



Effect of Phytobiotic Feed Additives- Garlic (*Allium sativum*), Ashwagandha (*Withania somnifera*) and Shatavari (*Asparagus racemosus*) as Alternatives to Antibiotic on Growth Performance and Economics in Broiler Chicken

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ABSTRACT

Background: Poultry production is a vital and rapidly growing sector, providing a significant source of animal protein to meet the nutritional needs of a growing population. The production of healthy and high-performing poultry is essential for the sustainability and profitability of this industry.

Methods: A feeding trial was conducted for 42 days at Veterinary College Navania, Udaipur in the year 2021. A total of 300, day-old broiler chicks (Cobb-400) were weighted and randomly distributed to ten treatment groups in a completely randomized design with three replicates of 10 birds under each treatment. The birds were fed as per feeding standard. The T₁ i.e. control group was fed on basal diet, while T₂ was supplemented with Oxytetracycline (OTC) powder @ 0.1 g/kg feed. T₃ and T₄ were supplemented with Garlic powder @ 0.75% and @ 1.50%. T₅ and T₆ were supplemented with Ashwagandha powder @ 0.75% and @ 1.50%. T₇ and T₈ were supplemented with Shatavari powder @ 0.75% and @ 1.50%. T₉ was supplemented with Garlic powder @ 0.25%, Ashwagandha powder @ 0.25% and Shatavari powder @ 0.25%. T₁₀ was supplemented with Garlic powder @ 0.50%, Ashwagandha powder @ 0.50% and Shatavari powder @ 0.50%.

Result: There were highly significant (P<0.01) effect of treatment on feed intake, body weight gain and feed conversion ratio (FCR) in different treatment groups. The result showed that the supplementation of 0.50% Garlic, 0.50% Ashwagandha and 0.50% Shatavari powder in broiler diet had significant effect on growth performance. However, net return per bird was higher in supplementation of 0.25% Garlic, 0.25% Ashwagandha and 0.25% Shatavari root powder.

Key words: Ashwagandha, Broiler chicks, Garlic, Growth, Oxy tetracycline, Shatavari.

INTRODUCTION

The main benefits of the poultry farming are to its enormous potential to bring about rapid economic growth, for weaker sections due to its low investment requirement (Anonymous 2014a). Banning the use of antibiotics in poultry production is a crucial and urgent public concern because its overuse or misuse have led to the emergence of antimicrobial resistant bacteria (Jan and Ester, 2020; Mojca, 2020b). Therefore, the use of herbal supplements or photobiotic is one of the solutions to promoting animal production, health and even eliminating the need for antibiotics (Daniel *et al.*, 2023; Musa *et al.*, 2020). Phytochemicals can be found in the leaves, stem bark, roots, buds, flowers and seeds of herbal plant at various concentrations (Ojediran *et al.*, 2024a). Phytogenic feed additives show a wide range of potential benefits such as, increased enzymatic activity in the intestinal tract, improved nutrient utilization, scavenging the activities of free radicals, inhibiting the activities of pathogenic organisms in the gut, oxidative stress prevention, amongst other all aimed at targeting the enhancement of performance of birds (Shittu *et al.*, 2024). Garlic (*Allium sativum*) having active ingredient alicine, diallyldisulfide has been considered as a wonder drug in herbal world and used as growth promoter. It

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improves nutrient utilization and feed conversion efficiency, improve digestion and immunity. Ashwagandha (*Withania somnifera*) it contains many active principles such as withanolides, somnitalglucose, inorganic salt, with anone,

dihydroxykaempferol-3 and rutinoides (Murthy *et al.*, 2009) and (Pal *et al.*, 2012). These active principles have been reported to possess immuno modulatory, general tonic, hepato-protective, anti-stress, growth promoter and antioxidant properties (Ansari *et al.*, 2008; Singh *et al.*, 2018; Kushwaha *et al.*, 2012 and Verma *et al.*, 2011) beside antibacterial and anti-fungal properties (Punetha *et al.*, 2010). Shatavari is the one of most commonly used herb in traditional medicine due to presence of steroidal saponins and sapogenins in various part of plant (Krishana *et al.*, 2005). It enhancing the appetite, performance and stimulates the liver function.

Therefore, considering the above facts the present research was planned to assess the effect of Garlic (*allium sativum*), Ashwagandha (*withania somnifera*) and Shatavari (*asparagus racemosus*) as alternatives to antibiotic on growth performance and economic in broiler chicks.

MATERIALS AND METHODS

The experiment was conducted at the Poultry Unit located in LFC (Livestock Farm Complex) and Department of Animal Nutrition, of College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur (Rajasthan). A total of 300, day-old broiler chicks (Cobb-400) were procured from Kewalramani Hatcheries Private Limited, Ajmer and randomly assigned to ten treatment groups in a completely randomized design with three replicates of ten birds under each treatment. Garlic (*Allium sativum*) powder, Ashwagandha (*Withania somnifera*) powder and Shatavari (*Asparagus racemosus*) powder were purchased from Mohanji Pansari Herbal Product Co. Rani Bazar, Industrial Area, Bikaner, Rajasthan. Oxytetracycline powder was purchased from local medical store, Bikaner. The ISO certified basal feed (broiler pre- starter, broiler starter and broiler finisher) "Udaipur Kukkut Utpadak Sahkari Samiti Limited was used for feeding of experimental broiler chicks. The basal feed and Garlic (*Allium sativum*), Ashwagandha (*Withania somnifera*) and Shatavari (*Asparagus racemosus*) powder were analyzed for chemical composition (Table 1) according to standard procedure (AOAC, 2016). The T₁ i.e. control group was fed on basal diet, while T₂ was supplemented with Oxytetracycline (OTC) powder @ 0.1g/

kg feed. T₃ and T₄ were supplemented with Garlic powder @ 0.75% and @ 1.50%. T₅ and T₆ were supplemented with Ashwagandha powder @ 0.75% and @ 1.50%. T₇ and T₈ were supplemented with Shatavari powder @ 0.75% and @ 1.50%. T₉ was supplemented with Garlic powder @ 0.25%, Ashwagandha powder @ 0.25% and Shatavari powder @ 0.25%. T₁₀ was supplemented with Garlic powder @ 0.50%, Ashwagandha powder @ 0.50% and Shatavari powder @ 0.50%. The chicks were fed commercial broiler mash in three phases, broiler pre starter (0-7 days), broiler starter (8-21days) and broiler finisher (22-42 days) feeds for different treatments as per feeding standard (BIS,2007) .

A feeding trial of 42 days was conducted. The biometric parameters viz. Feed Intake, body weight, body weight gain and feed conversion ratio (FCR) were recorded. The daily feed intake was calculated after the deduction of the leftovers from the feed offered. The accurate live body weight of the individual experimental chick was recorded in the morning hours before feeding with the assistance of digital weighing balance at a day old and thereafter at weekly interval, body weight gain was figured from the difference in body weight accomplished between the two successive weeks. The feed conversion ratio was determined by dividing the total feed intake by the body weight gain of the chicks. The feed cost of all ten treatment groups were estimated based on feed cost of readymade Pre starter feed, starter feed, finisher feed, Garlic powder, Ashwagandha powder and Shatavari powder. The total feed cost (Rs.) per kg weight gain in broiler chicks for various treatment groups was calculated and the reduction in feed cost per kg weight gain in terms of percentage over control was calculated. The data obtained were analysed using of analysis variance (ANOVA) and significance of mean differences were tested by Duncan's multiple range test (DNMRT) (Duncan, 1995).

RESULTS AND DISCUSSION

Effect on average feed intake

Average weekly feed intake were found to be 4352.78, 4178.46, 4119.18, 4082.93, 3946.17, 3917.96, 3936.27, 3937.93, 3966.52 and 3957.94 g, in T₁ (Control), T₂, T₃, T₄,

Table 1: Chemical composition of broiler pre- starter, broiler starter, Broiler finisher, *Allium sativum* (garlic) powder, *Withania somnifera* (Ashwagandha) root powder and *Asparagus racemosus* (Shatavari) root powder (% DM basis).

Chemical composition	Broiler pre starter	Broiler starter	Broiler finisher	<i>Allium sativum</i>	<i>Withania somnifera</i>	<i>Asparagus racemosus</i>
Proximate principles (%)						
Dry matter	89.72	91.22	91.52	91.52	94.60	90.99
Organic matter	95.53	93.23	93.28	96.84	94.32	96.00
Crude protein	23.09	22.38	20.29	18.20	5.21	15.29
Ether extract	2.93	4.26	4.68	5.32	0.57	0.66
Crude fibre	4.57	3.74	3.79	3.12	12.89	2.82
Total ash	4.47	6.77	6.72	3.16	5.68	4.00
Nitrogen free extract	64.94	62.85	64.52	70.20	75.65	77.23

T₅, T₆, T₇, T₈, T₉ and T₁₀ groups, respectively (Table 2). The highest average feed intake was found in T₁ (Control) group whereas, lowest average feed intake was found in T₆ group i.e., broiler fed a basal diet supplemented with ashwagandha root powder @ 1.50%. The statistical analysis of data revealed highly significant ($p < 0.01$) effect in terms of average weekly feed intake with dietary supplementation of Garlic, Ashwagandha and Shatavari alone and in combination at different levels in the ration of broiler chicks. The present findings are in agreement with (Eid *et al.*, 2014; Fayed *et al.*, 2011; Abdullah *et al.*, 2010; Raeesi *et al.*, 2010; Abou-Elangana *et al.*, 2016; Jimoh *et al.*, 2013; Samanthi *et al.*, 2015) who reported significant decrease in feed consumption due to supplementation of Garlic powder probably due to the associated flavor factor. (Shisodiya *et al.*, 2008; Muhammad *et al.*, 2009; Bhardwaj *et al.*, 2011; Abdallah *et al.*, 2016) and (Mane *et al.*, 2012; Pandey *et al.*, 2013; Gaikwad *et al.*, 2015; Mali *et al.*, 2017) reported that significant decrease in feed consumption due to supplementation of Ashwagandha and Shatavari powder as compare to the control group.

Effect on body weight

The average weekly body weight and body weight gain of broiler chicks for the different treatment groups were highly significant effect ($P < 0.01$) due to diet supplemented with Garlic, Ashwagandha and Shatavari root powder as compared to control group. The average weekly body weight (2399.65 g) and Cumulative body weight gain (2338.77 g) were highest in T₁₀ group i.e., broiler fed a basal diet supplemented with 0.50% Garlic powder, 0.50% Ashwagandha root Powder and 0.50% Shatavari root powder. The lowest weekly body weight (2113.25g) and body weight gain were found in (2052.28 g) in control group (Table 3). The observation made in this study corroborate the finding of (Senthilkumar *et al.*, 2015, Makwana *et al.*, 2019 and Singh *et al.*, 2019) reported significant increase in body weight in Garlic powder supplemented group as compared

to control group. (Vasanthakumar *et al.*, 2015; Singh *et al.*, 2017; Dhenge *et al.*, 2018; Kumari *et al.*, 2020) reported that significantly increase in body weight in Ashwagandha powder supplemented group. (Singh *et al.*, 2018; Chikwa *et al.*, 2018) reported that increase in body weight in Shatavari powder supplemented group as compared to control group. The present findings are in accordance with that (Makwana *et al.*, 2018; Singh *et al.*, 2019; Makwana *et al.*, 2019; Singh *et al.*, 2019; Alagbe and Oluwafemi 2019); reported significant ($P < 0.05$) increase in body weight gain in Garlic powder supplemented group as compared to control group. Similarly, (Dhenge *et al.*, 2018) reported significant increase in body weight gain in Ashwagandha powder supplemented group as compared to control group. (Gaikwad *et al.*, 2015; Mali *et al.*, 2017) reported that significantly increase in body weight gain in Shatavari powder supplemented group as compared to control group.

Effect on feed conversion ratio

The cumulative feed conversion ratio (FCR) of broiler chicks for the different treatment groups was highly significant effect ($P < 0.01$) due to diet supplemented with Garlic, Ashwagandha and Shatavari root powder as compared to control group. The feed conversion ratio (1.65) was lowest in T₁₀ group i.e., broiler fed a basal diet supplemented with 0.50% Garlic powder, 0.50% Ashwagandha root Powder and 0.50% Shatavari root powder and highest feed conversion ratio (2.01) in control group (Table 3).

The present finding is in accordance with the (Eid, and Iraqi, 2014) who reported that Garlic powder had a highly significant effect ($P < 0.01$) feed conversion ratio of diet supplemented with 200 g Garlic powder /tonne. (Kale *et al.*, 2016) studied that 0.25 and 0.5 per cent Ashwagandha root powder significantly ($P < 0.05$) higher on feed conversion ratio. Similarly, that inclusion of Aswaganda (0.5%), Shatavari (1%) and Aswaganda + Shatavari (0.5+0.5%) root powder in broiler ration as feed supplement was improving feed consumption ratio (Mane *et al.*, 2012).

Table 2: Effect of garlic powder, Ashwagandha root powder and Shatavari root powder on weekly feed intake (g/bird/week) in broiler chicks.

Weeks	Treatment groups										SEM
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	
I	162.26	161.33	159.36	159.78	161.74	161.76	160.24	158.18	164.96	165.98	3.249
II	367.03 ^c	364.26 ^c	416.14 ^a	413.98 ^a	399.87 ^a	396.89 ^{ab}	403.81 ^a	398.47 ^a	402.94 ^a	403.47 ^a	7.789
III	670.96	700.33	714.96	708.94	690.19	694.56	694.14	695.19	699.72	690.49	12.074
IV	768.32	770.06	776.12	772.12	766.36	767.34	764.98	764.88	765.76	766.44	15.483
V	952.14	908.34	968.46	961.92	932.14	930.87	931.37	930.35	934.47	932.38	19.964
VI	1432.07 ^a	1274.14 ^b	1084.14 ^c	1066.19 ^c	995.87 ^d	966.54 ^d	981.73 ^d	990.86 ^d	998.67 ^d	999.18 ^d	20.381
Cumulative feed intake	4352.78 ^a	4178.46 ^b	4119.18 ^{bc}	4082.93 ^{cd}	3946.17 ^e	3917.96 ^e	3936.27 ^e	3937.93 ^e	3966.52 ^e	3957.94 ^e	30.304

Means with different superscripts in a row differ significantly.

Table 3: Effect of garlic powder, Ashwagandha root powder and Shatavari root powder on body weight (g), average weekly weight gain (g), feed conversion ratio at different weeks in broiler chicks.

Week	Item	Treatment groups										SEM
		T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	
I	BW	159.46c	163.27c	162.42c	163.54c	164.08c	163.23c	163.85c	161.63c	171.83ab	173.02a	2.442
	WBWG	98.49 ^d	102.17 ^c	101.83 ^c	102.83 ^c	103.01 ^c	102.24 ^c	102.56 ^c	101.36 ^{cd}	110.70 ^{ab}	112.14 ^a	1.016
	FCR	1.64a	1.74bc	1.81a	1.79ab	1.68c	1.64de	1.67cd	1.64de	1.56f	1.53g	0.024
II	BW	360.12e	371.90de	391.16cd	394.66c	402.09c	405.01c	405.49c	404.42c	430.10ab	436.40a	6.882
	WBWG	200.66 ^f	208.63 ^f	228.74 ^e	231.12 ^{de}	238.01 ^{cd}	241.78 ^c	241.64 ^c	242.79 ^c	258.27 ^{ab}	263.38 ^a	2.783
	FCR	1.82a	1.74bc	1.81a	1.79ab	1.68c	1.64de	1.67cd	1.64de	1.56f	1.53g	0.024
III	BW	678.86f	742.12de	770.10d	775.77cd	792.11c	801.90c	803.75c	808.58c	856.42ab	866.26a	12.710
	WBWG	318.74 ^g	370.22 ^{ef}	378.94 ^{de}	381.11 ^d	390.02 ^{cd}	396.89 ^c	398.26 ^c	404.16 ^c	426.32 ^{ab}	429.86 ^a	4.934
	FCR	2.10a	1.89b	1.88b	1.86bc	1.76d	1.75d	1.74d	1.72d	1.64e	1.60f	0.031
IV	BW	1060.87f	1134.25de	1169.51d	1177.66cd	1208.17c	1222.77c	1226.26c	1235.84c	1303.96ab	1321.96a	21.602
	WBWG	382.01 ^f	392.13 ^{ef}	399.41 ^e	401.89 ^{de}	416.06 ^{cd}	420.87 ^c	422.51 ^c	427.26 ^c	447.54 ^{ab}	455.70 ^a	5.102
	FCR	2.01a	1.96b	1.94b	1.92bc	1.84cd	1.82d	1.81d	1.79de	1.71e	1.68f	0.028
V	BW	1488.18f	1640.97de	1649.65d	1663.12cd	1696.20c	1715.18c	1719.04c	1733.13c	1828.08ab	1851.38a	25.185
	WBWG	427.31 ^f	506.72 ^c	480.14 ^{de}	485.46 ^{cd}	488.03 ^c	492.41 ^c	492.78 ^c	497.29 ^c	524.12 ^{ab}	529.42 ^a	7.834
	FCR	2.22a	1.79e	2.01b	1.98bc	1.91c	1.89cd	1.89cd	1.87de	1.78ef	1.76f	0.030
VI	BW	2113.25d	2154.19cd	2159.81c	2168.13c	2199.34c	2215.19c	2214.18c	2240.58c	2364.92ab	2399.65a	40.669
	WBWG	625.07 ^a	513.22 ^d	510.16 ^d	505.01 ^d	503.14 ^d	500.01 ^{de}	495.14 ^e	507.45 ^d	536.84 ^{bc}	548.27 ^b	5.517
	FCR	2.29b	2.48a	2.12c	2.11c	1.97cd	1.93d	1.98c	1.95d	1.86d	1.82d	0.050
Cumulative WBWG		2052.28f	2093.09 ^{ef}	2099.22 ^{de}	2107.42 ^d	2138.27 ^{cd}	2154.20 ^c	2152.89 ^c	2180.31 ^c	2303.79 ^{ab}	2338.77 ^a	14.727
Cumulative FCR		2.01a	1.91b	1.89b	1.87bc	1.79d	1.77d	1.78d	1.76de	1.67f	1.65f	0.013

Means with different superscripts in a row differ significantly.

Table 4: Economics.

Components	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀
Total cost (Rs)	177.13	171.77	179.16	187.99	178.62	192.21	175.43	187.30	174.50	181.28
Live weight in 6 weeks (g)	2113.25	2154.19	2159.81	2168.13	2199.34	2215.19	2214.18	2240.58	2364.92	2399.65
Receipt/ bird @ Rs 95/kg live wt. (Rs)	200.73	204.63	205.10	205.96	208.90	210.42	210.33	212.80	224.58	227.90
Net return/bird (Rs)	23.60	32.86	25.94	17.97	30.28	18.21	34.90	25.50	50.08	46.62

Better feed conversion ratio of the broilers may be attributed to the antibacterial properties of Garlic, which resulted in better absorption of the nutrients present in the gut and finally leading to improvement in feed conversion ratio (Ganguly, 2013 and Ganguly and Verma 2015). Active constituent withanine and withanolide of *Withania somnifera* root powder that could act not only as antibacterials and antioxidants but as a stimulant of digestive enzymes in the intestinal mucosa and pancreas that improve the digestion of dietary nutrients and feed efficiency, subsequently increasing the growth rate (Ali, 2011). Improved feed utilization efficiency due to Shatavari root powder supplementation. (Rekhate *et al.*, 2004; Bhardwaj *et al.*, 2008 and Pedulwar *et al.*, 2007).

Economics

Total expenditure per bird (total feed cost, chick cost, vaccination and litter cost) (Rs) were 177.13, 171.77, 179.16, 187.99, 178.62, 192.21, 175.43, 187.30, 174.50 and 181.28 in T₁ (Control), T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉ and T₁₀ treatment groups, respectively. Receipt/bird @ Rs 95/kg live weight (Rs) were 200.73, 204.63, 205.10, 205.96, 208.90, 210.42, 210.33, 212.80, 224.58 and 227.90 in T₁ (Control), T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉ and T₁₀ treatment groups, respectively. The net return per bird (Rs) was higher in T₉ group (50.08) that is followed by T₁₀ group (46.62) and lowest in T₁ (Control) group (23.60) Table 4.

CONCLUSION

The supplementation of 0.50% Garlic powder, 0.50% Ashwagandha powder and 0.50% Shatavari powder into the basal diet of broilers significantly enhances their growth performance and feed conversion ratio. However, net return per bird was higher in supplementation of 0.25% Garlic, 0.25% Ashwagandha and 0.25% Shatavari root powder.

From the result of present study, it was concluded that dietary inclusion of 0.25% Garlic, 0.25% Ashwagandha and 0.25% Shatavari root powder can be used as growth promoters for more profit per bird.

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Conflict of interest

All authors declare that they have no conflict of interest.

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