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Effect of Supplementation of Rosemary (*Rosemarinus officinalis*) Leaves and Multienzyme on Growth Performance and Nutrient Utilization of Broiler Chicken

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ABSTRACT

The present study was conducted on broiler chickens to observe the effect of supplementation of Rosemary (*Rosemarinus officinalis*) leaves and Multienzyme on the growth performance, digestibility of nutrients and nitrogen balance. The feeding trial was conducted under standard feeding and managemental conditions with broiler starter (1-21 days) and finisher (22-35 days) ration on two hundred and forty day old day old Vencobb broiler chicks which were randomly divided into 4 treatment groups (T1 to T4) with four replicates of 15 chicks each. Birds were offered basal feed as per the BIS (2007). The treatment groups consisted of control group (T1) which was fed only basal diet, group T2 was supplemented with 0.5 per cent rosemary leaves powder, group T3 with 0.05 per cent multienzyme, group T4 with 0.5per cent rosemary and 0.05 per cent multienzyme in basal feed. The supplementation of Rosemary (*Rosemarinus officinalis*) and multienzyme alone and in combination showed highly significant ($P<0.01$) effect on total body weight, body weight gain, feed conversion ratio, performance index, protein efficiency ratio, dry matter, crude protein and ether extract digestibility. Whereas dietary inclusion of rosemary and multienzyme alone and in combination had no influence on feed consumption and nitrogen balance in broiler birds. Therefore, based on results obtained, the present study revealed that the combination of rosemary at 0.5 per cent with multienzyme enhanced the overall performance of broilers.

Key words: Rosemary, Broiler, Growth, Performance, Multienzyme.

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INTRODUCTION

The population of India is huge and increasing everyday so getting good quality food to every individual is challenging task. Poultry industry is a wide sector. It provides good quality protein in very short span of 35-42 days. The success of poultry sector depends on effective feed management because feed alone contribute 60-70 per cent of poultry production costs. The total poultry population in India is 851.81 million which is 16.81 per cent higher in number than 19th livestock census. The livestock sector contributes 4.11 per cent of GDP and 25.6 per cent of total agriculture GDP (DAHDF, 2019). The ban of growth-promoting antimicrobials in some countries, due to the risk of antibiotic-resistant bacteria in humans and increasing concern by consumers about food safety, has led to the search for non-therapeutic alternatives, including enzymes, organic acids, probiotics, prebiotics and phytogenic feed additives, that are able to support the productive performance and prevent the incidence of some diseases in poultry (Huyghebaert et al., 2011).

Rosemarinus officinalis is one of only two species in the genus Rosemarinus. It belongs to the kingdom plantae, family lamiales. Rosemary is an evergreen, fragrant, decorative, perennial plant that

may grow up to 2 m in many parts of the world. Rosemary has high antioxidant activity which improves bird performance. It contains polyphenolics (carnosol, carnosic acid, methyl carnosol, rosmarinic acid, ursolic acid and many others) which are the most biologically active compounds and have antimicrobial, antioxidant, antiparasitic, antiprotozoal, antifungal and anti-inflammatory properties that can change bird physiology (Christaki et al., 2012).

Most of the feed ingredients used in the poultry diet contain non-starch polysaccharides (NSPs) and phytates at different concentrations. The anti-nutritional effects of NSPs have been reported (Choct and Annison, 1990; Choct, 2006; Attia et al., 2008). Birds do not produce enzymes, such as cellulase, xylanase and phytase that are required for the digestion of NSPs and phytates. Supplementation of NSP degrading enzymes and phytase may not only reduce the anti-nutritive effects of NSPs and phytates (Attia, 2003), but also releases some nutrients that could be utilized by the birds (Attia et al., 2003a, 2003b). Supplementing multi-enzyme or phytase to corn-soy based broiler diets increased growth performance in comparison to unsupplemented diets (Kavitha et al., 2003). Therefore present study was conducted on broiler chickens to observe the effect of supplementation of Rosemary (Rosemarinus officinalis) leaves and multienzyme on the growth performance, digestibility of nutrients and nitrogen balance.

MATERIALS AND METHODS

Birds and diets

240 day-old, unsexed apparently healthy Ven Cobb broiler chicks were procured from a commercial supplier. Broiler chicks were equally and randomly divided into four dietary treatments groups (T1-T4) of 60 chicks each having almost similar average body weight. Each dietary group was further subdivided into four replicates (R1-R4) having 15 chicks in each replicate and reared up to 5 weeks of age. Similar managemental practices like vaccination, feeding, watering, lighting etc. were followed in all the test groups throughout the experiment. They were supplied with fresh drinking water daily ad lib. Dry sawdust was used as bedding material. The ISO certified basal feed in the form of broiler starter (0-3 weeks) and broiler finisher (3-5 weeks) was procured as per the BIS (2007) from commercial supplier. Good quality rosemary leaves powder was procured from the local market. The commercially available multienzyme salt formulation was procured from "Meteoric biopharmaceuticals Pvt. Ltd." Ahmedabad, Gujrat. The proximate analysis of broiler starter, broiler finisher and rosemary leaves powder were carried out according to the standard method of analysis (AOAC, 2005). The nutrient composition of starter, finisher feed and rosemary leaves powder is given in Table 1. Four different treatment diets were prepared for the feeding of broilers under different dietary groups.

Growth and digestion trial

A five weeks feeding trial was conducted commenced from 18 September to 22 October, 2021 to assess the pattern of feed intake of rosemary leaves powder, multienzyme and their combination based diets as well as the pattern of growth performance in broiler chicken. Each diet was offered ad libitum to the respective four replicated groups of chicks. The data on feed consumption and body weight gain was recorded weekly. Feed conversion ratio (feed: gain), performance index (gain: FCR) and protein efficiency ratio (protein intake: gain) were calculated. The mortality, if any, was recorded as and when it occurred, weighed and sent for post mortem examination.

A metabolic trial of five days was conducted after the end of feeding trial to assess the digestibility of various nutrients and balance study of nitrogen. Four birds (one bird per replicate) under each treatment were randomly selected for metabolic trial. During the five days metabolic period, the group wise daily feed intake and quantum of excreta voided were recorded at fixed morning hours (9:30 A.M.) every day. Samples of feed offered under different treatments and excreta voided were analysed for proximate principles as per AOAC (2005).The total

nitrogen content of feed and excreta was determined through Kjeldahl's method using Kel plus Automatic Nitrogen Analyzer equipment.

Statistical analysis

The experimental data were subjected to statistical analysis (SPSS Ver. 24.0) using one way analysis of variance as described by Snedecor and Cochran (2004) to test for significant variation between treatment groups. Probabilities values of less than 0.05 ($P<0.05$) and 0.01 ($P<0.01$) were considered significant. Comparison of mean values was carried out by Duncan's Multiple Range Test (Duncan, 1955). The results were interpreted and expressed as means ± pooled SEM.

RESULTS AND DISCUSSION

Growth performance

The statistical analysis of data revealed no significant difference of supplementation of rosemary leaves powder and multienzyme on cumulative feed consumption in broilers. The results are in accordance with Attia (2018) who reported that feed intake was not affected on dietary supplementation of rosemary leaves upto 1 per cent level. Mossa et al. (2019) also reported non-significant differences in the amount of feed intake on supplementation of rosemary inclusion of 0.25 and 0.5per cent. Regarding addition of multienzyme, the results of the study are similar with finding of Khan et al. (2006), Zakaria et al. (2010) and Dos Santos Andrade et al. (2017) who reported that feed intake did not differ significantly on supplementation of 0.05 per cent multienzymes in diets of broilers.

The total body weight of broiler chicken at third and at fifth week showed highly significant ($P<0.01$) effect on supplementation of rosemary and multienzyme. Further on comparison, significantly lowest mean body weight was observed in T1 group both at 3rd week and 5th week. There was no statistical difference among T2, T3 and T4 groups at 3rd week and 5th week. The results are in agreement with Ghazalah and Ali (2008) who reported that chicks fed 0.5 per cent rosemary leaves meal exhibited significantly higher body weights. Attia (2018) reported that supplementation of rosemary leaves meal upto 0.5per cent had significantly increased bird bodyweight. Meena (2015) also reported that addition of rosemary leaves at the level of 0.5, 1 and 1.5 per cent significantly improved body weight. Regarding addition of multienzyme, the results are in agreement with the findings of Khan et al. (2006), Attia et al. (2012) and Wang et al. (2013) who reported significant effect of enzyme on body weight.

A highly significant ($P<0.01$) effect on overall body weight gain by inclusion of rosemary and multienzyme was observed and showed that highest cumulative body weight gain was recorded in T4 group and lowest body weight gain was recorded in T1 group. The statistical analysis also revealed that there was no significant difference among T2, T3 and T4 groups. The results of present study are in accordance with Al-Kassie (2008) and Ghazalah and Ali (2008) who reported that dietary supplementation of rosemary at the level of 0.5 per cent has significant effect on body weight gain. Regarding addition of multienzyme, the findings are in agreement with that of Khan et al. (2006) and Pourreza et al. (2007) who reported that supplementation of enzyme improved body weight gain significantly ($P<0.05$) in broiler chicks.

Cumulative feed conversion ratio was found to be highly significant ($P<0.01$) on supplementation of rosemary and multienzyme. Further on comparison, overall cumulative FCR was highest in T1 group whereas T2, T3 and T4 groups were found similar. The results are supported by Ghazalah and Ali (2008), Elnaggar et al. (2016) who reported that dietary supplementation of rosemary at the level of 0.25 and 0.5 per cent significantly improved the feed conversion ratio. Almrsomi (2017) found in their results that addition of rosemary leaves powder at the level of 25g /kg, 50g /kg and 75g /kg to the diet had significantly superior feed conversion ratio. Regarding addition of multienzyme Attia et al. (2012) reported that supplementation of phytase and multienzyme in broiler chicks showed significant improvement in FCR as compared to control. Pucci et al. (2010) observed an improvement ($P<0.05$) in

feed conversion ratio in broilers fed diet containing corn and soybean meal supplemented with enzyme complex (amylase, cellulase and protease).

A highly significant (P<0.01) effect of supplementation of rosemary and multienzyme was found on performance index in broiler chickens. The cumulative mean performance index and PI at fifth week was significantly (P<0.01) higher for T4 group which was comparable with T2 and T3 groups and lower for T1 group. The results are in accordance with Elnaggar et al. (2016) who reported that dietary supplementation of rosemary at the level of 0.25% had significant effect on performance index. Tanwar et al. (2021) also found similar results with herbal products supplementation. Regarding supplementation of multienzyme, Nizamuddin et al. (2013) reported that values of performance index were significantly (P<0.05) higher in dietary enzyme treated groups as compared to control.

Protein efficiency ratio revealed highly significant (P<0.01) effect on supplementation of rosemary and multienzyme. Further protein efficiency ratio was significantly highest in T4 group and lowest in T1 group. In accordance with these finding Singh et al. (2015) revealed that all the herbal growth promoting additive treatments had better protein efficiency ratio (PER) than control. Elbushra (2012) also found significant improvements in protein efficiency values for the groups fed diets with 0.5 and 1.5 per cent fenugreek during the experiment period. Karnani et al. (2018) found similar observations with supplementation of curry leaves powder. Regarding addition of multienzyme, Effiong et al. (2019) also observed that enzyme supplementation significantly (P<0.05) improved protein efficiency ratio in broilers. The mortality, occurred during third and fourth week of rearing, was very less and post mortem findings showed some signs of heat stroke.

Table 1. Proximate composition of rosemary (*Rosemarinus officianlis*) leaves powder, broiler starter and finisher ration on DM basis

Proximate principles (per cent)	Broiler starter	Broiler finisher	Rosemarinus officianlis leaves powder
Dry Matter	90.3	89.3	92.5
Crude Protein	22.4	20.2	6.27
Ether Extract	2.40	2.50	3.69
Crude Fibre	5.00	5.00	21.0
Total Ash	6.40	6.56	6.90
Nitrogen Free Extract	63.7	65.6	62.1

Table 2. Effect of rosemary (*Rosemarinus officianlis*) leaves powder and multienzyme on performance of broiler chickens

Particulars	Treatments				P value
	T1	**T2**	**T3**	**T4**	
Feed consumption (g/bird) (0-5 wk)	2493± 61.72	2555± 42.06	2568± 50.86	2611± 65.02	NS
Initial body weight (g)	41.9± 0.18	41.9± 0.30	42.0± 0.12	42.3 ±0.11	NS
Final body weight gain (g)	1336[a] ±26.54	1520[b] ±27.97	1464[b] ±34.25	1559[b] ±36.61	**
Total body weight gain (g)	1294[a] ±26.36	1478[b] ±27.69	1422[b] ±34.13	1517[b] ±36.66	**
Feed conversion ratio	1.98± 0.02[b]	1.73± 0.01[a]	1.75± 0.02[a]	1.72± 0.03[a]	**
Performance index	652[a] ±15.75	856[b] ±19.12	812[b] ±25.69	882[b] ±29.85	**
Protein efficiency ratio	2.38± 0.03[a]	2.73± 0.01[b]	2.69± 0.03[b]	2.74± 0.05[b]	**
Digestibility of DM (%)	71.0± 0.14[a]	73.32± 0.26[b]	72.93± 0.48[b]	74.53± 0.27[c]	**
Digestibility of CP (%)	69.7± 0.43[a]	72.7± 0.34[b]	73.4± 0.38[b]	74.8± 0.30[c]	**
Digestibility of EE (%)	79.9± 1.00[a]	84.6± 0.33[b]	84.3± 0.46[b]	84.3± 0.72[b]	**
Nitrogen intake (g/bird)	3.77± 0.04	3.87± 0.05	3.36± 0.25	4.04± 0.35	NS
Nitrogen excreted (g/bird)	1.14± 0.03	1.06± 0.02	0.94± 0.04	1.02± 0.10	NS
Nitrogen retention (g/bird)	2.63± 0.02	2.82± 0.03	2.42± 0.20	3.02± 0.25	NS

a, b, c- Means superscripted with different letters within a column differ significantly from each other.
** P<0.01, *P<0.05, NS= Non-significant

Digestibility of nutrients and nitrogen balance

A highly significant (P<0.01) effect due to supplementation of rosemary and multienzyme was found on dry matter digestibility, crude protein digestibility and ether extract digestibility. The highest digestibility coefficient of dry matter was observed in T4 group. The lowest digestibility coefficient of dry matter was found in T1 group. There was non-significant difference between T2 and T3 groups. The highest digestibility coefficient of crude protein was observed in T4 group. The lowest digestibility coefficient of dry matter was found in T1 group. There was non significant difference between T2 and T3 groups. The highest digestibility of ether extract was observed in T2 group which was similar with T2 and T4 group. The lowest value was recorded in control group. The results are in accordance with Elnaggar et al. (2016) who reported that dietary supplementation of rosemary at the level of 0.25 per cent significantly improved the crude protein digestibility. Son (2015) also reported that dietary inclusion of droed rosemary leaves at 0.5 and 1 per cent level significantly improved nutrient digestibility. Husain (2020) also reported that addition of 1 and 2 per cent rosemary significantly improved digestibility of crude protein, ether extract, and dry matter. Moftakharzadeh et al. (2019) also stated that dry matter digestibility of diet significantly improved with multienzyme supplementation.

It was observed that Nitrogen intake, excretion and balance were not influenced by either rosemary and multienzyme supplementation. On comparison of means maximum nitrogen balance was found in T4 group and lowest in T3 group. Results are in accordance with Meena (2015) who also reported that supplementation of rosemary at the level of 0.5, 1 and 1.5 per cent had no significant effect on nitrogen intake. Similarly Dwivedi (2013) observed no effect of phytobiotic or herb supplementation on nitrogen balance. In accordance with the observations of the present study Effiong et al. (2019) reported that daily protein intake was not significantly ($P>0.05$) influenced by supplementation of feed grade enzyme. Grana et al. (2013) observed that the diets supplemented with phytase did not affect ($P>0.05$) N balance.

CONCLUSION

On the basis of performance of broilers, it can be concluded that dietary supplementation with rosemary leaves @0.5 per cent and multienzyme @0.05 per cent, alone and their combination enhanced the overall performance of broiler chicken. Thus, their use in the ration of broiler chicks as an alternative to commercial growth promoters may be useful for efficient broiler production.

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