Original Research

Effect of Supplementation of Distiller's Dried Grain with Soluble (DDGS) on Desi-Chicken Performance and Carcass Characteristics

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Abstract

Utilization of unconventional feed ingredients in poultry ration is a key determinant of successful poultry production. Distillers Dried Grains with Soluble (DDGS) is now becoming a popular unconventional and low-cost ingredient for livestock feed due to its high nutritive value. Hence, a study was conducted to assess the effect of DDGS on native chicken production performance. A total of 126, 8 weeks old desi-chicken were distributed randomly to 3 different dietary treatments that includes T_1 (control), 10 per cent inclusion of DDGS (T_2) and (T_3) 15 per cent inclusion of DDGS, respectively. The first experiment was performed between 8-12 weeks and the second experiment between 13-16 weeks of age. Performance parameters and carcass traits were studied at the end of feeding trial. The results showed that performance traits like body weights, body weight gains and feed efficiency and carcass traits such as New York dress weight, eviscerated carcass yield, ready to cook yield, cut-up parts, giblets yield and relative organ weights were not influenced by dietary inclusion of DDGS. The present study indicated that up to 15 % level of inclusion of DDGS has no deleterious effect on the performance, carcass characteristic of desi-chicken. Thus, DDGS can be safely incorporated to desi-chicken diet at this level without hampering production performance.

Key words: Carcass Traits, DDGS, Desi- Chicken, Production Performance

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Introduction

Poultry is one of the fastest growing segments of the agriculture sector in India. A major constrain affecting the growth of the poultry industry in India is price and availability of feed resources. Poultry industry is highly dependent on the feed because feed alone constitutes 65 per cent of the cost of production. Therefore, any price fluctuation in the feed will have a direct positive impact on the prices of eggs and meat. Shortage of conventional feed ingredients emphasis the researcher's on investigation of alternative feed sources. However, alternative feed ingredients in poultry may affect the performance either due to deficiencies or imbalance of nutrients or presence of some anti-nutritional factors.

An ingredient that has received considerable attention recently is distillers dried grains with soluble (DDGS). DDGS is a by-product from ethanol production that is obtained by fermentation of cereals grains. DDGS has been recognized as a good source of protein, energy, water soluble vitamins and minerals, amino acids for poultry (Wang *et al*., 2007b) and a valuable source of xanthophylls and linoleic acid as well (Runnels, 1957). Earlier work showed that feeding of DDGS (5 per cent) in broiler starter diet and upto 12 to 15 per cent in grower diet had no negative impact on production parameters (Lumpkins *et al*., 2004). DDGS can be included up to 15 per cent in layer diet and results showed increased yolk pigmentation. However, there are no much reports on the effect of supplementation of DDGS on desi-chicken. Considering the above points, the present study was performed to study the effect of feeding DDGS on desi-chicken (Aseel).

Materials and Methods

The present study was conducted at the Instructional Livestock Farm Complex, TANUVAS, (Chennai, India) with the aim to study the effect of the inclusion level of DDGS in desi-chicken performance (Aseel). A total of 126, 8 weeks old desi-chicken were randomly allotted into three replicates with 14 chicks each and these replicate were distributed randomly to three different dietary treatments as shown in Table 1. Two experiments were carried out, in which first experiment was performed between 8-12 weeks (Experiment-I) and the second experiment between 13-16 weeks of age (Experiment-II).

Table 1: Experimental design

Treatment	Inclusion	No. of Birds
T_1	Control (without DDGS)	42
T_2	10 % DDGS	42
T_3	15 % DDGS	42

Management of the Birds

The birds were fed with native growers feed with inclusion of DDGS that supplied 18 per cent crude protein and 2648 kcal/kg ME throughout the experimental period. Feed and water were provided *ad libitum*

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throughout the experimental period. Experimental feed formula were developed taking into account the result of the proximate analysis of DDGS. Lysine and methionine were supplemented to the diets as needed to maintain consistent amino acid levels. Experimental grower feed formula with inclusion of DDGS is presented in Table 2 and its nutrient composition is shown in Table 3.

Table 2: Desi- chicken grower feed formula with inclusion of DDGS

Ingredients (%)	**T_1 (0% DDGS)**	**T_2 (10% DDGS)**	**T_3 (15% DDGS)**
Maize	30	32	35
Cumbu	19.5	21.5	19.5
DORB	21	13.25	10
Soya bean meal	8.5	7	6
Sunflower oil cake	12	7.25	5.5
Dry fish	7	7	7
Min. Mixture	1.5	1.5	1.5
Di-calcium phosphate	0.3	0.3	0.3
Salt	0.2	0.2	0.2
DDGS	**0**	**10**	**15**
TOTAL	**100**	**100**	**100**
Lysine - g	0	30	50
Methionine -g	0	60	25

Table 3: Nutrients content of desi-chicken grower feed formula with inclusion of DDGS

Ingredients	**T_1 (0 % DDGS)**	**T_2 (10 % DDGS)**	**T_3 (15 % DDGS)**
Crude Protein %	18.071	18.06	18.03
M.E K cal / kg	2648	2647	2648
ME: C.P ratio	146.52	146.6	146.9
Crude Fibre %	10.51	9.54	9.14
Ether extract %	3.03	3.87	4.25
Calcium %	1.23	1.25	1.25
Av.Phosphorus %	0.48	0.5	0.51
Ca: Phos ratio	2.57	2.49	2.46
Lysine %	0.94	0.94	0.97
Methionine %	0.37	0.38	0.36
Linoleic acid %	0.85	0.82	0.83

Laboratory Analysis

The wet distiller's grains with soluble were sun-dried for three consecutive days to get moisture of about 8-12 per cent. Representative samples of DDGS were taken and analyzed before formulating the actual dietary treatments at the Department of Animal Nutrition, Madras Veterinary College, TANUVAS. The proximate analysis of DDGS sample was carried out as per the methods described by A.O.A.C (1990).

Parameter Studied

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Performance traits like body weights, body weight gains, and feed consumption was recorded at weekly intervals. The carcass traits such as New York dress weight, eviscerated carcass yield, ready to cook yield, cut-up parts, giblets yield and relative organ weights were measured at the end of the feeding experiment as per the standard method.

Statistical Analysis

The data collected on various parameters were grouped and subjected for statistical analysis of variable (ANOVA) as per the procedure of statistical analysis system software (SPSS, version 17) described by Snedecor and Cochran, 1994. All the percentage values in the study were converted to their arcsine square roots before subjecting to statistical analysis.

Result and Discussion

The Proximate Analysis of DDGS

The proximate analysis of DDGS is summarized in Table 4. The moisture, crude protein, ether extract, crude fibre and ash value of DDGS were within the normal range of NRC (Dale, 1994). However, the protein content of DDGS has been reported to vary between 23 and 32 per cent (Batal and Dale, 2006). The DDGS used in this experiment had proximate composition (%) of moisture (9.23), CP (29.05), EE (7.88), CF (13.73), ash (7.91), AIA (5.05) and NFE (40.17), respectively.

Table 4: Proximate analysis result of DDGS (Mean ± SE)

Proximate	Percentage (%)
Moisture	9.23±0.53
Crude protein (CP)	29.05±0.26
Ether extract	7.88±0.14
Crude fibre (CF)	13.73±0.66
Total ash	7.91±0.22
Acid insoluble ash	5.05±0.02
Nitrogen-free extract (NFE)	40.17±0.63

In the present experiment, the CP content of DDGS was 29.05 and these similar results were obtained by many other researchers. The chemical composition of the DDGS (DM basis %) had crude protein 30.9, crude fat 10.7, crude fibre 7.2, ash 6.0 and calculated ME 3810 Kcal/kg (Spiehs *et al*., 2002), whereas Dimova *et al*. (2009) reported that chemical composition of DDGS was (DM basis %) 90.8, 33.9, 5.5, 6.7, 32.19, 9.4, 49.2, 4.7 for DM, CP, EE, CF, NDF, ADF, NFE and ash, respectively. Kononoff *et al*. (2007) reported that chemical composition of DDGS (DM basis %) had C.P 26.6 to 33.9, EE 10 to 15.9, NDF 28.6 to 38.4, starch 2.45 to 9.25, phosphorus 0.77 to 1.06 and sulphur 0.46 to 0.83, respectively. This wide range is likely because of differences in the protein content of the base grain used to produce DDGS and also because of differences in residual starch content.

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Body Weight

The biweekly body weight (g) from 8 to 16 weeks of age of desi-chicken as influence by the dietary inclusion of different level of DDGS is presented in Table 5.

Table 5: Effect of feeding DDGS on biweekly body weight (Mean ± SE) of desi-chicken (g/bird) from 8th to 16th week of age

Treatment	8th week^{NS}	10th week^{NS}	12th week^{NS}	14th week^{NS}	16th week^{NS}
T_1 (Control)	406.04±13.81	607.80±17.72	803.69±21.78	961.44±28.03	1133.14±32.07
T_2 (10 % DDGS)	405.53±15.11	611.49±21.59	796.10±27.22	949.44±35.14	1122.08±34.63
T_3 (15 % DDGS)	405.56±11.24	616.83±17.26	841.36±19.06	983.64±28.48	1137.22±32.98

NS-non significant

It was observed that, there was non-significant differences exist between the treatment groups with respect to body weight. However, among the groups, it was observed that the treatment group supplemented with 15 per cent inclusion of DDGS had numerically higher body weight (841.36 gm at 12th weeks and 1137.22 gm at 16th weeks) when compared with 10 per cent DDGS supplemented and control group. Similar non-significant result on body weight were also reported by various researchers (Wang *et al*., 2007b; Niemiec *et al*., 2012) who reported that inclusion of DDGS has no significant effect on production performance like body weight, weight gain and livability in chicken. Our finding were in agreement with Sariozkan *et al*. (2015) who reported that performance parameters such body weight and weight gain were not affected by dietary supplementation of 30 per cent DDGS along with Yucca. Kaya and Şahin (2013) reported that, DDGS supplementation to the broiler diets up to 15 per cent had improved the body weight and body weight gain. Similarly, Ghazalah *et al*. (2012) showed that feeding broiler chicks on diets containing different levels of DDGS up to 60 per cent replacement for soya bean meal had improved body weight gain. This may be due to the amino acid composition and fibre content of DDGS. High fibre content, which may leads to amino acid deficiency, which yield a non-significant result in body weight and body weight gain.

Feed Consumption

The cumulative biweekly feed consumption of desi-chicken as influence by inclusion of DDGS is presented in Table 6. It was observed that a non-significant difference exist between the treatment groups, with respect to cumulative feed consumption. However, among the group, it was observed that the group supplemented with 15 per cent DDGS had numerically higher feed intake (4911.33 gm) when compared with 10 per cent DDGS supplemented group (4893.33 gm) and control group (4882.67 gm), respectively.

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Table 6: Effect of feeding DDGS on biweekly cumulative feed intake (Mean ± SE) of desi-chicken (g/bird) from 8th to 16th week of age

Treatment	8 wk^{NS}	10 wk^{NS}	12 wk^{NS}	14 wk^{NS}	16 wk^{NS}
T1 (Control)	1133.67±2.96	1781.67±4.91	2653.33±15.62	3704.00±5.03	4882.67±10.03
T2 (10 % DDGS)	1129.67±7.96	1780.00±10.53	2657.00±4.35	3697.00±7.50	4893.33±26.34
T3 (15 % DDGS)	1136.67±2.40	1787.33±11.56	2680.33±22.45	3723.00±13.85	4911.33±22.81

NS-non significant

The result of the present study showed non-significant differences between the treatment groups with respect to feed consumption. These finding were in agreement with the results of Niemiec *et al*. (2012), who reported that the diet with various levels of DDGS had no significant effect on the feed consumption. Similarly, Youssef *et al*. (2013) showed that feeding graded levels of DDGS (5, 10, 15 per cent) resulted in a non- significant differences among the various treatments with respect to feed intake. Min *et al*. (2015) reported that inclusion of 15 per cent DDGS in the broiler diets had no negative effects on feed intake which was in agreement with previous studies (Waldroup *et al*., 1981; Wang *et al*., 2007b; Min *et al*., 2012). However, in contrast to our finding, Kaya and Şahin (2013) reported that supplementation of DDGS upto 15 per cent in broiler diet had improved the feed intake. These differences may be due to the high fibre content and palatability of the DDGS.

Feed Efficiency

The cumulative biweekly feed efficiency of desi-chicken as influence by inclusion of DDGS is presented in Table 7. From the present study, it was observed that feed efficiency was not influenced by the dietary inclusion of DDGS up to 15 per cent. There was a linear increase in feed efficiency from 10 - 16 weeks of age in the entire treatment group. However, among the group, it was observed that the group without DDGS had better feed efficiency (4.31) when compared with 10 per cent DDGS (4.36) or 15 per cent DDGS supplemented group (4.33) at the end of the experiment.

Table 7: Effect of feeding DDGS on cumulative biweekly feed efficiency (Mean ± SE) of desi-chicken from 10th to 16th week of age

Treatment	8 wk^{NS}	10th week^{NS}	12th week^{NS}	14th week^{NS}	16th week^{NS}
T_1 (Control)	2.80±0.05	2.94±0.06	3.30±0.02	3.85±0.06	4.31±0.08
T_2 (10 % DDGS)	2.78±0.01	2.91±0.06	3.34±0.05	3.89±0.03	4.36±0.05
T_3 (15 % DDGS)	2.81±0.06	2.90±0.09	3.19±0.09	3.80±0.15	4.33±0.17

NS: Non-significant

Inclusion of DDGS at various levels in the diets showed a non-significant result with respect to biweekly FCR. The present finding were in agreement with the finding of earlier researchers (Wang *et al*., 2007b; Sariozkan *et al*., 2015; Niemiec *et al*., 2012; Youssef *et al*., 2013; Min *et al*., 2015) who reported that there

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was no effect on supplementation of DDGS on FCR. However, Kaya and Şahin (2013) and Ghazalah *et al.* (2012) reported that supplementation of DDGS at various levels had improved FCR in broiler chicken. Deniz *et al*. (2013) and Jiang *et al*. (2013) observed that feed conversion was negatively affected by the inclusion of 20 per cent of DDGS compared to other levels (0, 5, 10 and 15 per cent).

Carcass Characteristic

Effect of feeding DDGS on carcass characteristic such as New York dress, eviscerated carcass, ready to cook yield and giblets yield of desi- chicken is presented in Table 8. It was observed that the carcass traits were not affected by the supplementation of DDGS at different level when compared with control.

Table 8: Effect of feeding DDGS on carcass characteristic (%) (Mean ± SE) of desi-chicken at 12th and 16th week of age

Treatment	New York Dress Yield NS	Eviscerated Carcass Yield NS	Ready to Cook Yield NS	Giblets Yield NS
Experiment I (at 12th week of age)				
T_1 (Control)	84.53±3.53	66.07±2.22	71.06±2.36	4.99±0.19
T_2 (10 % DDGS)	88.71±0.68	63.11±1.28	68.13±1.17	5.01±0.26
T_3 (15 % DDGS)	86.69±1.98	65.32±1.93	69.99±2.32	4.67±0.49
Experiment II (at 16th week of age)				
T_1 (Control)	91.69±0.63	63.91±1.63	68.50±1.66	4.59±0.07
T_2 (10 % DDGS)	91.32±0.31	67.83±1.54	72.82±1.40	4.99±0.16
T_3 (15 % DDGS)	90.95±0.479	67.73±0.75	72.32±0.56	4.59±0.21

NS-Non-significant

Effect of feeding DDGS on relative organ weight (liver, kidney, heart, gizzard, proventriculus, spleen and bursa) of desi-chicken is furnished in Table 9. Relative organ weight obtained in the present study showed non-significant differences in all the treatment groups except liver weight.

Table 9: Effect of feeding DDGS on relative organ weight (%) (Mean ± S.E) of desi-chicken at 12th and 16th week of age

Treatment	Liver*	Kidney NS	Heart NS	Gizzard NS	Proventriculus NS	Spleen NS	Bursa NS
Experiment I (at 12th week of age)							
T_1 (Control)	2.00±0.09	0.63±0.04	0.40±0.018	2.59±0.15	0.44±0.04	0.17±0.01	0.23±0.03
T_2 (10 % DDGS)	1.93±0.14	0.70±0.06	0.44±0.014	2.65±0.24	0.44±0.02	0.17±0.03	0.21±0.03
T_3 (15 % DDGS)	1.81±0.08	0.59±0.06	0.44±0.016	2.43±0.44	0.51±0.03	0.14±0.01	0.22±0.02
Experiment II (at 16th week of age)							
T_1 (Control)	1.90^{b}±0.02	0.46±0.04	0.45±0.02	2.24±0.05	0.49±0.03	0.19±0.01	0.13±0.02
T_2 (10 % DDGS)	2.11^{a}±0.05	0.39±0.03	0.46±0.01	2.41±0.20	0.44±0.04	0.22±0.02	0.15±0.01
T_3 (15 % DDGS)	1.86^{b}±0.09	0.50±0.02	0.41±0.01	2.32±0.21	0.44±0.03	0.18±0.01	0.13±0.01

The values within a column differ significantly at 5% level; NS: Non-significant

Inclusion of DDGS at 10 per cent in experiment II showed significantly higher liver weight when compared to either 0 or 15 per cent DDGS inclusion. Aderolu *et al*. (2007), reported that weight of gizzard and liver,

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were significantly increased with the inclusion of 30-40 per cent BDG (Brewers Dried Grain). Similarly, Osmana *et al*. (2011) reported that 30 and 40 per cent DDGS treated chicken had increased liver weights when compared to the basal control diet. Whereas, Loar *et al*. (2010) reported that increasing DDGS inclusion from 8 to 25 per cent levels during the grower phase has resulted in a linear decrease of relative liver weight. Youssef *et al*. (2008 and 2013) suggested that 10-15 per cent of DDGS as a protein source could be included in broiler chicken diet without any significant effect on heart, liver and gizzard per cent or giblets yield. Similarly, Sariozkan *et al*. (2015) also reported that percentage of internal organs to live weight rate was not affected by dietary supplementation of DDGS and Yucca (*Yucca schidigera*) in broiler chicken. Swain *et al*. (2012) reported that non-significant differences were observed in heart, liver and spleen organ weight between the control and 10 per cent BDG or 20 per cent BDG supplemented group whereas relative weights of gizzard and thymus were increased significantly in Vanaraja chicks.

Cut-up Parts

The percentage of cut-up parts (drumstick, thigh, wing, back, breast and neck) for experiment I and experiment II of desi-chicken as influence by the dietary supplementation of different level of DDGS is presented in Table 10. It was observed that, there was non-significant differences exist between the treatment groups with respect to percentage of cut up parts in both the experiment I and II.

Table 10: Effect of feeding DDGS on cut-up parts (%) (Mean ± S.E) of desi-chicken at 12^{th} and 16^{th} week of age

Treatment	Cut-up-parts (%)					
	Drumstick^{NS}	Thigh^{NS}	Wing^{NS}	Back^{NS}	Breast^{NS}	Neck^{NS}
Experiment I (at 12^{th} week of age)						
T_1 (Control)	17.27±0.68	14.62±0.27	14.48±0.29	18.56±0.88	20.46±0.84	7.09±0.49
T_2 (10 % DDGS)	17.19±0.60	15.85±0.49	14.83±0.37	18.54±0.87	22.69±1.24	8.32±0.33
T_3 (15 % DDGS)	18.35±0.73	15.94±0.68	15.00±0.66	20.39±0.96	23.38±0.75	8.10±0.64
Experiment II (at 16^{th} week of age)						
T_1 (Control)	15.64±0.63	17.91±0.47	14.65±0.50	20.65±0.76	20.69±0.52	6.35±0.71
T_2 (10 % DDGS)	15.80±0.25	16.60±0.43	13.90±0.22	20.71±0.81	21.31±0.59	5.82±0.34
T_3 (15 % DDGS)	16.48±0.48	17.17±0.48	14.31±0.32	18.84±0.57	21.26±0.59	5.45±0.47

NS: Non-significant

The present finding were in agreement with the results of earlier researchers (Wang *et al*., 2007b; Youssef *et al*., 2008; 2013; Sariozkan *et al*., 2015) who reported that the birds supplemented diets with 10-15 per cent DDGS showed a non-significant differences with respect to dressing percentage or carcass yield when compared to the control. Konca *et al*. (2011) also reported that inclusion of 30% DDGS to quail diet did not show any significant effect on carcass traits. Various researcher's (Ghazala *et*

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al., 2012; Foltyn *et al*., 2013; Adamski *et al*., 2011; Lumkins *et al*., 2004) reported that supplementation of DDGS had no effect on carcass traits.

On contrary to this finding, earlier researchers (Wang *et al*., 2007a; 2008; Min *et al*., 2010; Lukaszewicz and Kowalczyk, 2014) observed that 30 per cent inclusion of DDGS had decreased dressing percentage and breast meat yield. Similarly, Schilling *et al*. (2010) noticed that 18-24 per cent inclusion of DDGS into broiler ration resulted in increased breast meat ratio when compared with control. Swain *et al*. (2012), who also reported that the eviscerated yield percentage, relative weights of wing and neck were significantly increased in Vanaraja chicks which were fed with 10-20 per cent of BDG (Brewers Dried Grain).

Conclusion

From the present study on the effect of DDGS supplementation in desi chicken, it can be concluded that DDGS inclusion at 10 per cent and 15 per cent had no deleterious effect on the performance and carcass characteristic of desi-chicken. Thus, DDGS can be safely incorporated to desi chicken diet at this level without hampering production performance. Future research work can be carried out by using higher inclusion of DDGS in desi-chicken with replacement of corn-soya meal.

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