Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(3): 1510-1513
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Received: 24-03-2018
Accepted: 25-04-2018

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Comparative evaluation of various exogenous enzymes on performance and carcass traits in broilers fed with soya replaced with DDGS (Distillers dried grain solubles) based diet

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Abstract
The present study was conducted to evaluate the efficacy and utilization of using Distillers Dried Grain Solubles (DDGS) as a replacer of soybean meal with or without exogenous enzyme supplementation on the performance and carcass traits in broiler chickens. Various observations viz. periodic feed intake (FI), body growth, feed conversion efficiency (FCR) and carcass characteristics of rearing broilers under different dietary treatments were observed. 520 day-old commercial broiler chickens were randomly divided into thirteen dietary treatments having two replicates (twenty birds in each replicate) in each treatment. According to the nutrient requirement of broiler birds, maize soybean meal based basal diet was formulated as control group (T_1). While treatment groups T_2, T_3, T_4; T_5, T_6, T_7; T_8, T_9, T_{10}; T_{11}, T_{12}, T_{13} were supplemented with 15, 30 and 45% DDGS without enzymes, phytase, protease and multienzyme, respectively. Performance of birds in terms of Body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) was improved in the groups fed with protease enzyme at 30% DDGS level. No significant effect was noticed on qualitative and quantitative carcass characteristics of birds.

Keywords: Broiler performance, carcass traits, exogenous enzymes, distillers dried grains solubles (DDGS)

Introduction
Modern broiler and layer industry is considered to be highly efficient in converting feed to food products, although they leak into the environment a significant amount of unutilized nutrients i.e., broilers lose almost 30% of ingested dry matter, 25% of gross energy, 50% of nitrogen and 55% of phosphorus intake in their manure [1]. During the recent increase in the ethanol production in our country in which the cereal grains are concentrated into simple sugars via enzymatic action followed by fermentation with yeast to produce ethanol and their co-product viz. Distillers dried grain soluble (DDGS) and CO_2 [2, 3]. Major concern of the use of DDGS as a food source in small animal i.e. in poultry is high fiber and low amino acid level and their availability [4-6].

The efficacy of exogenous feed enzymes added to poultry diets containing DDGS is not reliable and depends on factors such as the age, physiological stage of the bird, activity of the used enzymes, chemical composition, dietary level of the DDGS used and the composition of diet supplemented with DDGS. However, NSP-hydrolyzing enzymes generally seemed to be more resourceful than phytases, especially in terms of digestibility of nutrients, as well as growth performance of poultry birds fed with high-DDGS diets. So for this reason, NSP-hydrolyzing enzymes supplementation could be one of the most valuable methods to enhance the use of augmented levels of DDGS in poultry diets. Xylanase is a main NSP degrading enzyme used in poultry feeds to reduce viscosity of digesta caused by inclusion of high viscous grains (*e.g.* barely, wheat) in diets but also β- glucanase have been widely used because grain cell walls possess abundant carbohydrates linked by β- bond [7]. 60 to 70% of the provided P in typical broiler diet ingredients such as corn and soybean is bound to phytic acid [8] and phytate-P is usually unavailable for utilization by poultry, due to a lack of effective endogenous phytase enzyme which aids in digestion of the phytic acid complex [9]. Exogenous phytase enzyme supplementation could be helpful in liberating phytate bounded P and retention of dietary P.

Materials and Methods

Five hundred and twenty, day old commercial broiler chicks were procured from local commercial hatchery chicks and were reared under deep litter system. At poultry house these chicks were individually weighed, wing banded and randomly distributed into 26 subgroups having thirteen dietary treatments with two replicates per treatment with 10 birds in each replication. Group first was assigned as a control (T_1) and provided with maize- soyabean meal based basal diet, formulated to fulfill the nutrient requirement as per [10] while; second (T_2), third (T_3) and fourth (T_4) groups were provided with a 15, 30 and 45% soybean meal replaced with DDGS; fifth (T_5), sixth(T_6), and seventh (T_7) groups supplemented with phytase enzyme with 15, 30 and 45% DDGS level; eighth (T_8), ninth (T_9) and tenth (T10) groups were supplemented with protease enzyme with 15, 30 and 45% DDGS level; eleventh (T_{11}), twelfth (T_{12}) and thirteenth (T_{13}) groups were supplemented with multienzyme with 15, 30 and 45% DDGS level, respectively. Each Bird was vaccinated against F1 strain of Ranikhet disease on 0, 7th day and Gumboro disease on 14th day. Proper air ventilation system was maintained in the house for the flow of fresh air and removal of harmful gases from the poultry house. Six week feeding programme consisted of a starter diet from 0 to 28 days and a finisher diet from 29 to 42 days. Weighed amount of grind maize grains was offered on paper sheets for first 3 days and thereafter, starter diet was given in the automatic feeders up to 28 days of age. Afterwards, finisher feed was offered through hanging feeders which were maintained at appropriate heights. The chicks were provided *ad libitum* clean drinking water throughout the experimental study. The record of feed intake and body weight (BW) has been done at 0, 2, 4, and 6 weeks of the experiment. Feed conversion ratio was calculated as feed intake divided by body weight gain. Two birds from each replicate was randomly selected and humanely slaughtered at the end of the experiment and then carcass weight, breast, and thigh meat sample were taken in sample bottles and kept under refrigeration for further evaluation of carcass traits. Ingredient and chemical composition of experimental diets in Table1. Data was analyzed statistically as described by [11] and analysis of variance was used to study the differences among treatment means and they were compared by using [12].

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)

Results and discussion

Feed intake: Supplementation of protease enzyme at 30% DDGS level had significantly (P<0.05) lower feed intake as compared to control as well as from other dietary treatment groups. No effect of phytase and multienzyme was noticed on overall feed intake of birds, although they are statistically similar to control group upto 30% DDGS level. At 45% DDGS neither of the enzymes showed its effect on feed intake of birds. In contrast to our study [13] reported that at higher level of feeding DDGS to broiler birds the intake was increased, which could be attributed to the higher non starch polysaccharides (NSP) at higher DDGS replacement levels.

Table 2: Feed intake (g/bird) during different growth period under different dietary treatments

Treatments	0-2 week	3-4 week	5-6 week	0-6 week
T_1	$352.05^b \pm 3.04$	$1288.08^b \pm 16.59$	$2448.27^b \pm 25.63$	$4088.40^b \pm 46.15$
T_2	$342.41^b \pm 1.43$	$1281.45^b \pm 13.15$	$2433.73^{bc} \pm 28.94$	$4057.59^b \pm 32.37$
T_3	$345.09^b \pm 2.75$	$1254.13^b \pm 11.86$	$2428.85^{bc} \pm 23.16$	$4028.07^b \pm 35.56$
T_4	$360.22^a \pm 2.42$	$1376.73^a \pm 13.26$	$2588.18^a \pm 25.41$	$4293.13^a \pm 49.03$
T_5	$346.87^b \pm 1.71$	$1279.92^b \pm 18.81$	$2426.67^{bc} \pm 29.19$	$4053.46^b \pm 44.81$
T_6	$348.70^b \pm 4.23$	$1223.93^b \pm 16.64$	$2310.95^c \pm 35.44$	$3883.58^b \pm 56.73$
T_7	$365.30^a \pm 2.51$	$1359.17^a \pm 24.07$	$2561.07^a \pm 37.91$	$4242.54^a \pm 46.32$
T_8	$349.64^b \pm 3.14$	$1267.08^b \pm 16.47$	$2423.61^{bc} \pm 35.23$	$4040.33^b \pm 30.84$
T_9	$341.05^b \pm 2.11$	$1221.49^c \pm 19.81$	$2193.17^d \pm 38.78$	$3755.71^c \pm 27.92$
T_{10}	$359.18^a \pm 3.63$	$1367.90^a \pm 17.54$	$2577.33^a \pm 38.11$	$4277.41^a \pm 40.19$
T_{11}	$344.00^b \pm 5.94$	$1280.25^b \pm 24.23$	$2419.50^{bc} \pm 28.60$	$4043.75^b \pm 36.34$
T_{12}	$347.61^b \pm 4.60$	$1275.70^b \pm 18.74$	$2447.19^b \pm 34.97$	$4070.51^b \pm 42.35$
T_{13}	$365.72^a \pm 5.82$	$1371.20^a \pm 14.57$	$2580.63^a \pm 29.30$	$4265.55^a \pm 34.19$

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

Body weight gain (BWG): At end of the experiment, weight gain was significantly (P<0.05) higher in groups fed with 30% DDGS with protease and phytase enzyme supplementation. Addition of exogenous enzymes could not be able to improve the weight gain at 45% DDGS supplementation. The present findings are contrast with findings of [14] found that the enzyme combination (carbohydrases, phytase and protease) added to broiler diet with 5% DDGS had no effect on body weight gain.

Table 3: Average body weight gain (g/bird) during different growth period under different dietary treatments

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^b±33.45
T_2	224.67^b±7.75	847.44^a±17.27	1350.34^b±25.90	2422.45^b±34.95
T_3	227.58^{ab}±9.88	847.41^a±15.75	1392.02^b±29.18	2467.01^b±49.01
T_4	216.04^c±8.29	789.26^b±13.61	1264.07^c±26.01	2269.37^c±46.33
T_5	226.56^{ab}±9.94	841.44^a±18.19	1352.13^b±30.69	2412.97^b±31.24
T_6	227.55^{ab}±10.8	831.14^a±13.02	1452.28^a±27.79	2520.13^{ab}±36.36
T_7	212.95^c±9.55	788.16^b±14.74	1269.05^c±28.04	2269.28^c±46.73
T_8	226.80^{ab}±6.01	843.25^a±13.59	1367.68^b±36.57	2437.73^b±57.89
T_9	234.57^a±9.08	895.38^a±15.74	1465.27^a±27.79	2595.22^a±35.40
T_{10}	215.10^c±7.96	781.42^b±16.59	1274.90^c±28.81	2271.41^c±28.02
T_{11}	222.61^{ab}±9.90	842.63^a±14.81	1357.04^b±32.37	2422.28^b±32.45
T_{12}	227.87^{ab}±9.41	842.13^a±18.14	1424.06^a±36.71	2494.06^b±36.64
T_{13}	212.81^c±9.85	781.76^b±21.20	1273.24^c±38.06	2267.81^c±47.10

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

Feed conversion ratio

Overall the value of FCR at 45% DDGS level was significantly higher (P<0.05) than the control group and no effect of enzyme supplementation was observed at this level. Treatment group T_9 (1.44) had significantly lower (P<0.05) FCR value than control group (1.68). So, it could be concluded that the enzyme protease improved overall FCR at 30% soybean meal replacement level with DDGS, but, no improvement was observed due to addition of phytase and multienzyme. However [15], found that overall FCR increased (P<0.05) with inclusion of 15% DDGS supplemented with NSP (non starch polysaccharides) enzymes.

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

Treatment	0-2 week	3-4 week	5-6 week	0-6 week
T_1	1.48^{ab}±0.01	1.53^c±0.02	1.80^d±0.03	1.68^c±0.04
T_2	1.52^b±0.01	1.51^{bc}±0.01	1.82^d±0.02	1.67^{bc}±0.02
T_3	1.51^{ab}±0.02	1.47^b±0.02	1.74^c±0.01	1.63^{bc}±0.04
T_4	1.52^b±0.02	1.74^d±0.04	2.04^e±0.03	1.89^e±0.06
T_5	1.53^b±0.01	1.52^{bc}±0.02	1.67^b±0.02	1.60^{bc}±0.05
T_6	1.52^b±0.01	1.47^b±0.02	1.64^b±0.05	1.57^b±0.02
T_7	1.51^{ab}±0.01	1.72^d±0.04	2.01^e±0.03	1.86^e±0.04
T_8	1.55^b±0.01	1.50^{bc}±0.01	1.77^{cd}±0.02	1.65^{bc}±0.06
T_9	1.45^a±0.02	1.36^a±0.02	1.49^a±0.04	1.44^a±0.05
T_{10}	1.50^{ab}±0.02	1.75^d±0.03	2.02^e±0.03	1.88^e±0.02
T_{11}	1.54^b±0.02	1.52^{bc}±0.01	1.78^{cd}±0.01	1.66^{bc}±0.05
T_{12}	1.52^{ab}±0.02	1.51^{bc}±0.02	1.71^c±0.02	1.63^{bc}±0.03
T_{13}	1.47^a±0.02	1.73^d±0.03	2.03^e±0.05	1.88^e±0.04

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

Significant influence was not observed on chemical composition of broiler meat with supplementation of exogenous enzymes (Table 5). CP content of the breast muscle was higher than that of the thigh muscle which is due genetic trait of the different muscles of broiler birds but statistical difference could not be seen in any group. These results showed that there was no adverse effect of replacing soybean meal with DDGS up to 45% (equivalent to maximum 13.95 and 11.25% in starter and finisher ration, respectively) on the qualitative values of the carcass traits with or without enzyme supplementation. The results of the present study were also in accordance to those of [16] 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.

Table 5: Composition (%) of breast and thigh muscles in experimental birds under different dietary treatments

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	74.63±15.54	19.28±2.16	5.18±0.68	75.51±13.91	18.51±2.11	7.14±0.81
T_6	75.02±11.59	19.76±4.89	5.12±0.76	76.24±17.92	18.84±4.89	7.03±0.69
T_7	75.21±18.71	19.21±2.90	5.21±0.79	75.64±11.95	18.33±3.79	7.26±0.61
T_8	74.77±12.86	19.32±3.85	5.14±0.62	75.56±14.89	18.53±2.95	7.11±0.91
T_9	75.26±14.52	19.85±4.70	5.10±0.79	76.39±11.83	19.04±2.34	7.01±0.89
T_{10}	74.12±16.70	19.26±2.95	5.15±0.69	75.32±13.76	18.25±3.50	7.37±0.92
T_{11}	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_{12}	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_{13}	74.39±13.86	19.10±3.75	5.23±0.73	75.12±15.72	18.34±2.06	7.25±0.74

Non significant differences were noted in the dressed, eviscerated and drawn yield of carcass at all DDGS replacement levels (Table 6). The results of current study are in agreement with those of Ghazalah *et al.* (2012) who showed that there was no significant effect on carcass traits up to 60% replacement of soybean meal with DDGS. The results of [17] were also similar to the present study as the dressing yield was not affected by the addition of DDGS or by the addition of enzymes (xylanase and phytase) to the diets with high levels of DDGS.

Table 6: Dressed, eviscerated, drawn yield and weight of giblets of the experimental birds under different dietary treatments

Treatments	Dressed (%)	Eviscerated (%)	Drawn (%)	Liver (%)	Heart (%)	Gizzard (%)	Giblet (%)
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
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
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
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
T_5	70.94±3.47	62.67±2.58	67.44±5.44	2.56±0.73	0.56±0.02	1.65±0.33	4.77±0.91
T_6	69.34±2.18	62.59±1.71	67.28±2.46	2.48±0.48	0.53±0.04	1.68±0.39	4.69±0.92
T_7	68.80±1.44	60.44±6.46	65.09±7.64	2.43±0.68	0.51±0.26	1.71±0.36	4.65±0.92
T_8	70.25±8.28	61.34±2.93	66.12±5.38	2.52±0.65	0.47±0.06	1.69±0.61	4.78±0.95
T_9	72.34±6.58	63.56±4.68	68.44±2.24	2.57±0.48	0.56±0.03	1.75±0.39	4.88±1.15
T_{10}	68.84±4.24	60.56±6.31	65.24±4.46	2.48±0.42	0.54±0.02	1.66±0.35	4.68±0.97
T_{11}	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
T_{12}	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
T_{13}	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

At end of the experiment, supplementation of protease enzyme at 30% DDGS level had significantly (P<0.05) lower feed intake as compared to control as well as from other dietary treatment groups while, weight gain was significantly (P<0.05) higher in groups fed with 30% DDGS with protease and phytase enzyme supplementation. So, it could be concluded that the enzyme protease improved overall FCR at 30% soybean meal replacement level with DDGS but, no improvement was observed due to addition of phytase and multienzyme. CP content of the breast muscle was higher than that of the thigh muscle which is due genetic trait of the different muscles of broiler birds but statistical difference could not be seen in any group.

References

1. Ravindran V, Hew LI, Ravindran G, Bryden WL. Apparent ileal digestibility of amino acids in dietary ingredients for broiler chickens. Animal Science. 2005; 81(1):85-97.
2. Rosentrater KA. Some physical properties of distillers dried grains with solubles (DDGS). Applied Engineering in Agriculture. 2006; 22(4):589-95.
3. Fallahi P, Rosentrater KA, Muthukumarappan K, Tulbek M. Effects of steam, moisture, and screw speed on physical properties of DDGS-based extrudates. Cereal Chemistry. 2013; 90(3):186-97.
4. Lee JJ, Sally AR, Jerry S. Feeding by-products high in concentration of fibre to nonruminants. InA paper presented at the third National Symposium on alternative feeds for livestock and poultry held in Kansas City MO. 2003, (4).
5. Lumpkins BS, Batal AB, Dale NM. Evaluation of distillers dried grains with solubles as a feed ingredient for broilers. Poultry science. 2004; 83(11):1891-6.
6. Lim C, Garcia JC, Aksoy MY, Klesius PH, Shoemaker CA, Evans JJ. Growth response and resistance to Streptococcus iniae of Nile tilapia, Oreochromis niloticus, fed diets containing distiller's dried grains with solubles. Journal World Aquaculture Society. 2009; 38:231-237.
7. Paloheimo M, Piironen J, Vehmaanperä J. Xylanases and cellulases as feed additives. Enzymes in Farm Animal Nutrition, 2010, 12-53.
8. Aguilar R, Quesada M, Ashworth L, Herrerias-Diego YV, Lobo J. Genetic consequences of habitat fragmentation in plant populations: susceptible signals in plant traits and methodological approaches. Molecular ecology. 2008; 17(24):5177-88.
9. Waldroup PW, Kersey JH, Saleh EA, Fritts CA, Yan F, Stilborn HL *et al*. Nonphytate phosphorus requirement and phosphorus excretion of broiler chicks fed diets composed of normal or high available phosphate corn with and without microbial phytase. Poultry Science. 2000; 79(10):1451-9.
10. BIS Bureau of Indian Standards, Poultry Feed Specification, 5th revision. Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi, 2007.
11. Snedecor GW, Cochran WG. Statistical Methods, 6th edn. The lowa State University Press, Ames, lowa. 1994.
12. 12 Duncan D.B. Multiple range and multiple F tests. Biometrics. 1956; 11:1-42.
13. Barekatain MR, Choct M, Iji PA. Xylanase supplementation improves the nutritive value of diets containing high levels of sorghum distillers' dried grains with solubles for broiler chickens. Journal of the Science of Food and Agriculture. 2013; 93(7):1552-9.
14. Waititu SM, Yitbarek A, Matini E, Echeverry H, Kiarie E, Rodriguez-Lecompte JC *et al*. Effect of supplementing direct-fed microbials on broiler performance, nutrient digestibilities, and immune responses. Poultry science. 2014; 93(3):625-35.
15. Campasino A, Williams M, Latham R, Bailey CA, Brown B, Lee JT. Effects of increasing dried distillers' grains with solubles and non-starch polysaccharide degrading enzyme inclusion on growth performance and energy digestibility in broilers. Journal of Applied Poultry Research. 2015; 24(2):135-44.
16. Ghazalah AA, Abd-Elsamee MO, AbdEl-Hakim AS, Ibrahim MM. Evaluation of using distillers dried grains with solubles (DDGS) in broiler diets. Egyptian Poult. Sci. J. 2012; 32:381-97.
17. Świątkiewicz S, Koreleski J. The use of distillers dried grains with solubles (DDGS) in poultry nutrition. World's Poultry Science Journal. 2008; 64(2):257-66.