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Effect of Feeding *Moringa oleifera* Leaf Meal with Multienzyme on Performance, Carcass Characteristics and Economics of Production of Broiler Chicks

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ABSTRACT

Background: Moringa leaves have wide range of medicinal value including antimicrobial property. Therefore, it could be an alternative of antibiotic growth promoters in poultry but the presence of phytate and other anti-nutrients can reduce the bioavailability of certain nutrients. Enzymes may reduce anti-nutrients effect, break down non-starch polysaccharides (NSPs), reduce intestinal viscosity and ultimately improve digestibility of nutrients by improving gut performance. An experiment was conducted to assess the effect of supplementation of *Moringa oleifera* leaf meal with multienzyme on the performance, carcass characteristics and economics of broiler chicks.

Methods: Day-old, 150 broiler chicks (Vencobb-400) were randomly allotted to five treatment groups. The T_1 *i.e.* control group was fed on basal diet, while, T_2, T_3, T_4 and T_5 treatment groups were supplemented with 0.5%, 1.0%, 1.5% and 2.0% of moringa leaf meal in combination with multienzyme @ 50g/100kg feed in the basal broiler starter and finisher ration, respectively.

Result: Body weight gain was higher (P<0.01) in broilers fed diet supplemented with 1.5% *Moringa oleifera* leaf meal (MOLM) and multienzyme at 3 or 6 weeks of age. The best feed conversion ratio (FCR) at the starter phase was recorded in the T_2 group and over the entire period of the trial T_4 treatment group had the best FCR. Significant increase in dressing yield percent and relative weight of giblet was observed in broilers fed diet with 1.5% level of moringa leaf meal and multienzyme. Supplementation of MOLM with multienzyme was profitable in terms of reduction in feed cost per kg gain. It was concluded that supplementation of *Moringa oleifera* leaf meal @ 1.5% with multienzyme at 50g/100Kg dose in the diet was effective in improving the performance and net profit in broiler chicks.

Key words: Broiler chicks, Carcass characteristics, Economics, *Moringa oleifera*, Multienzyme.

INTRODUCTION

Among various agriculture and allied farming, poultry farming is one of the most important economic components of the farmer's economy because it provides eggs, meat, feathers and manure with little capital investment and fewer workforces (Najeeb *et al.,* 2014). In India, the poultry population has increased from 729.2 million to 851.81 million, an increase of almost 17 per cent as per 20th Livestock Census (DAHD, 2019). Antibiotics, since their discovery in the 1920s, have played a critical role in contributing to the economic effectiveness of animal production as feed supplements at sub-therapeutic doses, to improve growth and feed conversion efficiency and to prevent infections (Castanon, 2007) but due to drug resistance problems associated with antibiotic use most researchers are seeking antibiotic alternatives and feed additives to promote growth and enhance the gut health of animals (Abbas, 2013). Moringa leaves have wide range of medicinal value including growth promotion and antimicrobial effect (Mbikay, 2012). Several researches have showed Moringa leaf meal effects on broilers weight gain, feed conversion ratio and body weight (Olugbemi *et al.,* 2010) and egg production (Teteh *et al.,* 2016).

The price of feed ingredients is increasing consistently and now it has been a major constraint. As consequence cheaper and nonconventional feed ingredients have to be used which contain higher percentage of Non-Starch Polysaccharides (NPS) and antinutritive factors which reduced the efficiency of nutrient utilization. Enzymes break down NSPs, reduce intestinal viscosity and ultimately enhanced digestibility of nutrients by improving gut performance. The uses of a combination of various exogenous enzymes in broiler diets have shown a positive effect on the performance and economic production of broiler

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chicken (Yadava *et al.*, 2009). Some enzymes have potential for use in the poultry feed include cellulase (ß-glucanases), xylanases and associated enzymes, phytases, proteases, lipases and galactosidases. This alters the microflora profile in the small intestine, since enzymes affect the amount and form of the substrate present within the intestine, their use having a direct effect on the bacteria that make up the microfloral population. This leads to augmentation of endogenous digestive enzymes, which are either insufficient or absent in the bird, resulting in improved digestion. Kamble *et al.* (2007) observed that multienzymes with probiotic (0.75g/kg feed) supplementation results in better broiler performance and increased profit margin (Rs. 0.01-0.36 per bird). Therefore, the present study was carried out to evaluate the efficacy of supplementation of *Moringa oleifera* leaf meal with multienzyme on the growth performance, carcass characteristics and economics of production in broiler chicks.

MATERIALS AND METHODS

An experiment was conducted with broiler chicks during February - March, 2020 at the poultry farm of College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur. A total of 150, day old, unsexed and apparent healthy Vencobb-400 broilers chicks were procured from a commercial hatchery (Kewalramani Hatcheries Private Limited, Ajmer). The experimental broiler chicks were wing banded for identification and weighed individually before starting the experiment. The broiler chicks were divided randomly into 5 treatment groups (T_1, T_2, T_3, T_4 and T_5) with three replicates under each treatment. Good quality *Moringa oleifera* leaf meal (MOLM) powder was procured from Sinhal Herbs, Neemuch, M.P. The commercially available multienzyme feed supplement *i.e.* ENZYCOMP HD was procured from GK Biochemical Corporation, Surat, Gujarat. Various enzymes were present in the product as reported by the manufacturer (Table 1).

The T_1 *i.e.* control group was fed on basal diet while T_2, T_3, T_4 and T_5 treatment groups were supplemented with 0.5%, 1.0%, 1.5% and 2.0% of moringa leaf meal in combination with multi enzyme @ 50g/100kg feed in the basal broiler starter and finisher ration, respectively. Moringa leaf meal and multienzyme were mixed with the ISO certified basal feed (broiler starter and broiler finisher) of Godrej Agrovet Limited and used for feeding of experimental broiler chicks. The BIS (2007) feeding standard was followed for feeding of broilers during the experimental trial. Feed and water were supplied *ad libitum*. During the feeding trial, weekly feed intake and body weight gain were recorded. At the end of trial, two birds from each replicate were weighed individually and allowed to fast for 12 hour to empty gut contents before sacrifice and slaughtered to record the data on carcass characteristics and organ weights. The organs weight was expressed as gram and dressing yield and eviscerated yield were expressed in the percentage. The chemical compositions of broiler starter, broiler finisher and MOLM were analysed according to the standard methods of analysis (AOAC, 2016). Feed conversion ratio and economics of production were calculated from the primary data. The data on various parameters were subjected to ANOVA (Snedecor and Cochran, 1989) and means were tested for significant differences as per Duncan's multiple range test (Duncan, 1955).

Table 1: Composition of multi enzyme.

Enzyme	Quantity
Xylanase	2500000 IU/Kg
Beta-glucanase	225000 IU/Kg
Cellulase	290000 IU/Kg
Beta-mannanase	120000 IU/Kg
Alpha amylase	32000000 IU/Kg
Amyloglucosidase	60000 IU/Kg
Phytase	100000 IU/Kg
Protease	700000 IU/Kg
Lipase	50000 IU/Kg
Pectinase	7000 IU/Kg

RESULTS AND DISCUSSION

The broiler starter feed contained 22.36% crude protein, 4.13% ether extract, 3.70% crude fiber, 6.75% total ash, 63.06% nitrogen free extract, 1.25% acid insoluble ash, 9.90% neutral detergent fiber, 3.33% acid detergent fiber, 1.16% calcium and 1.18% phosphorus. The broiler finisher feed contained 20.24% CP, 4.56% EE, 3.70% CF, 6.70% TA, 64.80% NFE, 1.35% AIA, 10.11% NDF, 3.53% ADF, 0.88% calcium and 0.93% phosphorus. Whereas, Moringa leaf meal contained 24.56%, 7.10%, 7.82%, 9.20%, 51.32%, 0.51%, 11.30%, 8.39%, 1.58% and 0.30% CP, EE, CF, TA, NFE, AIA, NDF, ADF, Ca and P, respectively. Metabolizable energy contained in starter and finisher ration was 3400.48 and 3418.64 kcal/ kg, respectively. Whereas, calorie protein ratio (E: P ratio) content in starter and finisher ration was 152.07:1 and 168.90:1, respectively.

Growth performance

Body weight gain (BWG) was highest ($P<0.01$) in broilers fed diet supplemented with 1.5% MOLM with multi enzyme @ 50g/100 kg feed at starter and finisher phase (Table 2). This result is akin to Egu (2019) who found that the inclusion of MOLM in diet of broilers significantly ($P<0.05$) enhanced the weight gain at 3 and 6 week age. Swian *et al.,* 2014 observed significantly ($P<0.05$) higher body weight gain in broilers fed with enzyme supplemented ration than control during starter (0-21 days) and finisher (22-42 days) phase. However, Zakaria *et al.* (2010) observed no difference in BWG in broilers at 3 weeks of age but increased BWG at 6 week due to addition of multienzyme at different levels (0.25, 0.50 and 0.75g/kg diet). Broilers fed diet supplemented moringa leaf meal at 0.5, 1.0 and 2.0 % with multienzyme diet consumed significantly less feed compared to those

fed control diet and diet supplemented with MOLM at 1.5% and multienzyme @ 50g/100kg diet at 6 weeks of age, whereas there was no change in feed consumption due to dietary treatment at 3 weeks of age. Tekeli *et al.,* (2011) also reported no significant effect (P>0.05) on feed consumption of *Moringa oleifera* leaf meal. Amerah *et al.,* (2016) reported that feed intake was not influenced (P>0.05) by dietary enzymes during the starter phase. The reduction in feed intake with MOLM supplementation could be due to reduced palatability of the diet (Kakengi *et al.,* 2003) but improvement in feed consumption due to enzyme supplementation may be attributed to overcome the adverse effects of anti-nutritional factors and improve digestion of fibre and non-starch polysaccharides (Sharifi *et al.,* 2013). Significant (P<0.01) improvement in feed conversion ratio (FCR) was reported in broilers fed MOLM and multienzyme supplemented diet as compared to control at 3 or 6 weeks of age. These results are similar to the findings of Nikam *et al.,* (2016) who reported that supplementation of NSP hydrolyzing enzymes at 1X and 2X concentration did favorably influenced the FCR (P<0.05) during starter and finisher phases. Contrary to this, Haribhau *et al.,* (2020) reported that supplementation of multiple enzymes at 1X and 2X did not influence FCR (P>0.05) during 0-42 days of age.

Carcass characteristics

There was highly significant (P<0.01) effect of supplementation of *Moringa oleifera* leaf meal with multienzyme on dressing yield and eviscerated yield per cent. The highest values of dressing yield and eviscerated yield percentage were recorded to be 75.15% and 70.15%, respectively in T_4 group containing 1.5% MOLM with multienzyme at 50g/100kg feed and the lowest carcass yield was recorded in control group (Table 2). Sarker *et al.,* (2017) also observed significantly higher dressing percentages for the broilers fed moringa leaf meal (0.5%, 1.0%, 1.5% and 2.0%) than the broilers fed nutritional feed alone. Rambabu *et al.,* (2012) observed significant difference for dressing and eviscerated weight percentage in broilers fed with enzyme supplemented ration than control. However, Sangilimadan *et al.,* (2012) and Verma *et al.,* (2012) observed dressing and eviscerated weight percentage differs non-significantly in broilers fed with enzyme supplemented ration than control.

The relative weight of liver, heart, gizzard and giblet was significantly higher (P<0.01) in broilers fed *Moringa oleifera* leaf meal with multienzyme as feed additive in the ration. Highest weight of liver, heart, gizzard and giblet was recorded to be 76.98, 12.90, 37.12, 127.00g respectively in T_4 group containing 1.5 % MOLM with multienzyme (Table 2). Similarly, Abousekken (2015) reported significant (P<0.05) higher values of organ weight (%) of gizzard, liver and heart of birds fed moringa leaves extracts. Voemesse *et al.*, (2018) observed that gizzard weight was significantly increased (P<0.05) in chickens fed 0, 1 and 3% MOLM as compared to control. In contrast, Mikhail *et al.,* (2020) found non-significant effect on giblet, liver and gizzard weight of broilers fed MOLM at 0, 2.5, 5 and 7.5% level. Hamid and Mukhtar (2016) reported that feeding of broiler chicks on different level of moringa leaf meal with or without enzyme on heart, liver and gizzard showed no significantly (P>0.05) difference among treated groups. This might be due to efficient digestion and absorption of nutrients leading to better growth and development of the gut.

Cost benefit analysis

Results indicated that addition of *Moringa oleifera* leaf meal with multienzyme reduce the overall cost (Rs) of feed per kg gain as compared to control but maximum reduction in

Table 2: Effect of multienzyme supplementation on growth performance, carcass characteristics and organs weight.

Parameters	Treatment groups					SEM
	T_1	T_2	T_3	T_4	T_5	
Body wt. gain (g)						
3rd week	612.79^{a}	697.14^{bc}	677.22^{b}	726.05^{c}	675.07^{b}	7.124
6th week	1836.00^{a}	2149.62^{b}	2201.05^{c}	2267.02^{d}	2200.34^{c}	22.995
Feed intake (g)						
0-3 week	1190.72	1178.93	1164.78	1246.33	1191.55	8.029
0-6 week	3923.20^{c}	3826.99^{a}	3905.88^{ab}	3938.80^{c}	3822.29^{a}	17.282
FCR						
0-3 week	1.81^{b}	1.60^{a}	1.63^{a}	1.62^{a}	1.65^{a}	0.015
0-6 week	2.03^{c}	1.71^{ab}	1.74^{ab}	1.70^{a}	1.70^{ab}	0.018
Dressing yield (%)	72.45^{a}	74.85^{bcd}	74.98^{bcd}	75.15^{d}	75.10^{cd}	0.164
Eviscerated yield (%)	67.24^{a}	69.82^{bcd}	70.00^{cd}	70.15^{d}	70.04^{cd}	0.169
Liver (g)	53.14^{a}	70.19^{b}	72.86^{c}	76.98^{e}	75.89^{d}	1.024
Heart (g)	10.23^{a}	11.85^{b}	12.34^{d}	12.90^{e}	12.01^{c}	0.106
Gizzard (g)	34.45^{a}	35.89^{b}	36.02^{c}	37.12^{e}	36.89^{d}	0.117
Giblet (g)	97.82^{a}	117.93^{b}	121.22^{c}	127.00^{e}	124.79^{d}	1.236

Means with different superscripts in a row differ significantly.

Table 3: Overall feed cost (Rs) and percentage reduction in feed cost per unit weight gain in various treatment groups.

Comparative economics	Treatment groups				
	T_1	T_2	T_3	T_4	T_5
Starter feed cost/kg gain	81.61	75.85	75.66	76.99	80.68
Finisher feed cost/kg gain	92.93	81.04	78.41	77.67	78.15
Overall cost/kg gain	89.15	79.35	77.56	77.45	78.93
% Overall reduction in feed cost/kg gain	0	10.99	13.00	13.13	11.47

overall cost of feed per kg gain was obtained in T_4 group (Basal diet + 1.5% MOLM + multienzyme 50g/100kg) *i.e.*13.13% reduction (Table 3). Increased meat yields are required for better profitability and increased dressing percentage in broilers was observed in *Moringa oleifera* leaf meal with multi enzyme supplemented groups. It might be attributed to better FCR on supplementation of *Moringa oleifera* leaf meal and multienzyme. Similarly, higher (P<0.05) net profit has been recorded by the earlier workers on supplementation of mixture of probiotics and enzymes (Swain *et al.*, 2009) in poultry.

CONCLUSION

The results of the study showed that 1.5% *Moringa oleifera* leaf meal (MOLM) could be included into the diet of broiler chickens with multienzyme @ 50g/100kg feed for beneficial effects in terms of improved overall performance of broilers and increased margin of profit in broiler production. The feeding of moringa leaf meal with multienzyme is beneficial as a growth promoter or feed supplement in commercial broiler production.

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