

Effect of Feeding Different Dietary Levels of Rice Distiller's Dried Grains with Solubles (RDDGS) on Growth Performance of Commercial Broiler Chicken

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ABSTRACT

A by-product of ethanol manufacturing, Rice Distillers Dried Grains with Solubles (RDDGS), is utilized as an alternate protein source in poultry diets. The current investigation was carried out over a duration of six weeks to examine the effect of feeding different dietary levels of RDDGS on growth performance of commercial broiler chicken. A total of 144 straight-run day-old commercial broiler chicks were randomly distributed to six treatments. Each treatment group consisted of four replicates and in each replicate, six chicks were there, leading to 24 chicks per treatment. The experimental diets consisted of Control basal diet (T₁), and the diets T₂ to T₆ with 5, 10, 15, 20 and 25% RDDGS, respectively. The body weight of birds fed basal diet (T₁) was significantly ($p < 0.05$) higher than all the treatment groups, followed by basal diet with 5% RDDGS (T₂). Body weights in treatments T₃, T₄, and T₅ were significantly ($p < 0.05$) lower, while basal diet with 25% RDDGS (T₆) had the lowest body weight. Basal diet (T₁) showed significantly ($p < 0.05$) higher BWG than all other treatment groups. Birds fed basal diet with 5% RDDGS (T₂) had significantly ($p < 0.05$) higher BWG than those fed with T₃, T₄, T₅ and T₆ diet, but was significantly ($p < 0.05$) lower than T₁ diet. There were no significant differences in mean feed consumption between birds fed the T₃, T₄, T₅ and T₆ diets. However, the highest feed consumption was observed in T₁ followed by T₂, T₅, T₄, T₃ and T₆ diets. Overall FCR was significantly ($p < 0.05$) better in T₂ and T₃ treatment groups as compared to control diet. The highest return over feed cost was obtained in the T₂ diet as compared to other dietary groups. Beneficial effects on performance were noted at the lower level of 5% RDDGS in the diet. Hence, it can be concluded that RDDGS can be incorporated in broiler ration at the levels of 5%.

Key words: Commercial broiler chicken, Growth performance, Protein source, RDDGS, ROFC

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INTRODUCTION

Feed cost constitutes approximately 75-80% of the total production expenses in broiler farming. In India, maize and soybean meal serve as the primary conventional sources of energy and protein in poultry diets. Although soybean meal is the most widely used protein source, it is relatively costly and competes directly with human food consumption. Therefore, exploring suitable unconventional feed ingredients is essential to enhance the potential for reducing production costs. Rice-based Distiller's Dried Grains with Solubles (DDGS) has gained increasing attention as a feed ingredient in recent years. DDGS is a co-product generated during the ethanol production process from cereal grains like corn, wheat, barley, sorghum, and rice, following the fermentation of their starch content (Youssef *et al.*, 2013). Rice-based DDGS typically comprise 65% distiller's grains and 35% soluble (Babcock *et al.*, 2008). According to Dinani *et al.* (2019), RDDGS contains a high protein content of 44.68% and provides a gross energy value of 4232 Kcal/kg. The DDGS can be utilized in either wet or dried form, with studies indicating that animal performance does not differ significantly between the two formats (Koger *et al.*, 2010). Therefore, the present research was carried out to ascertain the effects of feeding different dietary levels of RDDGS on performance of commercial broiler chicken.

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MATERIALS AND METHODS

The experimental study was conducted at Poultry Research Station, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Anand, Gujarat (India). Total one

hundred and forty-four (144) straight-run day-old commercial broiler chicks of a single hatch were purchased from a private hatchery. The duration of experiment was six weeks (16th March to 26th April, 2024) to study the effect of feeding different dietary levels of Rice Distiller's Dried Grains with Solubles (RDDGS) on their performance. The average temperature during the study period was 30.18°C and relative humidity 65.00%. After arrival, chicks were wing-banded and weighed individually. The chicks were randomly distributed to six treatments. Each treatment group consisted of four replicates and in each replicate, six chicks were there, leading to 24 chicks per treatment. Six experimental diets (T₁, T₂, T₃, T₄, T₅ and T₆) were formulated and provided *ad libitum* to the birds of respective treatments as pre-starter, starter, and finisher diets during 0-7 days, 8-21 days and 22-42 days of age, respectively. Basal diet was formulated as per BIS specifications and it is considered as control diet (T₁) without inclusion of RDDGS. Within the remaining experimental diets, i.e., T₂ to T₆, the basal diet was incorporated with the RDDGS @ 5, 10, 15, 20 and 25%, respectively. Standard medication protocols were followed. All essential biosecurity measures were implemented. The birds were immunized against Ranikhet Disease (RD) and Infectious Bursal Disease (IBD) according to the standard schedule. During the experiment, the feed consumption, weekly and total body weight and body weight gain, feed conversion ratio (FCR) were studied and recorded. After the end of the experiment, economics in terms of return over feed cost (ROFC) was calculated as subtracting the feed cost from the income obtained from selling birds based on their live weight. The data were analyzed statistically using Completely Randomized Design as per Snedecor and Cochran (1994). Means of replicates under each treatment were considered for analysis by Duncan's *post hoc* test at $p < 0.05$.

RESULTS AND DISCUSSION

Body Weight (BW)

The results of body weight at day old age were found to be non-significant between all treatment rations. At the end of the third week, significantly ($p < 0.05$) higher body weight was recorded in the birds fed with T₁ diet as compared to the birds fed with T₂ and T₄ diets. The birds fed with T₆ diet had significantly ($p < 0.05$) lowest body weight among all the treatments. The sixth week body weight was significantly ($p < 0.05$) higher in the birds fed with T₁ diet than the other treatments. T₃, T₄, and T₅ showed no significant differences from each other, but were significantly lower than T₁ and T₂ (Table 1). These results were in agreement with Lukaszewicz and Kowalczyk (2014), who reported decreased final body weight with incorporation of DDGS up to 15% in the broiler diet. Wang *et al.* (2007^b, 2008), Dingore (2015), Borah *et al.* (2019) and Kumar *et al.* (2023) also reported significantly lowest body weight with inclusion of higher levels of RDDGS or DDGS in broiler diets as compared to

control diet. However, contrary to present findings, Ghazalah *et al.* (20012), Kaya and Sahin (2013), Singh *et al.* (2020) and Dang *et al.* (2020) reported higher body weight in the birds fed with RDDGS or DDGS diets than the control diet.

Table 1: Body weight (BW) at different ages (0, 3 and 6 weeks) in broilers fed different levels of rice DDGS (Mean \pm SE)

Treatments	BW ₀	BW ₃	BW ₆
T ₁	43.90 \pm 0.60	812.04 ^a \pm 18.85	2418.25 ^a \pm 62.37
T ₂	42.69 \pm 0.48	701.17 ^b \pm 12.82	2205.33 ^b \pm 32.84
T ₃	43.16 \pm 0.69	632.99 ^{cd} \pm 21.16	1706.44 ^c \pm 50.21
T ₄	41.71 \pm 0.56	668.71 ^{bc} \pm 13.50	1623.25 ^c \pm 43.66
T ₅	42.42 \pm 0.92	607.79 ^d \pm 12.15	1657.25 ^c \pm 44.58
T ₆	42.95 \pm 0.60	504.79 ^e \pm 13.48	1356.50 ^d \pm 47.00
SEm	1.27	19.97	56.23
CD at 5%	NS	59.33	167.07
CV%	5.93	6.10	6.15

Means with different superscripts within a column differ significantly ($p < 0.05$), NS=Non-significant

Body Weight Gain (BWG)

During the pre-starter phase, body weight gain was non-significant for all the treatment rations. In the starter phase, significantly ($p < 0.05$) higher body weight gain was observed in the birds fed with basal diet than all other treatments, while in finisher phase, birds on the T₃, T₄ and T₅ diets showed similar weight gains, which were significantly ($p < 0.05$) lower than T₁ and T₂ diet. Overall, body weight gain was significantly ($p < 0.05$) higher in T₁, followed by T₂ than all other treatments. There were no significant differences in overall body weight gain between birds fed the T₃, T₄ and T₅ diets. Treatment group T₆ resulted in the lowest overall weight gain indicating that it was the least effective diet for growth (Table 2). Present findings were similar to the results reported by Wang *et al.* (2008), Loar and Corzo (2011), Dingore (2015), Borah *et al.* (2019) and Kumar *et al.* (2023), who observed that inclusion of higher levels of RDDGS in broiler diets results in lower body weight gain as compared to control diet. In contrast to the present findings, Thein *et al.* (2020) observed no effect on the body weight gain with inclusion of RDDGS up to 20%.

Feed Consumption

The feed consumption in the pre-starter phase was significantly highest in T₁ diet followed by T₄ diet among 6 groups. In the starter, finisher and overall periods, mean feed consumption of birds fed with T₁ diet was significantly ($p < 0.05$) higher than all other treatments. Birds fed with T₂ diet had significantly ($p < 0.05$) higher feed consumption than those fed with T₃, T₄, T₅ and T₆ diet, but was significantly ($p < 0.05$) lower than T₁ diet. There were no significant differences in mean feed consumptions between birds fed the T₃, T₄, T₅ and T₆ diets (Table 3). The findings of presents study were in agreement with Wang *et al.* (2007^b), Loar and Corzo (2011), Abudabos *et al.* (2017), Shirisha *et al.* (2021) and Kumar *et al.* (2023), who reported significant decrease in feed



consumption with higher levels of RDDGS in broiler diets as compared to control diet. Present results differ with finding of Wang *et al.* (2007^a), Kaya and Sahin (2013), and Shirisha *et al.* (2021), who reported increase in the total feed consumption of the birds supplemented with RDDGS diets.

Feed Conversion Ratio

The FCR was found to be non-significant during pre-starter phase. In the starter phase, significantly ($p < 0.05$) improved FCR was found in the birds fed with control and 5% inclusion of RDDGS diet. While in the finisher phase, FCR of birds fed diet with inclusion of 5% RDDGS was significantly better ($p < 0.05$) than all other treatments, except 10% RDDGS inclusion, which had no significant difference. However, there

was no significant difference among the FCR values for the control, 10%, 15% and 25% RDDGS inclusion diets. FCR of birds fed diet with inclusion of 25% RDDGS was significantly ($p < 0.05$) higher than all other treatments (Table 4). These findings were in accordance with Youssef *et al.* (2013), who reported that feed conversion ratio was worse at the highest DDGS level (15.0%) when broilers were fed diets containing 0, 5, 10 or 15% DDGS from 12 to 35 days of age. Similar trend of increased FCR due to higher inclusion of DDGS in the broiler ration up to 15% was also found by Lukaszewicz and Kowalczyk (2014). Wang *et al.* (2007^a), Loar and Corzo (2011), Abudabos *et al.* (2017), Singh *et al.* (2020) and Kumar *et al.* (2023) found significant ($p < 0.05$) increase in FCR at higher RDDGS inclusion levels (above 10%).

Table 2: Body weight gain (BWG) at different stages of life in weeks in broilers fed different levels of rice DDGS (Mean ± SE)

Treatments	BWG ₀₋₁	BWG ₂₋₃	BWG ₄₋₆	BWG ₀₋₆
T ₁	113.44 ± 3.64	654.69 ^a ± 16.53	1606.21 ^a ± 53.62	2374.34 ^a ± 62.37
T ₂	98.04 ± 4.06	560.44 ^b ± 10.79	1504.17 ^a ± 23.21	2162.65 ^b ± 32.70
T ₃	109.43 ± 3.85	481.49 ^{cd} ± 20.74	1046.60 ^b ± 54.50	1637.52 ^c ± 50.52
T ₄	104.14 ± 3.20	522.86 ^{bc} ± 12.03	954.54 ^{bc} ± 33.73	1581.55 ^c ± 43.44
T ₅	110.21 ± 3.48	455.17 ^d ± 11.25	1049.46 ^b ± 36.53	1614.84 ^c ± 44.76
T ₆	101.15 ± 3.09	360.69 ^e ± 12.34	851.71 ^c ± 36.84	1313.55 ^d ± 47.21
SEm	4.49	16.74	47.59	58.41
CD at 5%	NS	49.72	141.39	173.55
CV%	8.47	6.62	8.14	6.56

Means with different superscripts within a column differ significantly ($p < 0.05$).

Table 3: Overall feed consumption (FC) at different stages of life in weeks in broilers fed different levels of rice DDGS (Mean ± SE)

Treatments	FC ₀₋₁	FC ₂₋₃	FC ₄₋₆	FC ₀₋₆
T ₁	133.50 ^a ± 4.22	966.67 ^a ± 57.28	2913.96 ^a ± 25.64	4014.14 ^a ± 71.10
T ₂	114.25 ^c ± 3.27	848.17 ^b ± 41.21	2277.05 ^b ± 24.21	3239.47 ^b ± 53.51
T ₃	122.67 ^{bc} ± 2.35	811.00 ^c ± 35.45	1815.46 ^c ± 28.11	2749.13 ^c ± 40.52
T ₄	130.33 ^{ab} ± 4.91	806.46 ^c ± 32.10	1841.46 ^c ± 28.19	2778.25 ^c ± 40.54
T ₅	123.25 ^{bc} ± 1.29	811.29 ^c ± 32.97	1879.83 ^c ± 15.71	2814.37 ^c ± 40.42
T ₆	118.08 ^c ± 2.14	790.67 ^c ± 30.65	1739.16 ^c ± 23.09	2647.91 ^c ± 37.78
SEm	3.27	11.78	60.71	60.99
CD at 5%	9.73	34.99	180.39	181.20
CV%	5.29	2.81	5.84	4.01

Means with different superscripts within a column differ significantly ($p < 0.05$).

Table 4: Feed conversion ratio (FCR) at different stages of life in weeks in broilers fed different levels of rice DDGS (Mean ± SE)

Treatments	FCR ₀₋₁	FCR ₂₋₃	FCR ₄₋₆	FCR ₀₋₆
T ₁	0.85 ± 0.02	1.48 ^d ± 0.06	1.81 ^b ± 0.01	1.66 ^b ± 0.03
T ₂	0.81 ± 0.03	1.52 ^d ± 0.05	1.51 ^c ± 0.06	1.47 ^c ± 0.04
T ₃	0.81 ± 0.03	1.70 ^{bc} ± 0.07	1.71 ^{bc} ± 0.11	1.62 ^{bc} ± 0.06
T ₄	0.89 ± 0.02	1.54 ^{cd} ± 0.03	1.93 ^{ab} ± 0.12	1.71 ^b ± 0.06
T ₅	0.81 ± 0.01	1.79 ^b ± 0.05	1.79 ^b ± 0.01	1.70 ^b ± 0.02
T ₆	0.82 ± 0.01	2.20 ^a ± 0.08	2.06 ^a ± 0.09	1.96 ^a ± 0.07
SEm	0.02	0.06	0.08	0.05
CD at 5%	NS	0.17	0.23	0.15
CV%	5.23	7.03	8.46	5.98

Means with different superscripts within a column differ significantly ($p < 0.05$).

Return over Feed Cost (ROFC)

ROFC (Rs. per kg broiler bird) from the birds fed with T₁, T₂, T₃, T₄, T₅ and T₆ diets were 46.62, 53.18, 47.08, 43.44, 44.04 and 34.45, respectively. The highest ROFC was obtained in the birds fed with T₂ diet as compared to other dietary groups. The ROFC obtained in this study showed that supplementation of basal diet with 5% level of RDDGS in broiler ration was economically beneficial. The current results were consistent with Borah *et al.* (2019), who found slightly improved gross profit per bird at 5% RDDGS, before decreasing at higher inclusion rates.

CONCLUSION

From the study, it can be concluded that the increasing level of RDDGS inclusion from 5, 10, 15, 20 and 25 % in basal diet of the broiler birds significantly and negatively influenced their live body weight, body weight gain and total feed consumption as compared to control group diet. Broiler birds fed with 5% RDDGS in basal diet showed significantly improved overall feed conversion ratio as compared to other treatments, and hence RDDGS can be used @ 5% in broiler diet as an alternative of protein source ingredient.

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