on performance and blood biochemistry. *Turkish Journal of Veterinary and Animal Sciences*, **32**(1): 43-48.