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Effect of Multienzyme Cocktail on Growth Performance, Digestibility and Carcass Characteristic of Broilers Fed Soybean Meal Replaced with Distillers Dried Grain Solubles (DDGS) and Maize Based Diet

Sonu*, Zile Singh Sihag, Rajesh Dalal and Parveen Ahlawat

Department of Animal Nutrition, College of Animal Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125004 (India)

*Corresponding Author E-mail: sonudahiya239@gmail.com

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ABSTRACT

An experiment was conducted on broiler chicks to evaluate the effect of supplementing different levels of DDGS supplemented with multienzyme @ 25g/100kg of feed on their production performance, digestibility and carcass trait for a period of six weeks. 280 day old broilers chicks were procured and they were randomly distributed into seven dietary treatment groups i.e. T_1, T_2, T_3, T_4, T_5, T_6 and T_7 consisted of 14 replications with 20 birds per replicate. The experimental study involves record of various observations viz. feed intake, periodic growth, feed conversion ratio (FCR), energy and nitrogen retention, carcass traits under different dietary treatment. Basal control diet (T_1) was formulated as per BIS (2007) specifications having maize and soybean meal as main ingredients, while in other dietary treatments T_2, T_3 and T_4 were formulated with 15, 30 and 45% of soybean meal replaced with DDGS respectively, and in T_5, T_6 and T_7 the multienzyme (25g/ 100kg of diet) was added along with replacement of soybean meal with DDGS @ of 15, 30 and 45% respectively. The performance of the broiler chicks was not significantly differed ($P<0.05$) due to addition of multienzyme however the results were similar to control diet in the groups fed 15% and 30% replacement of soybean meal with DDGS. The effect of supplementation of multienzyme has not been noticed on the digestibility and carcass characteristics of different treatment groups.

Key words: *Broilers, Carcass Traits, Distillers dried grain soluble (DDGS), Multienzyme, Performance.*

INTRODUCTION

India with 1.2 billion people population is the biggest consumer market in the world. Poultry sector is one of the key industries to provide feed security to such a large population in terms of energy and protein as well as employment of people. Poultry production in India is very important as egg and chicken meat are very rich source of protein, different minerals and vitamins.

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Feed contribute as much as 70% of production and the most viable is the source of protein as it is highly priced and not easily available. So an alternative and cheap source of protein like DDGS, addition in poultry ration could make it cost effective. Distillers Dried Grain with Solubles (DDGS) is byproduct of ethanol industry which is obtained from grains through a process of dry milling. Different contents like protein, metabolizable energy, phosphorus and unsaturated fat is high in DDGS. Hydrolysis and drying process by which DDGS is submitted increases the concentration of free fatty acids and crude fibre. Almost whole of the starch has been converted to ethanol so a high concentration of non-starch polysaccharides especially cell-wall components exists in this product. This is the reason that the use of exogenous enzymes is presented as an alternative to enhance the efficient use of nutrients in diets formulated with DDGS. With increasing feed prices, the interest in using alternative feed sources like DDGS in poultry diets has escalated during recent years. Various exogenous enzymes such as phytase and different combinations of amylase, protease and carbohydrases have found increased use in poultry diets. Exogenous enzymes may ameliorate the anti nutritive effects of non starch polysaccharide and phytate hence they can enhance the digestibility of feed ingredients and reduce nutrient excretion to the environment by birds.[1, 21] The objective of the current study was to determine the growth performance, digestibility and carcass traits of broiler birds fed with DDGS based diet with or without multienzyme supplementation.

MATERIAL AND METHODS

280 day old broiler chickens were reared and seven diets were formulated for each growth period for the planned experimental work. Maize and soybean meal based diet was computed as per BIS[3] standards to meet out nutrient requirements of broiler birds to serve as control. $T_{1,}$ control group was formulated by incorporation of maize and soybean while chicks in treatment groups T_2, T_3 and T_4 were fed basal diet with soybean meal @ 15, 30 and 45% replaced by DDGS without enzyme, respectively. The dietary treatment groups T_5, T_6 and T_7 were formulated by addition of multienzyme @ 25 gm/100kg of feed along with 15, 30 and 45% soybean meal replaced with DDGS, respectively. Birds had *ad libitum* access to the diets and various weekly records such as feed offered, residual amount of feed and body weight was maintained for each replicate to calculate the feed consumption per bird and record was maintained up to 6 weeks of age. Feed Conversion Ratio (FCR) for each replicate was calculated mathematically as follows: FCR=Total feed consumed (g)/Total body weight gain (g). At the end of the experiment a metabolism trial was conducted, in which two birds from each replicate was randomly selected and gave them enough time to acclimatize for the changed environmental conditions. Collection of representative samples of digesta in plastic bottles has been done for three days regularly in morning time and these sample bottles then kept in deep freeze for the determination of moisture and nitrogen contents. Feed offered and weighing records were maintained on daily basis during the experimental work. Nutrients availability for each replicate was calculated by dividing the amount of retained nutrients (ingested nutrients – excreted nutrients) with the amount of ingested nutrients. Likewise dry matter retention has been calculated. Gross energy of oven dried feed samples and excreta samples were estimated by using Bomb Calorimeter. The gross heat of combustion in calories per gram of the material was computed by substituting values in equation: Gross heat of combustion (cal/g)= $t\times w - (C1+C2+C3)/M$, Where, t (Rise in temperature),w (Water equivalent), M (Weight of sample),C1(Correction in calories for heat of formation of acid), C2 (Correction in calories for heat of combustion of fuse wire), C3 (Correction in calories for heat of combustion of thread, 27.73 cal/20 cm). Estimation of metabolizable energy (ME) was done from the estimated gross energy values of feed and excreta sample, as ME = E diet – E excreta -

N×8.22. Gross energy metabolizability (%) was calculated as follows: Nitrogen corrected metabolizable energy (Kcal/kg)/ Gross energy of dry feed (Kcal/kg)×100. Live weights of birds was recorded and then sacrificed by following 'Halal' method. Dressing percentage was calculated as by using the formula; Dressed weight/ Live weight ×100. The eviscerated, drawn weights were recorded, eviscerated and drawn percentage was calculated as: Eviscerated weight = Dressed weight – weight of viscera and eviscerated percentage was calculated by Eviscerated weight/ Live weight× 100. Drawn weight is found by adding Eviscerated weight and weight of giblets and drawn percentage was evaluated by drawn weight/ live weight × 100. Samples of breast and thigh muscles were taken in sample collection bottles separately, from each of the slaughtered bird and stored in deep-freeze separately for further analysis. Chemical analysis of collected sample of breast and thigh muscle was done. Analysis of data was done by using general linear model procedure of statistical package for social sciences 20th version (SPSS)[16]. Analysis of variance was used to study the differences among treatment means and they were compared by using Duncan's Multiple Range Test (DMRT) as modified by Kramer[9] and differences among the treatments were tested for significance at ($p \leq 0.05$) level.

Table 1: Ingredient (%) and chemical composition (% DM basis) of control diet

Feed ingredient	Starter diet	Finisher diet
Maize (kg)	57	63
Soybean (kg)	31	25
Fish meal (kg)	8	7
Vegetable oil (kg)	2	3
Mineral mixture (kg)	2	2
Feed additive (gm)	320	320
Multienzyme (gm)	25	25
Chemical composition (% Dry Matter Basis)		
Crude Protein %	23.18	21.32
Crude Fibre %	4.42	3.26
Ether Extract %	3.84	5.15
Total ash %	8.78	8.74
Metabolizable energy** (Kcal/kg)	3000.30	3174.25

***Feed additives** include Meriplex-20g, Vitamin, Ventrimix-25g, Coccidiostat (Dinitro-0-Toluamide)-50g, Choline chloride-50g, Lysine-50g, DL-methionine-100g, CTC-25

** **Calculated values- (Singh and Panda)[15]**

RESULT AND DISCUSSION

The ingredients and chemical composition of basal ration has been presented in Table 1. The data pertaining to feed intake in broiler chicken at 6 weeks of age under different dietary treatments are presented in Table 2. The average feed intake was significantly ($P<0.05$) differed and T_4 and T_7 had a higher feed intake in comparison to other dietary treatments. The overall feed intake (0-6 week) was significantly ($P<0.05$) higher in the groups fed with 45% DDGS level and no effect of addition of multienzyme was noticed. No negative impact of feeding 20% corn DDGS to broiler birds but at higher level i.e. at 25% inclusion of corn DDGS feed intake was higher[20].

Table 2: Feed intake (g/bird) of birds during different growth period under different treatment groups

Treatments	0-2 week	3-4 week	5-6 week	0-6 week
T_1	352.05^{b}±3.04	1288.08^{b}±16.59	2448.27^{b}±25.63	4088.40^{b}±46.15
T_2	342.41^{b}±1.43	1281.45^{b}±13.15	2433.73^{bc}±28.94	4057.59^{b}±32.37
T_3	345.09^{b}±2.75	1254.13^{b}±11.86	2428.85^{bc}±23.16	4028.07^{b}±35.56
T_4	360.22^{a}±2.42	1376.73^{a}±13.26	2588.18^{a}±25.41	4293.13^{a}±49.03
T_5	344.00^{b}±5.94	1280.25^{b}±24.23	2419.50^{bc}±28.60	4043.75^{b}±36.34
T_6	347.61^{b}±4.60	1275.70^{b}±18.74	2447.19^{b}±34.97	4070.51^{b}±42.35
T_7	365.72^{a}±5.82	1371.20^{a}±14.57	2580.63^{a}±29.30	4265.55^{a}±34.19

Means bearing different superscripts in a column, differ significantly (P<0.05)

The average body weight gain (Table 3) among all the age group showed significant (P<0.05) differences. At the end of experiment (6^{th} week) the average weight gain in treatment groups T_4 (2269.37) and T_7 (2267.81) was significantly lower (P<0.05) than groups T_1 (2434.76). The weekly body weight gain among all the age group showed significant differences during whole experimental period. Body weight gain of broiler birds decreased significantly when fed with higher DDGS level[5].

Table 3: Average body weight gain (g/bird) of birds during different growth period under different treatment groups

Treatments	0-2 wk	3-4 wk	5-6 wk	0-6 wk
T_1	237.06^{a}±8.34	838.47^{a}±12.05	1359.23^{b}±22.62	2434.76^{a}±33.45
T_2	224.67^{b}±7.75	847.44^{a}±17.27	1350.34^{b}±25.90	2422.45^{a}±34.95
T_3	227.58^{ab}±9.88	847.41^{a}±15.75	1392.02^{b}±29.18	2467.01^{a}±49.01
T_4	216.04^{c}±8.29	789.26^{b}±13.61	1264.07^{c}±26.01	2269.37^{b}±46.33
T_5	222.61^{ab}±9.90	842.63^{a}±14.81	1357.04^{b}±32.37	2422.28^{a}±32.45
T_6	227.87^{ab}±9.41	842.13^{a}±18.14	1424.06^{a}±36.71	2494.06^{a}±36.64
T_7	212.81^{c}±9.85	781.76^{b}±21.20	1273.24^{c}±38.06	2267.81^{b}±47.10

Means bearing different superscripts in a column, differ significantly (P<0.05)

The Feed Conversion Ratio as depicted in Table 4 showed that a significant differences (P<0.05) was noticed as the group fed with 45% DDGS had poor FCR as compared to other groups. The FCR was comparable in T_2, T_3, T_5 and T_6 to that of control group but no effect of additional enzyme supplementation was noticed. However the use of β mannanase has improved the performance of animals fed soybean based diet[13, 14, 8, 12]. No improvement in performance when a combination of β-mannanase and galactanase was supplemented in a soybean based diet[19]. Other researcher have also shown a significant improvement in broilers fed a corn soybean meal diet supplemented with β- mannanase, protease or a combination of protease and xylanase [10,9].

Table 4: Feed conversion ratio (FCR) during different growth period under different dietary regime

Treatment	0-2 week	3-4 week	5-6 week	0-6 week
T_1	1.48^{ab}±0.01	1.53^{b}±0.02	1.80^{b}±0.03	1.68^{b}±0.04
T_2	1.52^{b}±0.01	1.51^{ab}±0.01	1.82^{b}±0.02	1.67^{ab}±0.02
T_3	1.51^{ab}±0.02	1.47^{a}±0.02	1.74^{a}±0.01	1.63^{ab}±0.04
T_4	1.52^{b}±0.02	1.74^{c}±0.04	2.04^{c}±0.03	1.89^{c}±0.06
T_5	1.54^{b}±0.02	1.52^{ab}±0.01	1.78^{ab}±0.01	1.66^{ab}±0.05
T_6	1.52^{ab}±0.02	1.51^{ab}±0.02	1.71^{a}±0.02	1.63^{ab}±0.03
T_7	1.47^{a}±0.02	1.73^{c}±0.03	2.03^{c}±0.05	1.88^{c}±0.04

Means bearing different superscripts in a column, differ significantly (P<0.05)

Table 5 depicted the data pertaining to DM metabolizabilty and Nitrogen Retention. The DM metabolizability was differed significantly ($P<0.05$) as the group fed with 45% soybean replaced with DDGS level noticed a lower metabolizability as compared to control diet. But the nitrogen retention related data not influenced by the addition of multienzyme as well DDGS.

Table 5: DM metabolizability and nitrogen metabolizability of the experimental birds under different treatment groups

Treatment	DM metabolizability (%)	N_2 retention (%)
T_1	$63.93^b \pm 0.92$	61.79±0.40
T_2	$63.32^b \pm 0.49$	61.17±0.41
T_3	$62.62^b \pm 0.69$	60.78±0.22
T_4	$59.81^a \pm 0.80$	58.32±0.34
T_5	$62.64^b \pm 0.82$	60.22±0.34
T_6	$63.54^b \pm 0.79$	60.89±0.27
T_7	$59.23^a \pm 0.86$	58.67±0.41

Means bearing different superscripts in a column, differ significantly ($P<0.05$)

Table 6 depicted the data pertaining to nitrogen corrected metabolizable energy and percentage gross energy metabolizability. However no any significant difference was observed in the data. DDGS and multienzyme could not able to show their effect on the data related to energy metabolizability. But in the current study no significant effect was observed due to enzyme addition because feed ingredient or diets that contain substantial concentration of fiber respond to a greater extent to carbohydrase supplementation[2]. A trend also noticed that repressed effect of carbohydrases supplementation when energy value of the feed ingredient or diet being treated is high[1]. Corn DDGS negatively affected the N retention and DM metabolizability[18]. Beneficial effect of phytase enzyme on the performance of birds without consistent influence on metabolizable energy content and digestibility of amino acids in 40% DDGS based diet also reported[11].

Table 6: Metabolizable energy (kcal/kg) and percent gross energy metabolizability in experimental birds under different treatment groups

Treatment	Nitrogen Corrected metabolizable energy (kcal/kg)	Gross Energy metabolizability (%)
T_1	3178.30±40.12	64.94±2.41
T_2	3329.40±42.88	65.76±4.35
T_3	3363.07±44.90	64.12±1.47
T_4	3440.66±.34.95	63.88±6.26
T_5	3313.10±40.83	65.49±3.62
T_6	3340.97±42.46	63.87±4.48
T_7	3445.77±43.49	63.69±1.68

Table 7 depicted the chemical composition of breast and thigh muscle of broiler birds. No significant differences have been noticed among the treatment groups. It seemed that neither the feeding of DDGS nor enzyme improved the chemical composition. However the group containing 15% and 30% DDGS showed similar result as compared to control diet. There was no negative effect up to 45% DDGS supplemented diet on meat qualities of thigh and breast muscle of broiler birds[4]. Results also found that there was no significant effect of DDGS level and various enzymes (phytase, xylanase, amylase and protease) or their interaction on the average value of carcass traits[7].

Table 7: Composition (%) of breast and thigh muscles in experimental birds under different treatment groups

Treatment	Breast muscle			Thigh muscle		
	Moisture	Crude protein	Fat	Moisture	Crude protein	Fat
T_1	74.92±12.81	19.35±1.87	5.14±0.51	75.52±12.86	18.62±2.90	7.02±0.96
T_2	74.54±14.47	19.18±3.03	5.23±0.73	75.23±16.66	18.58±3.01	7.08±0.85
T_3	75.05±16.71	19.44±2.88	5.19±0.67	76.24±15.52	18.69±1.89	7.06±0.89
T_4	74.35±11.72	19.08±2.98	5.32±0.64	75.63±11.73	18.42±3.27	7.25±0.83
T_5	74.67±17.84	19.30±1.79	5.13±0.91	75.22±17.94	18.48±1.21	7.15±0.73
T_6	75.13±13.43	19.58±2.76	5.25±0.58	76.25±14.83	18.83±4.86	7.25±0.97
T_7	74.39±13.86	19.10±3.75	5.23±0.73	75.12±15.72	18.34±2.06	7.25±0.74

Table 8 depicted the carcass composition of broiler birds. No any significant difference on carcass traits have been noticed among the different dietary treatment groups fed with multienzyme and DDGS. The effect of enzyme was not noticeable. No significant effect on carcass traits up to 60% replacement of soybean meal with DDGS[7]. Dressing yield was not affected by the addition of DDGS or by the addition of additives (xylanase and phytase) to the diets with high levels of DDGS[17].

Table 8: Dressed, eviscerated, drawn yield and weight of giblets of the experimental birds under different treatment groups

Treatments	Dressed (%)	Eviscerated (%)	Drawn (%)	Liver (%)	Heart (%)	Gizzard (%)	Giblet (%)
$\mathbf{T_1}$	71.17±6.96	63.23±1.56	68.10±4.06	2.57±0.66	0.56±0.44	1.74±0.21	4.87±1.06
$\mathbf{T_2}$	70.12±6.88	62.18±2.15	66.93±2.33	2.55±0.63	0.50±0.08	1.70±0.34	4.75±1.02
$\mathbf{T_3}$	69.32±4.45	61.43±6.12	66.13±5.12	2.46±0.42	0.51±0.08	1.73±0.14	4.70±0.91
$\mathbf{T_4}$	68.97±7.62	60.38±5.07	65.06±1.15	2.50±0.38	0.49±0.39	1.69±0.44	4.68±0.92
$\mathbf{T_5}$	69.34±1.77	62.54±2.09	67.29±6.56	2.49±0.19	0.58±0.04	1.68±0.52	4.75±1.03
$\mathbf{T_6}$	69.73±3.96	61.92±1.89	66.57±8.47	2.51±0.67	0.45±0.15	1.69±0.38	4.65±0.33
$\mathbf{T_7}$	68.76±8.07	60.49±5.60	64.90±9.14	2.36±0.74	0.43±0.03	1.62±0.21	4.41±0.87

CONCLUSION

In conclusion the overall performance, digestibility and carcass traits were not benefitted by the supplementation of multienzyme cocktail but the DDGS level upto 45% in the broiler ration can replace the soybean protein source with no harmful effect.

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