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Effect of Phytobiotic Feed Additives Garlic (*Allium sativum*), Ashwagandha (*Withania somnifera*) and Shatavari (*Asparagus racemosus*) as Alternatives to Antibiotic on Feed Intake, Metabolizability of Nutrients and Balance Study in Broiler Chicks

Hemant Kumar Jediya[1], Monika Joshi[2] and S. K. Sharma[3]

[1]Dept. of Animal Nutrition, [2]Dept. of Animal Nutrition, [3]Dept. of Veterinary Medicine, College of Veterinary and Animal Science, Navania, Udaipur, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan (313 601), India

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Corresponding drmonikashivsharma@gmail.com

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ABSTRACT

An experiment was conducted during March to April, 2021 at Poultry unit of College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur (Rajasthan), India planned to investigate the effect of phytobiotic feed additives viz., garlic, ashwagandha and shatavari as alternatives to antibiotic on feed intake, metabolizability of nutrients and balance study of broiler chicks. A total of 300 day-old broiler chicks (Cobb-400) were involved in the 42-days. The T_1 *i.e.* control group was fed on basal diet, while T_2 was supplemented with Oxy tetra cycline (OTC) powder @ 0.1 g kg^{-1} feed. T_3 and T_4 were supplemented with Garlic powder @ 0.75% and @ 1.50%. T_5 and T_6 were supplemented with Ashwagandha powder @ 0.75% and @ 1.50%. T_7 and T_8 were supplemented with Shatavari powder @ 0.75% and @ 1.50%. T_9 was supplemented with Garlic powder @ 0.25%, Ashwagandha powder @ 0.25% and Shatavari powder @ 0.25%. T_{10} was supplemented with Garlic powder @ 0.50%, Ashwagandha powder @ 0.50% and Shatavari powder @ 0.50%. Feed intake was a highly significant (p<0.01) effect in different treatments groups. Non significant (p>0.05) effects were observed on dry matter and Organic matter metabolizability in different treatment groups. The metabolizability of crude protein, crude fibre and total ash was highly significant (p<0.01) effect and ether extract had a significant (p<0.05) effect due to treatments groups. The balance study of nitrogen, calcium and phosphorus had a highly significant (p<0.01) effect in different treatment groups.

KEYWORDS: Broiler, feed, garlic, ashwagandha, shatavari powder, metabolizability, nutrients balance

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Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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1. INTRODUCTION

Antibiotics have been used widely to prevent infections and poultry diseases and for the improvement of meat and egg production. However, the use of antibiotics is restricted due to drug resistance in bacteria, drug residue in carcasses and also alteration of natural gut micro flora. Kabir et al. (2004) and Hind et al. (2014) found significantly higher levels of diverse antibiotic residues in the edible tissues of chickens given therapeutic or prophylactic antibiotics. For these reasons, many countries around the world have either limited or prohibited the use of antibiotics as growth promoters in livestock. This has created a gap in which animal nutritionists are working intensively to explore safe alternatives from natural sources (Abdel-Aziz et al., 2015; Abu Hafsa et al., 2016). Phytogenic substances are generally regarded as safe in food and feed industries (Elghalid et al., 2020; Kholif and Olafadehan, 2021). Phytogenic compounds have potential antimicrobial effects with multiple mechanisms of action (Dalle Zotte et al., 2016). Thus, traditional herbal knowledge heritage includes uses of turmeric, ginger, garlic, Ashwagandh, Shatavari onion, lemongrass Aloe vera, amla etc. in human and animal nutrition. (Patel and Srinivasan, 2004) have suggested that phytogenic substances can stimulate digestive secretions such as saliva and bile. They reported that improving enzyme activity is the main mode of nutritional action of phytogenic feed additives. Garlic (*Allium sativum*) having the active ingredient alicine, diallyldisulfide has been considered a wonder drug in the herbal world and used as a growth promoter. It improves nutrient utilization and feed conversion efficiency, and improves digestion and immunity. Garlic acts as only a mild antibiotic in comparison to modern antibiotics, but the added advantage of its use as an antibiotic is that the microorganisms do not develop a resistance against garlic as they do against conventional antibiotics. Ashwagandha (*Withania somnifera*), which in turn may improve the performance of birds. Ashwagandha root is bitter to taste and contains several alkaloids (0.13 to 4.30%), which offer medicinal usage. It contains many active principles such as withanolides, withanone, somnitalglucose, rutinosides, inorganic salt and di-hydroxy kaempferol-3 (Pal et al., 2012). These active principles have been reported to possess immunomodulatory, general tonic, hepato-protective, anti-stress, growth promoter and antioxidant properties (Ansari et al., 2008; Singh et al., 2010; Kushwaha et al., 2012 and Varma et al., 2012) beside antibacterial and anti-fungal properties (Punetha et al., 2010). Shatavari possesses nutritive, antistress, adaptogenic, immunomodulatory, galactogogue, anabolic and performance-enhancing properties and is used in various medicinal preparations Shatavari is the one of the most commonly used herbs in traditional medicine due to the presence of steroidal saponins and sapogenins in various part of the plant (Krishana et al*.,* 2005). The root powder of Shatavari (*Asparagus racemosus*) is used as an herbal feed supplement in poultry feed. Shatavari augment the appetite and stimulates the liver function.

Therefore, considering the above facts the present research was planned to assess the effect of phytobiotic feed additives-garlic (*allium sativum*), ashwagandha (*withania somnifera*) and shatavari (*asparagus racemosus*) as alternatives to antibiotic on feed intake , metabolizability of nutrients and balance study in broiler chicks.

2. MATERIALS AND METHODS

2.1. Study sites

The experiment was conducted during March to April, 2021 at the Poultry unit of the College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur (Rajasthan), India.

2.2. Experimental animals and feeding

An experiment was conducted for six weeks on three hundred, day old chicks, unsexed, apparently healthy broiler chicks (VENCOBB). Each bird was weighed individually on arrival and randomly distributed to ten different dietary treatments groups ($T_1 - T_{10}$) using a completely randomized design (CRD). The body weight of chicks has remained similar in all the groups. Each random treatment has three replicates ($R_1 - R_3$) having 10 birds in each replicate. The ISO certified basal feed in the form of broiler pre starter, broiler starter and broiler finisher was procured from feed distributor "Udaipur Kukkut Utpadak Sahkari Samiti Ltd.", Udaipur (Rajasthan) in required amount. Phytobiotic feed additives garlic (*allium sativum*), ashwagandha (*withania somnifera*) and shatavari (*asparagus racemosus)* powders were procured from the local market. The Proximate composition of the experimental feed was analyzed according to standard methods of analysis (Anonymous, 2016).The chemical composition of the Experimental feed is presented in (Table 1). The feeding was done in three phases, broiler pre starter (0–7 days), broiler starter (8–21 days) and broiler finisher (22–42 days) feeds for different treatments as per the guidelines of (Anonymous, 2007). Diet T_1 served as control while diet T_2 was supplemented with Oxy tetracycline (OTC) powder @ 0.1 g kg^{-1} feed. T_3 and T_4 were served as Basal diet supplemented with Garlic powder @ 0.75% and @ 1.50%. T_5 and T_6 were served as Basal diet supplemented with Ashwagandha root powder @ 0.75% and @ 1.50%. T_7 and T_8 were served as Basal diet supplemented with Shatavari root powder @ 0.75% and @ 1.50%. T_9 was served as a Basal diet supplemented with Garlic powder @ 0.25%, Ashwagandha root powder @ 0.25% and Shatavari root powder @ 0.25%. T_{10} was served as a Basal diet supplemented with Garlic powder @ 0.50%, Ashwagandha root powder @ 0.50% and Shatavari root powder @ 0.50%.

Table 1: Proximate composition of broiler pre starter, broiler starter Broiler finisher, *Allium sativum* (garlic) powder, *Withania somnifera* (Ashwagandha) root powder and *Asparagus racemosus* (Shatavari) root powder

Chemical composition	Broiler pre starter	Broiler starter	Broiler finisher	*Allium sativum*	*Withania somnifera*	*Asparagus racemosus*
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
Mineral composition (%)						
Calcium	1.07	1.09	1.06	0.50	1.17	0.24
Phosphorus	0.69	0.70	0.63	0.70	0.63	0.86

2.3. Method of data collection

A metabolism trial of 7 days was conducted at the end of the experiment. The birds were fed individually with their respective treatment diets. The adaptation period was approximately 2 days, followed by a collection period of 5 days. During the collection period, data on the quantity of feed offered, left over and excreta voided were recorded in order to determine the feed intake, nutrients utilization and nitrogen, calcium and phosphorus retention. The daily feed intake was calculated after the deduction of the leftovers from the feed offered. The digestibility/metabolizability of nutrients was analysed by proximate principles as per (Anonymous, 2016). The total nitrogen content of feed and excreta was determined through Kjeldahl's method using Kel plus Automatic Nitrogen Analyzer equipment. The calcium and phosphorus of feed and excreta samples was estimated using procedures described by (Talpatra et al., 1940). The per cent nitrogen, calcium and phosphorus retention under different treatments was calculated through percent difference in intake and outgo of nutrients. The data obtained in the experiment were analyzer using of analysis variance (ANOVA) by (Snedecor and Cochran, 2004). Significance of means differences were tested by Duncan's New Multiple Range Test (DNMART) (Duncan, 1955) as modified by (Kramer, 1957).

3. RESULTS AND DISCUSSION

3.1. Average feed intake

Average weekly feed intake by the broilers in six weeks period in T_1 (Control), T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 and T_{10} treatment groups 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, respectively (Table 2). The highest average feed intake was found in T_1 (Control) group whereas, lowest average feed intake was found in T_6 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.

3.2. Metabolizability of nutrients

The mean values of dry matter metabolizability (%) and organic matter metabolizability (%) were found to be 73.12 and 76.03, 73.74 and 76.81, 74.03 and 77.19, 74.61 and 77.68, 74.87 and 77.83, 75.30 and 78.21, 75.22 and 78.03, 75.43 and 78.42, 76.02 and 78.83, 76.16 and 79.21 in T_1 (Control), T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 and T_{10} treatment

Table 2: Effect of Garlic powder, Ashwagandha root powder and Shatavari root powder on feed intake (g bird^{-1} week^{-1}) in broiler chicks

	Treatment groups										
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	SEm
I Week	162.26	161.33	159.36	159.78	161.74	161.76	160.24	158.18	164.96	165.98	3.249
II Week	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 Week	670.96	700.33	714.96	708.94	690.19	694.56	694.14	695.19	699.72	690.49	12.074
IV Week	768.32	770.06	776.12	772.12	766.36	767.34	764.98	764.88	765.76	766.44	15.483
V Week	952.14	908.34	968.46	961.92	932.14	930.87	931.37	930.35	934.47	932.38	19.964
VI Week	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
CFI	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

Cumulative feed intake; Means with different superscripts in a row differ significantly

groups respectively and non significant (p>0.05) effect were found on dry matter and Organic matter metabolizability. The mean values of crude protein, crude fibre and Total Ash (TA) metabolizability (%) were found to be 74.19, 26.73, and 55.07, 76.22, 27.91 and 55.46, 76.92, 28.47 and 56.39, 77.24, 29.24 and 57.45, 77.84, 30.11 and 58.29, 77.13, 31.07 and 60.21,78.35, 30.61 and 59.92, 78.63, 31.69 and 61.48, 80.11, 32.78 and 62.71, 83.70, 33.12 and 63.26 in T_1 (Control), T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 and T_{10} treatment groups, respectively (Table 3) and highly significant (p<0.01) effect on crude protein ,crude fibre and Total Ash (TA) metabolizability. The mean values of ether extract metabolizability (%) was found to be 74.09, 74.88, 75.91, 76.83, 77.04, 78.14, 77.29, 79.33, 80.17 and 81.28 in T1 (Control), T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9, T_9 and T_{10} treatment groups, respectively and significant (p<0.05) effect on ether extract metabolizability due to supplementation of garlic, Ashwagandha and Shatavari alone and in combination at different levels in the ration of broiler chicks. Saini, et al. (2017); Kehinde et al. (2019) reported that numerical improvement in dry matter digestibility in the Ashwagandha powder supplemented group as compared to control group. The present study was in agreement with Attia et al. (2017) who reported that the digestibility coefficient of crude protein and ether extract were significantly (p<0.01) increased in Ashwagandha powder supplemented group as compared to the control group.

3.3. Balance study

The mean values of nitrogen, calcium and phosphorus balance were found to be 2.28, 0.40 and 0.35, 2.30, 0.43 and 0.37, 2.35, 0.50 and 0.39, 2.37, 0.53 and 0.42, 2.42, 0.55 and 0.41, 2.49, 0.62 and 0.45, 2.45, 0.60 and 0.41, 2.53, 0.63 and 0.47, 2.57, 0.64 and 0.47, 2.60, 0.67 and 0.49 g

Table 3: Effect of garlic powder, ashwagandha root powder and shatavari root powder on metabolizability of nutrients (%) in broiler chicks

	Treatment groups										
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	SEm
DM	73.12	73.74	74.03	74.61	74.87	75.30	75.22	75.43	76.02	76.16	1.144
OM	76.03	76.81	77.19	77.68	77.83	78.21	78.03	78.42	78.83	79.21	1.398
CP	74.19^{c}	76.22^{c}	76.92^{bc}	77.24^{b}	77.84^{b}	77.13^{b}	78.35^{b}	78.63^{b}	80.11^{ab}	83.70^{a}	1.309
EE	74.09^{b}	74.88^{b}	75.91^{b}	76.83^{b}	77.04^{b}	78.14^{ab}	77.29^{b}	79.33^{a}	80.17^{a}	81.28^{a}	1.235
CF	26.73^{d}	27.91^{cd}	28.47^{c}	29.24^{bc}	30.11^{b}	31.07^{ab}	30.61^{b}	31.69^{a}	32.78^{a}	33.12^{a}	0.709
TA	55.07^{c}	55.46^{c}	56.39^{bc}	57.45^{b}	58.29^{b}	60.21^{a}	59.92^{ab}	61.48^{a}	62.71^{a}	63.26^{a}	1.244

Means with different superscripts in a row differ significantly

bird^{-1} day^{-1} in T_1 (Control), T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 and T_{10} treatment groups, respectively (Table 4). The balance of nitrogen, calcium and phosphorus showed highly significant (p<0.01) effect on with dietary supplementation of garlic, Ashwagandha and Shatavari alone and in combination at different levels as alternatives to Antibiotic growth promoters in the ration of broiler chicks. The present findings were similar to Saini et al. (2017) reported that significantly increased N balance in broilers fed different levels of Ashwagandha powder as compared to the control group. Ashwagandha contains withanine and withanolides, these compounds may stimulate the gastrointestinal tract secretions which help to increase nutrient digestion and absorption (Jyotsana and Berwal, 2019).

Table 4: Effect of garlic powder, ashwagandha root powder and shatavari root powder on balance of nitrogen, calcium and phosphorus (g bird^{-1} day^{-1}) in broiler chicks

	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	SEm
Nitrogen balance	2.28^{e}	2.30^{e}	2.35^{de}	2.37^{d}	2.42^{cd}	2.49^{bc}	2.45^{c}	2.53^{ab}	2.57^{a}	2.60^{a}	0.024
Calcium balance	0.40^{i}	0.43^{h}	0.50^{g}	0.53^{ef}	0.55^{e}	0.62^{bc}	0.60^{cd}	0.63^{b}	0.64^{b}	0.67^{a}	0.006
Phosphorus balance	0.35^{g}	0.37^{fg}	0.39^{ef}	0.42^{d}	0.41^{de}	0.45^{bc}	0.41^{de}	0.47^{ab}	0.47^{ab}	0.49^{a}	0.005

Means with different superscripts in a row differ significantly

4. CONCLUSION

The highly significant (p<0.01) effect on average feed intake and balance of nitrogen, calcium and phosphorus. Non significant effect on (p>0.05) dry matter and Organic matter, a significant (p<0.05) on ether extract and highly significant (p<0.01) on crude protein, crude fibre, total ash metabolizability .It is concluded that supplementation of garlic, Ashwagandha and Shatavari alone and in combination at different levels as alternatives to Antibiotic growth promoters showed positive effect on feed intake, Metabolizability and nutrients balance in broiler chicks.

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