

EVALUATION OF RICE DISTILLER'S GRAINS WITH SOLUBLES (RDDGS) IN COMMERCIAL BROILER DIET ON HEMATO-BIOCHEMICAL PARAMETERS, AND INTESTINAL HISTOMORPHOLOGY

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ABSTRACT

A biological trial was conducted at Department of Poultry Science, Madras Veterinary College, Chennai to evaluate the effect of inclusion of RDDGS in commercial broiler diet on hematological, serum biochemical parameters. A total of 144 commercial day-old broiler chickens were allotted to four treatments with three replicates and 12 birds per replicate. Experimental diets were prepared by including RDDGS at 0, 5, 10, 15% at the expense of soyabean meal was prepared to be nearly isocaloric and isonitrogenous as per BIS (2007) standards. At the end of the experiment blood was collected from one male and one female from each replicate and analyzed for serum biochemical and hematological parameters. Statistical analysis of data revealed that there was no significant ($P > 0.05$) difference in the hematological, serum biochemical and intestinal histomorphology parameters. It can be concluded that the RDDGS can be included up to 15% in commercial broiler diets without effecting the hematological and serum biochemical parameters.

Key words: RDDGS - soyabean meal - hematological - serum biochemical parameters

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INTRODUCTION

Poultry industry is the fastest growing sector in Indian agriculture. Feed is the major constituent in the poultry production accounts for 65-75 % of total cost

of production. Feed costs are primarily driven by the cost of protein sources. Substitution of expensive protein sources with lower cost ingredients would potentially reduce the cost of the feed. Soybean meal (SBM) is the major protein source used in poultry diet. Instability in its production, indiscriminate exports and higher demand has resulted in its shortage for the poultry industry leading to its higher price. Substitution of SBM at reasonable price will lead to economic broiler production (Dinani *et al.*, 2018). Distillers dried grain solubles are the dry residue that remains after fermentation

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of grains (corn, wheat, sorghum, rice, and barley) in the production of ethanol by selected enzymes and yeasts. The by-products from the dry grinding of the grains are used to produce distillers' grains with solubles (De Magalhaes, 2013). RDDGS having high content of crude protein and energy can be potential protein source. Hence the present study was carried out to evaluate the effect of feeding of RDDGS in commercial broilers on their hematological and serum biochemical parameters.

MATERIALS AND METHODS

Experimental design and diets

The research work was carried out at Department of Poultry science, Madras Veterinary College, Chennai, India as per guidelines and approval of institutional animal ethical committee (IAEC) with IAEC number 17/SA/ IAEC/2022. A total of 144-day old commercial broilers were distributed randomly into four treatments with three replicates containing twelve birds per replicates. Four experimental rations nearly isocaloric and isonitrogenous were formulated by incorporating 0, 5, 10, 15 % RDDGS as per BIS (2007) standards. The birds were reared for six weeks in a deep litter house with standard managemental practices by providing *ad libitum* feed and water.

Sample collection

After experimental period one male and one female were randomly selected from each replicate were slaughtered by severing the jugular vein and blood was collected in EDTA vacutainer vials and vials with coagulant were

allowed to clot and centrifuged at 3000 rpm for 5 minutes to separate the serum for further analysis.

Serum biochemical parameters

The separated serum was preserved at -20°C until analysed. The samples were analysed for glucose, triglycerides, cholesterol, HDL and LDL at Centralized Clinical Laboratory, Madras Veterinary College, Chennai. Protein fractions such as total protein, albumin, globulin was estimated using A15 Biosystem auto analyzer by using commercially available enzymatic diagnostic kits (Agappe) from Radiant diagnostics, Chennai.

Hematological parameters

The total erythrocyte count and total leucocyte count were estimated by Neubauer counting chamber by using Nambiar's diluting fluid (Bancroft and Marilyn, 2008). The blood samples were analysed for packed cell volume (PCV) and hemoglobin concentration by using the methods described by Lamb (1981).

Intestinal histomorphology

Jejunum samples were taken from three birds per treatment after the experimental period of 42 days and were flushed with phosphate buffer saline and preserved in 10 % neutral buffer formalin for processing. Then it was dehydrated and embedded in paraffin wax. Serial histological sections of 5 µm thickness were cut on a microtome and mounted on slides. The slides were stained with haematoxylin and counter stained with eosin as described by Incharoen *et al.* (2010). The villus height, width and crypt depth were

determined by using image analysis software (Mag vision). Six villus height, width and crypt depth were measured in μm per sample.

Statistical analysis

The data was analyzed by general linear model with univariate analysis using software (IBM SPSS version 25.0 for windows) as per Snedecor and Cochran (1989). The differences between means were determined at 5 % probability level ($P < 0.05$) using Duncan's Multiple Range Test (DMRT) as modified by Kramer (1956).

RESULTS AND DISCUSSION

Serum biochemical parameters

The effect of feeding different levels of RDDGS in broilers on serum biochemical parameters presented in Table 1. The statistical analysis of serum biochemical parameters such as total protein, albumin, globulin, glucose, triglycerides, total cholesterol, HDL, LDL had no significant difference ($P > 0.05$) among the all treatment groups.

The present experiment results were in accordance with Kucheriya (2019) who reported that RDDGS partial replacement of soyabean meal up to 10% had no significant effect on the serum biochemical parameters. Vanaraja chicken fed with high protein RDDGS had no negative effect on total protein and cholesterol (Raju *et al.*, 2022). Abdel-Raheem *et al.* (2011) also reported non-significant difference in the serum protein and albumin in commercial broiler chicken fed with up to 12% corn DDGS. Choi *et al.* (2014) also observed the same non-significant effect of RDDGS

inclusion up to 25% on total protein, glucose, cholesterol, triglyceride in juvenile seabream (*Pargus major*).

The present results were in disagreement with Youssef *et al.* (2013) who observed that there was significant decrease in the glucose concentration when commercial broilers fed with cDDGS up to 15%. El-Abd and Niamat (2013) showed increased total protein and globulin concentration in Japanese quails fed with corn DDGS (cDDGS) at 50% and 100% replacement of conventional protein source. Mir *et al.* (2017) reported increase in the triglycerides and cholesterol in serum of broilers fed with broken rice up to 40% and cDDGS up to 10%. Serum cholesterol and triglyceride levels decreased significantly when commercial broilers fed with 15% RDDGS when compared to control (Dinani *et al.*, 2018). Shirisha *et al.* (2021) observed that there was significant increase in the serum cholesterol and total protein, when commercial broilers fed with RDDGS up to 16% with or without enzyme supplementation. Serum total protein was increased and serum total cholesterol level decreased with increasing level of RDDGS (0, 5, 10, 15 %) in Japanese quail's diet (Keerthana *et al.*, 2022).

Hematological parameters

Effect of feeding different levels of RDDGS in commercial broilers on hematological parameters (Mean $\pm$ SE) is shown in Table 2. The hematological parameters were within normal range and statistical analysis of the data shown that there was no significant ($P > 0.05$) difference in the

Table 1. Effect of feeding different levels of RDDGS in commercial broiler chickens on hematological parameters
(Mean ± SE)

S.No	Hematological parameters	T1 (control)	T2 (5 %)	T3 (10 %)	T4 (15 %)	F VALUE
1	Packed cell volume (%)	40.67 ± 0.67	39.50 ± 2.47	42.00 ± 2.17	39.50 ± 0.83	0.48 ^{NS}
2	Hemoglobin (g / dl)	9.37 ± 0.30	9.81 ± 0.30	9.98 ± 0.31	9.36 ± 0.26	1.16 ^{NS}
3	Total Erythrocyte Count (10 ⁶ / µl)	2.88 ± 0.59	2.94 ± 0.72	2.99 ± 0.10	2.96 ± 0.11	0.28 ^{NS}
4	Total Leukocyte Count (10 ³ / µl)	10.78 ± 0.24	10.75 ± 0.28	10.67 ± 0.25	9.95 ± 0.20	2.27 ^{NS}

NS- Not significant, No. of observations (N)= 6

Table 2. Effect of feeding different levels of RDDGS in commercial broiler chickens on serum biochemical parameters (Mean ± SE)

S. No	Serum biochemical parameters	T1 (control)	T2 (5 %)	T3 (10 %)	T4 (15 %)	F VALUE
1	Total protein (g / dl)	2.85 ± 0.14	2.50 ± 0.14	2.38 ± 0.13	2.57 ± 0.11	2.14 ^{NS}
2	Albumin (g / dl)	1.50 ± 0.09	1.40 ± 0.05	1.30 ± 0.16	1.31 ± 0.06	0.72 ^{NS}
3	Globulin (g / dl)	1.35 ± 0.17	1.10 ± 0.10	1.08 ± 0.11	1.26 ± 0.09	1.04 ^{NS}
4	Glucose (mg / dl)	173.67 ± 14.19	142.83 ± 13.97	160.50 ± 9.36	179.64 ± 11.97	1.90 ^{NS}
5	Triglycerides (mg / dl)	1299.33 ± 14.88	1326.50 ± 56.82	1368.83 ± 12.91	1322.49 ± 7.64	0.88 ^{NS}
6	Total cholesterol (mg / dl)	129.00 ± 12.10	112.83 ± 8.36	111.17 ± 7.68	210.41 ± 70.12	1.75 ^{NS}
7	HDL (mg / dl)	59.23 ± 5.45	60.16 ± 1.99	62.86 ± 4.74	64.46 ± 4.58	0.31 ^{NS}
8	LDL (mg / dl)	61.66 ± 2.84	59.66 ± 4.63	68.00 ± 8.02	77.66 ± 8.21	1.62 ^{NS}

NS- Not significant, No. of observations (N) = 6

Table 3. Effect of feeding different levels of RDDGS in commercial broiler chickens on intestinal histomorphology (Mean ± SE)

S. No	Intestinal histomorphology	T1 (control)	T2 (5 %)	T3 (10 %)	T4 (15 %)	F VALUE
1	Villus height (µm)	657.84 ± 141.03	725.35 ± 171.02	644.97 ± 171.02	620.06 ± 141.03	0.99 ^{NS}
2	Villus width (µm)	75.8 ± 10.57	81.22 ± 6.60	94.88 ± 16.77	82.30 ± 8.13	0.52 ^{NS}
3	Crypt depth (µm)	94.02 ± 10.02	102.62 ± 12.16	76.4 ± 12.16	92.17 ± 10.02	0.69 ^{NS}
4	VH: CD	7.02 ± 2.09	10.19 ± 2.54	8.86 ± 2.54	7.16 ± 2.09	0.46 ^{NS}

NS - Not significant, No. of observations (N) = 3

blood hemoglobin, packed cell volume, total erythrocyte count and total leucocyte count in broilers fed with RDDGS.

The results were in line with Dinani *et al.* (2018) who reported no significant difference in the hematological parameters when commercial broilers were fed with RDDGS up to 15 %. RDDGS along with rice gluten meal in combination with or without enzymes when included in commercial broilers diet had no effect on the hematological parameters (Dinani *et al.*, 2019). In contrary to the present results Ghazalah *et al.* (2011) reported that there was significant ($P < 0.05$) increase in the hemoglobin % when corn DDGS (cDDGS) was substituted up to 75% for soyabean meal in layers. Similarly, Youssef *et al.* (2013) also observed increase in hemoglobin % when corn DDGS (cDDGS) was included up to 15% in commercial broiler chicken diet. Gupta *et al.* (2017) reported improvement in PCV and hemoglobin % by including RDDGS in layers diet up to 30%.

Intestinal histomorphology

Effect of feeding different levels of RDDGS in commercial broilers on intestinal histomorphology (Mean $\pm$ SE) is shown in Table 3. Statistical analysis of the data revealed that there was no significant ($P > 0.05$) difference in the villus height, villus width, crypt depth, villus height: crypt depth. The villus height ranges between 620.06 μ m to 725.35 μ m. The present results were in line with Sepehri *et al.* (2021) who included wheat DDGS (wDDGS) up to 12% in commercial broiler chicken diets (1-21 days) and up to 20% DDGS during 22-

42 days and observed that the effect of wDDGS on the histology of jejunum broiler chickens in 21 and 42 days was not significant ($P > 0.05$). In contrary to the present experiment, Gupta *et al.* (2015) observed that the duodenum and crypt depth decreased and villus height / crypt depth ratio were increased at 10 % inclusion level of RDDGS in commercial broilers, Dinani *et al.* (2020) reported that the villus height and villus depth were found lower in 15% RDDGS inclusion levels in commercial broiler chicken.

CONCLUSION

Thus, it can be concluded that RDDGS can be safely included up to 15% in commercial broiler ration without any negative impact on serum biochemical, hematological, and intestinal histomorphology parameters.

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