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## Effect of feeding rice distillers dried grains solubles on carcass characteristics and visceral organ weight in commercial broilers

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### Abstract

The present study was carried out at the Department of Poultry Science, Veterinary College, Hebbal, Bengaluru, Karnataka during 2022-23. A biological experiment of 128 d old broiler chicks for six weeks was undertaken with complete randomized design divided into four treatments, each consisting of 4 replicates and 8 broilers in each replicate. Four experimental diets were prepared according to Bureau of Indian standards guidelines, incorporating rice distillers dried grains with solubles at inclusion levels of 0%, 5.0%, 10.0%, and 15.0% for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>, respectively. The finding indicated that the inclusion of 5, 10 and 15% rice distillers dried grains with solubles did not show any significant difference ( $p>0.05$ ) in carcass characteristics such as dressing percentage, drumstick yield, thigh yield, breast yield, abdominal fat and weights of visceral organs including the heart, liver, gizzard and proventriculus across all groups. Therefore, feeding rice distillers dried grains with solubles up to 15 per cent in a broiler diet can be recommended without any adverse effects.

**Keywords:** Carcass characteristics, visceral organ weight, broilers

### Introduction

Poultry comprising chickens, ducks, turkeys and geese are indispensable for meeting global protein needs and maintaining economic stability. From small-scale backyard farming to large-scale industrial operations, the poultry industry serves diverse consumer demands and market dynamics. In the present scenario among all the livestock, the poultry sector has shown enormous growth in both layer and broiler production. The poultry production in India was estimated to be 851.81 million as per the 20<sup>th</sup> Livestock Census. The escalating expense of conventional animal feed ingredients across many developing nations, with corn and soybean meal standing as the primary constituents of poultry feed, has led to a persistent rise in demand and limited supply of raw feed ingredients, thereby surging the cost of feed production. Exploring substitutes for protein and energy sources in poultry diets emerges as a vital strategy to meet future demands and mitigate feed production costs. Using unconventional feed ingredients is a way to lower production costs by substituting them for traditional ones and unconventional feed sources can still play a significant role in cost reduction by replacing some of the conventional ingredients.

The total production of rice during the 2022-23 period is estimated to reach a record high of 1357.55 lakh tonnes. This figure reflects an increase of 62.84 lakh tonnes compared to the previous year's rice production of 1294.71 lakh tonnes (Ministry of Fisheries, Animal Husbandry and Dairying, 2023) [8]. Some broken or damaged rice, which is considered unsuitable for human and animal consumption, is repurposed for alcohol production, primarily by the potable liquor industry. The by-products of this process, known as distillers dried grains solubles (DDGS), are subsequently utilized by the feed industry (USDA, 2023) [16].

Rice distillers dried grains with solubles (RDDGS) are a byproduct of the rice alcohol industry, produced through the distillation of fermented rice. The process involves cooking rice at 131 °C and 2.6 kg/m<sup>2</sup> pressure, followed by the addition of yeast for fermentation (Huang *et al.*, 1999) [3].

It is rich in supplemental protein, containing approximately 45% of protein and has metabolizable energy of around 3500 kcal/kg, crude fibre 6.71% and crude fat 7.93% (Talsani *et al.*, 2021) [14]. Rice-DDGS is higher in protein and energy compared to rice and lower in fiber compared to its byproducts like rice bran or rice polishing. Addison *et al.* (2018) [10] observed that carcass traits, cut-up parts, giblet yield and relative organ weights were not influenced by dietary inclusion of 15% level of DDGS. Palanivel *et al.* (2021) [9] reported that rDDGS can safely incorporated into the vanaraja chicken diet up to the inclusion level of 10% without affecting carcass yield

Based on the observed data regarding the positive effects of rice DDGS on carcass characteristics in birds, the present study comprehensively evaluated broiler carcass traits through the inclusion of rice DDGS in their diet.

### Materials and Methods

The experiment was conducted at Department of Poultry Science, Veterinary College, Hebbal, Bengaluru, Karnataka during 2022-23. The study was approved in the Institutional Animal Ethics Committee of KVAFSU, Bidar, Karnataka.

### Collection Rice distiller dried grains solubles samples and other ingredients

The rice distiller dried grains solubles (DDGS) used in this experiment were obtained from Golden Feeds, Chitradurga, Karnataka. The proximate composition of the sample was analyzed by Trouw Nutrition India Private Ltd., located in Telangana. Other feed ingredients were purchased from a local feed shop.

### Experimental design

A total of 128 d old broiler chicks were procured from Venkateshwara Hatcheries Pvt. Ltd., Palamaner, Chittoor, Andhra Pradesh. The chicks were weighed and allocated randomly to 4 experimental groups consisting of 4 replicates with 8 chicks each. The chicks were kept warm during the first four weeks of age by using incandescent bulbs for supplementary heating. The chicks were vaccinated against Newcastle and Infectious bursal disease as per the standard schedule. Chicks were reared under a deep litter system up to six weeks of age, with the supply of *ad libitum* feed and water.

### Experimental diets

The experimental diets, along with their ingredients and nutrient composition for pre-starter (1-7 days), starter (7-21 days) and finisher (21-42 days) phases, have been provided in accordance with the feeding standards recommended by BIS (2007) [1]. The experimental diets were T<sub>1</sub> (control diet without rDDGS), T<sub>2</sub> (Diet containing 5% of rDDGS), T<sub>3</sub> (Diet containing 10% of rDDGS) and T<sub>4</sub> (Diet containing 15% of rDDGS).

### Carcass traits

At the end of the experiment two bird from each replicate were slaughtered for Carcass characteristics like dressing percentage, drumstick yield, thigh yield, abdominal fat and visceral organs weights like heart, liver, proventriculus were recorded by slaughtering two birds from each replicate at the end of the experiment and were expressed in the terms of gram per cent (g/100 g).

### Statistical Analysis

The experiment was designed as a complete randomized design (CRD) with one-way analysis. All data related to various parameters of the biological trial were analyzed following the standard procedures outlined by Snedecor and Cochran (1994) [13], utilizing SPSS 20 statistical software. Differences between means were evaluated using Tukey's Range Test at a significance level of ( $p \leq 0.05$ ).

### Results

The results of the effect of feeding Rice Distillers Dried Grains Solubles (DDGS) on carcass traits and relative weight of visceral organs on 42<sup>nd</sup> d in broilers were represented in Table 1 and Table 2, respectively. There was no significant difference ( $p < 0.05$ ) in dressing percentage, drumstick yield (%), thigh yield (%), breast yield per cent, abdominal fat(%) and the weights of visceral organs including the heart, liver, gizzard and proventriculus (%) of birds in the groups fed with different inclusion level of rDDGS compared to the control group at the end of the experiment (42<sup>nd</sup> d).

At the end of 42<sup>nd</sup> d, the mean dressing percentage in groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 68.73, 68.13, 68.83 and 68.55, respectively. The ANOVA indicated no significant ( $p > 0.05$ ) difference in dressing percentage of birds among different treatment groups compared to control.

The yield of thigh (%) in groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> was 10.45, 10.33, 10.19 and 10.49, respectively. The statistical analysis revealed no significant ( $p > 0.05$ ) difference in the yield of thigh (%) among the different treatments compared to control.

At the end of the experiment the yield of breast (%) in groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 26.49, 26.98, 25.68 and 25.66, respectively. The statistical analysis revealed no significant ( $p > 0.05$ ) difference in the yield of breast (%) among the different treatments compared to control.

The yield of drumstick (%) in groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> at the end of the experiment was 8.70, 8.83, 8.91 and 8.93, respectively. The higher per cent of drumstick yield observed in T<sub>4</sub> (8.93) and lower per cent in T<sub>1</sub> (8.70). The statistical analysis revealed no significant ( $p > 0.05$ ) difference in the yield of drumstick (%) among the different treatments compared to control.

The percent abdominal fat (%) in groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> at the end of the experiment was 1.356, 1.265, 1.229 and 1.231, respectively. The statistical analysis revealed no significant ( $p > 0.05$ ) difference in the yield of abdominal fat (%) among the different treatments compared to control.

The weight of heart was statistically not significant ( $p > 0.05$ ) among all the treatments groups in comparison to control group. The heart weight (% live weight) in groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 0.487, 0.461, 0.458 and 0.472, respectively.

The weight of liver (% live weight) in different treatment groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 1.77, 1.76, 1.75 and 1.77, respectively and the weight of liver was statistically not significant ( $p > 0.05$ ) among all the treatments groups in comparison to control group.

The proventriculus weight (g/100g body weight) in different treatment groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 0.379, 0.354, 0.375 and 0.372, respectively. ANOVA revealed that there was no significant difference ( $p > 0.05$ ) in the proventriculus weight among all the groups compared to control group.

The weight of gizzard (% live weight) in different treatment groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 1.80, 1.79, 1.88 and 1.77,

respectively. The higher weight (%) of gizzard observed in T<sub>3</sub> (1.883) and lower weight (%) observed in T<sub>4</sub> (1.779). There was no significant difference ( $p>0.05$ ) in the relative weight of gizzard among all the groups compared to control group.

### Discussion

The present study in agreement with Tang *et al.* (2011) [15] observed no differences ( $p>0.05$ ) in dressing percentages and carcass parts yields (% of carcass weight) among treatments. Our results are in agreement with the annual report (2014-15) from ICAR-CARI [4] demonstrated that incorporating rDDGS up to a 10% level did not negatively impact carcass traits in broiler chickens. Kim *et al.* (2016) [6] found that broiler chickens raised from 28 to 56 d old can tolerate the inclusion of up to 24% distillers dried grains with solubles (DDGS) in their diet during the later stages of growth without experiencing negative impacts on carcass characteristics. The results of the present study were in agreement with Singh *et al.* (2018) [12] observed the feeding of Rice -DDGS at various inclusion levels (0, 5, 10, 15 and 20%) by replacing maize and soyabean meal from the basal diet in broilers. The carcass quality traits and various cut-up parts did not differ significantly in different dietary treatments. The findings of the present results were in agreement with Saikia *et al.* (2020) [11] concluded that DDGS can be incorporated at 20% level in the rations of indigenous chicken for economic gain without any adverse effect on dressing percentage as well as various carcass

traits and organoleptic qualities. The results of the present study were in agreement with Dang *et al.* (2021) [2] studied the effect of feeding different levels of Rice-DDGS at 0, 5, 8 and 10% with basal diet on performance in broiler and observed that no significant difference in meat yield and quality among different groups by the dietary inclusion level of Rice-DDGS.

Contrary to this, Wang *et al.* (2008) [17] reported carcass yield and breast meat yield reduced when feeding maize DDGS levels greater than 15% of the diet. The present study contrary to Loar *et al.* (2010) [7] evaluated the effect of two levels (0 vs 8%) of distillers dried grains with solubles (DDGS) in a starter broiler diet (0 to 14 d) after these same birds were subsequently fed a grower diet (14 to 28 d) with either 0, 7.5, 15, 22.5 or 30% DDGS. Increasing levels of DDGS in the diet led to a reduction in the relative weight of the liver. The liver was selected as an indicator of potential metabolic challenges related to high DDGS intake. This decline in liver weight with increasing DDGS levels suggests possible marginal toxicity leading to liver atrophy. The results of the present study were also in disagreement with Keerthana *et al.* (2022) [5] conducted a study to determine the effect of incorporation of Rice DDGS at 0%, 5%, 10%, 15% and 20% with basal diets on serum biochemical profile and carcass characteristics of Japanese quails. The carcass traits like live weight and carcass weight were significantly ( $p<0.05$ ) increased with increasing levels of rice DDGS.

**Table 1:** Effect of feeding Rice distillers dried grains solubles (Rice-DDGS) on carcass characteristics (% of live weight) (Mean ± SE) in broilers.

Experimental group	Description of the treatment	Dressing Weight (%)	Thigh (%)	Breast (%)	Drumstick (%)	Abdominal fat (%)
T <sub>1</sub>	Control diet	68.73±0.661	10.45±0.677	26.49±0.688	8.70±0.270	1.356±0.054
T <sub>2</sub>	5% Rice DDGS incorporated in diet	68.13±0.602	10.33±0.879	26.98±0.398	8.83±0.141	1.265±0.067
T <sub>3</sub>	10% Rice DDGS incorporated in diet	68.83±0.880	10.19±0.450	25.68±1.654	8.91±0.620	1.229±0.120
T <sub>4</sub>	15% Rice DDGS incorporated in diet	68.55±0.879	10.49±0.3031	25.66±0.490	8.93±0.150	1.231±0.075

**Table 2:** Effect of feeding Rice distillers dried grains solubles (Rice-DDGS) on visceral organs weight (Mean ± SE) in broilers

Experimental group	Description of the treatment	Heart (%)	Liver (%)	Proventriculus (%)	Gizzard (%)
T <sub>1</sub>	Control diet	0.487±0.010	1.77±0.036	0.379±0.018	1.80±0.065
T <sub>2</sub>	5% Rice DDGS incorporated in diet	0.461±0.010	1.76±0.065	0.354±0.009	1.79±0.044
T <sub>3</sub>	10% Rice DDGS incorporated in diet	0.458±0.017	1.75±0.100	0.375±0.016	1.88±0.123
T <sub>4</sub>	15% Rice DDGS incorporated in diet	0.472±0.017	1.77±0.075	0.372±0.024	1.77±0.040

### Conclusion

Based on the results of the present study it was concluded that incorporating rice DDGS at up to 15% of the diet resulted in no significant difference ( $p>0.05$ ) observed in carcass characteristics such as dressing percentage, drumstick yield, thigh yield, breast yield, abdominal fat and the weights of visceral organs including the heart, liver, gizzard and proventriculus among the birds fed rice DDGS diet in comparison to the control group at the end of the experiment (42<sup>nd</sup> d). Therefore, it was concluded that feeding rice DDGS up to 15% in a broiler diet can be recommended without any adverse effects.

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