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Effect of Feeding Rice Based Distillers Dried Grains with Solubles (rDDGS) on Haematological, Serum Biochemical and Carcass Traits in Broilers

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ABSTRACT

A biological experiment of 160 day old chicks for six weeks was undertaken with completely randomized design (CRD) divided into five treatments with 32 chicks with four replicates per treatment. Five experimental diets as per ICAR (2013) were prepared by incorporating rice distillers dried grains with solubles (rDDGS) at inclusion level of (0, 7.5, 10.0, 12.5 and 15.0%). Haematological parameters did not show any significant (P>0.05) difference as compared to control. Serological parameters and serum enzymes also did not exhibit any significant (P>0.05) difference as compared to control but serum cholesterol level decreased significantly (P<0.05) in 15% rDDGS group and triglyceride level decreased significantly (P<0.05) in 12.5 and 15% rDDGS groups as compared to control. Carcass traits in terms of immune organ weight, cut up parts, feather and blood loss (%), skin and shank coloration did not show any significant (P>0.05) difference as compared to control. Thus, it is concluded that rDDGS can safely incorporated at the inclusion level of 15% in broiler diet without any adverse effect on haematological, serum biochemical and carcass traits.

Key words: *Rice distillers dried grains with soluble, Haematological, Serum biochemical, carcass trait, Broiler.*

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 recurring expenditure. 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.

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India is second largest producers of rice in world after China, producing approximately 106.65 MT rice in 2013-14[2]. Now days, certain newer rice by products are available in appreciable quantities and cheaper rate that can be utilized from rice processing industries such as rice based distillers dried grains with solubles (rDDGS). It is relatively a new feedstuff having brownish colour and coarse powdery texture. Distillers dried grains with soluble (DDGS) is co-product of the ethanol (biofuel) industry produced during dry milling process. Corn, wheat, barley and sorghum cereals are commonly used ingredients for fermentation during bioethanol production. In the present context, rice as subtract for bioethanol production is increasing due to its relative lower price, higher production and easy availability leads to increased availability of co-product rice DDGS (rDDGS). It contains all the nutrients from grain in a concentrated form except for the majority of the starch, which has been utilized in the fermentation process. It contains 65% distiller's grain and 35% its soluble[4]. Addition of rice DDGS up to 10% level did not exert any adverse effect on carcass traits in broiler[11]. Rao *et al.*[16], reported that rDDGS can safely be incorporated in broiler at the inclusion level of 10%. Gupta[9] reported that rDDGS can safely be incorporated in layer diet upto the inclusion level of 10% without affecting egg production and egg quality traits. Serum-biochemical and haematological profile are related to the health status and vital indicators of physiological and nutritional status of birds. Since most of the research work done is limited to corn, wheat, barley and sorghum DDGS. Very scanty researches are available in literature regarding effect of feeding rDDGS in poultry. So, there is need to explore effect of feeding rDDGS on haematological, serum biochemical and carcass traits in broilers.

MATERIAL AND METHODS

The research work carried out at the Division of Avian Nutrition and Feed Technology, ICAR-Central Avian Research Institute (CARI), Izatnagar, India in the year 2018. The study was carried out as per the guidelines and approval of Institute Animal Ethical Committee (IAEC) and Committee for the purpose of control and supervision of experiments on animals (CPCSEA).

Experimental Design: A biological experiment of six weeks was undertaken with completely randomized design (CRD) on broiler chickens (CARIBRO Vishal) to investigate the effects of rice distiller's dry grain with soluble (DDGS) feeding on haematological, serum biochemical and carcass traits in broilers. A total of 160 day old chicks were taken and divided into five groups with 32 birds in each treatment. Each replicate consists of 8 birds housed together in battery cages and 4 replicates allocated for each treatment.

Haematological parameters: Haematological parameters were estimated using Abacus junior vet 5 haemo-analyser (Datron, Ltd.). Blood in 1% EDTA were collected from eight birds per treatment at the time of slaughter (42 days). Total leukocytes count (TLC), Differential leukocytes count (DLC), Total RBC count, Hb, PCV, MCV, MCH, MCHC, RBC distribution width (RDWc), platelet count, platelet %, MPV and platelet distribution width (PDWc) were recorded from each samples.

Serological parameters: Serum glucose, total protein, albumin, globulin cholesterol, triglycerides, serum enzymes SGOT, SGPT and alkaline phosphatise were estimated using standard procedures through commercial diagnostic kits.

Carcass traits: At the time of slaughter (42th day) one male and one female broiler from each replicate group were selected for determination of carcass traits in terms of immune organ weight cut up parts, feather and blood loss (%), skin and shank coloration. All of the data regarding organ weight, cut up parts and length were expressed per kilogram of BW. Skin and shank coloration were measured by Roach color fan (Scale 1-15),

Experimental diets: Five experimental broiler diets *iso-caloric* and *iso-nitrogenous*were prepared by incorporating different levels of

rice DDGS (0, 7.5, 10.0, 12.5 and 15.0%) as per ICAR[10] standard. The diets along with all the used ingredients including rice DDGS were analyzed for proximate[3], calcium[18] and fibre fractions[19]. *In vitro* pepsin-pancreatin digestibility of rDDGS and soybean meal was measured according to the method of Gopalkrishnan and Prakash[8]. Mycotoxin (aflatoxin B1 and ochratoxin) screening has been done by thin layer chromatography[3] for rDDGS.

Statistical analysis: Data was subjected to test of significance as per complete randomized design[17]. Treatments means were separated using Duncan's multiple range test[6]. The SPSS (Statistical Package for the Social Sciences) software program (IBM Corporation, Somers, NY, USA) version 16.0 used for analysis of data.

RESULTS AND DISCUSSION

Chemical composition of test material and diets: Experimental diets ingredients and nutrient composition as prestarter (0-2 wk) and starter (2-3 wk) and finisher diets (3-6 wk) has been given in the table no.1 as per ICAR (2013) feeding standard. Rice DDGS analyzed and reported in this study contained (%) Moisture 8.65, Dry matter (DM) 91.35,Crude protein (CP) 44.68, Ether extract (EE) 6.47, Crude fibre (CF) 9.12, Total ash (TA) 4.01, Acid insoluble ash (AIA) 1.27, Nitrogen free extract (NFE) 35.72, Calcium 0.62, Phosphorus 0.83, Neutral detergent fibre (NDF) 45.60, Acid detergent fibre (ADF) 12.87, Acid detergent soluble (ADS) 32.73, Acid detergent lignin (ADL) 2.14 and Gross energy 4232 kcal/kg on as such basis. *In vitro* pepsin-pancreatin digestibility (IVPPD) of rice DDGS was found 79.81% while IVPPD of soybean meal was reported 88.15%. No detectable aflatoxin B1 and ochratoxin has been found in rDDGS.

Our results are in agreement with Mandal[13], Gupta[9] and Rao *et al.*[16] who reported 45% CP but contrary to this Patil *et al.*[14] reported 30% CP in rDDGS. Furthermore, the drying process can have crucial influence not only on variability of nutrients but also on concentration and availability of nutrients in different samples.

Haematological parameters The data pertaining to influence of different levels of rDDGS feeding to broilers on haematological parameters have been presented in Tables 2. Total leukocytes count (TLC), Differential leukocytes count (DLC), Total RBC count, Hb, PCV, MCV, MCH, MCHC, RBC distribution width (RDWc), platelet count, platelet %, MPV and platelet distribution width (PDWc) were recorded from each samples. Haematological parameters did not show any significant ($P>0.05$) difference as compared to control. All the values of various haematological parameters were ranges between normal physiological values. It indicated no adverse effect of rDDGS supplementation in broiler diets up to 15% inclusion level. Gupta *et al.*[9] reported inclusion of 5, 7.5 and 10% level of rDDGS significantly ($P<0.01$) enhance the PCV and Hb values than 0% inclusion level. Ghazalah *et al.*[7] reported that DDGS level at 75% substitution for SBM significantly increased Hb % in layers, while, in broiler, DDGS up to 15% insignificantly affected the hematological parameters. Thus, our results are in agreement with Ghazalah *et al.*[7] and disagreement with Gupta *et al*[9].

Serological parameters: The data pertaining to influence of different levels of rDDGS feeding to broilers on serological parameters have been presented in Tables 3. Serological parameters in terms of glucose, total protein, albumin, globulin and serum enzymes SGOT,SGPT and alkaline phosphatase did not exhibit any significant ($P>0.05$) difference as compared to control but serum cholesterol level decreased significantly ($P<0.05$) in 15% rDDGS group and triglyceride level decreased significantly ($P<0.05$) in 12.5 and 15% rDDGS groups as compared to control. Choi *et al.*[5] reported dietary inclusion of rice DDGS up to 25% did not affect the plasma content of total protein, glucose, cholesterol and triglyceride in juvenile red seabream (*Pagrus major*). Abd El-Hack[1] indicated that increasing corn DDGS level significantly ($P\leq0.01$) increased serum triglycerides, cholesterol and LDL for hens fed diet contained 22% DDGS in the diet. Gupta *et*

al.[9] reported 10% rice DDGS had significantly (P<0.01) higher effect on serum albumin, total serum protein, serum A/G ratio, serum glucose value and significantly (P<0.01) lowering effect on serum lipid profile (triglycerides, cholesterol, LDL and VLDL). Our results are in agreement with Choi *et al.*[5] but disagreement with Abd El-Hack[1] and Gupta *et al*[9].

Carcass traits: The data pertaining to influence of different levels of rDDGS feeding to broilers on carcass traits have been presented in Tables 4. Carcass traits in terms of immune organ weight (spleen ,bursa and thymus), cut up parts, feather and blood loss (%), skin and shank coloration did not show any significant (P>0.05) difference as compared to control. Our results are in agreement with ICAR- CARI, annual report[11] which showed that addition of rDDGS up to 10% level did not exert any adverse effect on carcass traits in broiler. Contrary to this Loar *et al*[12] reported cut up parts and organ weight declined in a linear manner with increasing maize DDGS above 14%level. No further references are available in the literature regarding effect rDDGS on carcass traits of broiler.

Table 1: Ingredients and nutrient composition of prestarter, starter and finisher diets for different level of rDDGS

	prestarter diet (0-2 wk)					starter diet (2-3 wk)					finisher diet (3-6 wk)				
Ingredients	**D1**	**D2**	**D3**	**D4**	**D5**	**D1**	**D2**	**D3**	**D4**	**D5**	**D1**	**D2**	**D3**	**D4**	**D5**
Maize	54.42	55.3	55.46	55.94	56.4	55.63	56.94	57.41	57.66	58.1	62	63.41	63.78	64.18	64.37
SBM	38.4	30.7	28.2	25.5	22.9	37.1	29.2	26.6	24.1	21.4	31.3	23.4	20.8	18.2	15.7
oil	3	2.3	2.1	1.8	1.52	3.5	2.7	2.37	2.15	1.9	3.22	2.34	2.1	1.8	1.6
DDGS	0	7.5	10	12.5	15	0	7.5	10	12.5	15	0	7.5	10	12.5	15
LSP	1.4	1.3	1.3	1.3	1.2	1.35	1.27	1.23	1.2	1.17	1.2	1.05	1.03	1.0	0.96
DCP	1.82	1.83	1.84	1.83	1.83	1.55	1.56	1.56	1.58	1.58	1.45	1.5	1.5	1.5	1.5
Lysine	0	0.13	0.19	0.23	0.27	0	0	0	0	0.05	0	0	0.01	0.05	0.1
Methionine	0.2	0.16	0.14	0.13	0.11	0.1	0.07	0.06	0.04	0.03	0.06	0.03	0.01	0	0
Constant*	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nutrient compsition (%)															
CP	21.98	22.01	22.04	22.00	22.01	21.51	21.49	21.50	21.53	21.50	19.50	19.49	19.49	19.50	19.53
ME(kcal/kg) **	2998	2999	3000	2998	2999	3049	3052	3049	3051	3052	3100	3099	3101	3098	3100
Ca	1.03	1.03	1.04	1.05	1.02	0.95	0.95	0.95	0.95	0.95	0.86	0.85	0.85	0.85	0.85
P	0.45	0.45	0.45	0.44	0.44	0.40	0.40	0.40	0.40	0.40	0.38	0.38	0.38	0.38	0.38
Lysine	1.18	1.20	1.22	1.22	1.22	1.15	1.17	1.15	1.10	1.10	1.09	1.03	0.99	0.97	0.97
Methionine	0.52	0.52	0.52	0.52	0.52	0.47	0.48	0.48	0.48	0.48	0.41	0.42	0.41	0.41	0.43
Threonine	0.81	0.83	0.82	0.81	0.81	0.80	0.79	0.77	0.79	0.77	0.68	0.67	0.68	0.69	0.67
Cost (Rs./ kg)	28.53	27.25	26.85	26.36	25.87	28.03	26.45	25.88	25.35	24.92	26.72	25.09	24.55	24.08	23.78

*Constant 0.765 includes salt 0.4%, trace mineral premix 0.1%, vitamin premix 0.15%, vit. B complex 0.015%, choline chloride 0.05% and toxin binder 0.05% (As per ICAR,2013) **calculated value

Table 2: Effect of feeding different levels of rDDGS on haematological parameters

Treatment	**T1**	**T2**	**T3**	**T4**	**T5**	**Pooled SEM**	**P Value**
rDDGS (%)	**0**	**7.5**	**10**	**12.5**	**15**		
WBC	22.7	21.6	21.2	21.7	23.7	0.622	NS
Neutro.	5.1	5	5.3	4.9	5.1	0.153	NS
Lym.	15	13.9	14	14.3	15.6	0.491	NS
Mono.	1.3	1.5	1.1	1.3	1.8	0.156	NS
Neutro.%	22.3	23.3	25	22.4	21.8	0.392	NS
Lym%	66.5	64.4	62.1	65.9	65.2	0.889	NS
Mono.%	5.8	7.2	5.4	6	8.1	0.777	NS
H:L	0.34	0.36	0.38	0.34	0.34	0.008	NS
RBC	2.2	2.3	2.3	2.3	2.2	0.036	NS
Hb	9.3	10	9.7	10.4	9.9	0.157	NS
PCV%	24.1	25.8	25	25.7	23.1	0.485	NS
MCV	110	112	110	113	104	1.286	NS
RDWc	12.2	11.2	12.7	12.2	11.8	0.334	NS
MCH	42.6	43.3	42.9	45.7	44.1	0.374	NS
MCHC	38.6	38.6	39.2	40.5	42.9	0.684	NS
PDWc	32.7	33.7	34.6	32.8	34.8	0.623	NS
PLT	29.3	29	31.3	28.3	31.5	0.782	NS
PLT %	0.29	0.29	0.31	0.28	0.32	0.008	NS
MPV	8.9	9.1	9.3	9	9.8	0.167	NS

Units:WBC (X 10^4 ul),RBC (X10^6 ul),Hb (g/dl),MCV (fl),MCH(pg),MCHC(g/dl) and PLT(X10^3 ul). NS-Non-significant (P>0.05)

Table 3: Effect of feeding different levels of rDDGS on serum biochemical parameters

TREATMENT	rDDGS (%)	Glucose (mg/dl)	Protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A:G	Cholesterol (mg/dl)	Triglyceride (mg/dl)	SGOT (U/ml)	SGPT (U/ml)	ALP (U/ml)
T1	**0**	214	5.2	1.9	3.3	0.57	121^{b}	117^{b}	175	10	52
T2	**7.5**	205	5.2	2.0	3.3	0.60	122^{b}	111^{ab}	176	10	51
T3	**10**	209	5.2	1.9	3.3	0.60	123^{b}	112^{ab}	177	11	57
T4	**12.5**	207	5.2	1.9	3.3	0.56	123^{b}	106^{a}	179	10	56
T5	**15**	201	4.8	1.9	3.0	0.65	108^{a}	103^{a}	174	9	60
	Pooled SEM	1.600	0.059	0.020	0.056	0.012	1.803	1.601	0.682	0.220	1.245
	P Value	NS	NS	NS	NS	NS	P<0.05	P<0.05	NS	NS	NS

Values bearing different superscripts within the column differ significantly, NS-Non-significant (P>0.05)

Table 4: Effect of feeding different levels of rDDGS on carcass traits (% live wt.) and body coloration

Treatment	RGM (%)	Skin color	Shank color	Blood loss	Feather loss	Spleen	Bursa	Thymus	Drumstick	Back	Wings	Neck
T1	0	4.00	4.25	3.4	9.2	0.17	0.10	0.31	10.3	15.8	8.2	4.9
T2	7.5	3.25	4.75	3.0	9.2	0.23	0.10	0.31	10.0	15.8	8.4	4.9
T3	10	4.00	5.00	3.0	9.1	0.20	0.10	0.37	10.5	15.8	8.5	4.9
T4	12.5	4.00	4.75	3.0	8.8	0.22	0.10	0.32	10.1	15.9	8.4	5.0
T5	15	3.50	4.25	2.7	9.7	0.20	0.11	0.33	10.3	16.0	8.4	4.6
	Pooled SEM	0.160	0.112	0.078	0.099	0.0115	0.0041	0.0137	0.091	0.116	0.065	0.061
	P value	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS-Non-significant (P>0.05)

CONCLUSIONS

Thus, it is concluded that rDDGS can safely incorporated at the inclusion level of 15% in broiler diet without any adverse effect on haematological, serum biochemical and carcass traits.

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