

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.705.049>

Effect of Feeding Rice Gluten Meal (RGM) on Haematological, Serum Biochemical and Carcass Traits in Broilers

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ABSTRACT

A biological experiment of six weeks was undertaken with completely randomized design (CRD) on broiler chickens to investigate the effects of rice gluten meal (RGM) feeding on haematological, serum biochemical and carcass traits of broiler chickens. A total of 192 day old chicks were taken and divided into six treatments with 32 chicks with four replicates per treatment. Six experimental diets as per ICAR (2013) were prepared by incorporating five different levels of RGM (0, 10, 15, 20, 25 and 30 %). Chemical analysis on as such basis indicated that RGM contained crude protein 49.94% and gross energy 4742 kcal/kg. Haematological parameters did not show any significant ($P>0.05$) difference as compared to control and other dietary treatments. 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. Serum glucose, globulin, triglycerides, serum enzymes SGPT and alkaline phosphatase did not exhibit any significant ($P>0.05$) difference as compared to control. Serum total protein, albumin and SGOT decreased significantly ($P<0.01$) in 25 and 30% RGM groups as compared to control. Serum cholesterol decreased significantly ($P<0.05$) in 25 and 30% RGM groups as compared to control. Thus, it is concluded that rice gluten meal (RGM) can safely incorporated at the inclusion level of 20 % in broiler diet without any adverse effect on haematological, serum biochemical and carcass traits.

Keywords

Rice gluten meal,
Haematological,
Serum biochemical,
Carcass trait,
Broiler

Article Info

Accepted:
04 April 2018
Available Online:
10 May 2018

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.

India is second largest producers of rice in world after China, producing approximately 106.65 MT rice in 2013-14 (Agriculture statistics, 2015-16). 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 gluten meal (RGM). Rice gluten meal is a by-product of wet-milling of rice obtained after starch extraction and syrup preparation. It is relatively a new feedstuff having brownish color and coarse powdery texture. Initial research finding showed that RGM can be included up to 10% level in broiler chicken without affecting feed efficiency and dressing percentage (Sherazi *et al.*, 1995). Metwally and Farahat (2015) found that broiler fed RGM with different inclusion rates up to 12.5% had the same growth performance, carcass traits and serological parameters. Kumar *et al.*, (2016) found that RGM could replace ground nut cake (GNC) in the concentrate mixture of growing calves up to 75% level without any adverse effect on growth performance and serological parameters. Malik *et al.*, (2017) reported that replacement of ground nut cake (GNC) by RGM and maize gluten meal (MGM) at 75% level did not differ in feed efficiency and average daily gain (ADG) in growing Sahiwal cattle. Thus, regarding feeding value of rice gluten meal (RGM) very scanty research is available and no research is available regarding effect of feeding RGM on haematological, serum biochemical and carcass traits in broilers up to 30% inclusion level. So, there is need to evaluate RGM effect of feeding RGM on haematological, serum biochemical and carcass traits in broilers due to its increased availability as low cost feed source.

Materials 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 gluten meal (RGM) feeding on haematological, serum biochemical and carcass traits in broilers. A total of 192 day old chicks were taken and divided into six groups with 32 chicks in each treatment. Each replicate consists of 8 chicks housed together in battery cages and 4 replicates allocated for each treatment.

Experimental diets

Six experimental broiler diets *iso-caloric* and *iso-nitrogenous* were prepared by incorporating different levels of rice gluten meal (0, 10, 15, 20, 25 and 30 %) with as per ICAR (2013) standard. The diets along with all the used ingredients including rice gluten meal were analyzed for proximate (AOAC, 2000), calcium (Talpatra *et al.*, 1940) and fibre fractions (Van Soest and Wine, 1967). *In vitro* pepsin-pancreatin digestibility of RGM and soybean meal was measured according to the method of Gopalkrishnan and Prakash (2000). Mycotoxin (aflatoxin B1 and ochratoxin) screening has been done by thin layer chromatography (AOAC, 2000) for RGM.

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 phosphatase 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),

Statistical analysis

Data was subjected to test of significance as per complete randomized design (Snedecor and Cochran, 1989). Treatments means were separated using Duncan's multiple range test (Duncan, 1955). 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) diets have been given in table 1 and finisher diets (3-6 wk) in table 2 as per ICAR (2013) feeding standard.

RGM used in this experiment was analyzed and contained (%) Moisture 7.64, Dry matter (DM) 92.36, Crude protein (CP) 49.94, Ether extract (EE) 5.79, Crude fiber (CF) 7.43, Total ash (TA) 3.31, Acid insoluble ash (AIA) 0.89, Nitrogen free extract (NFE) 33.53, Calcium 0.84, Phosphorus 0.98, Neutral detergent fiber (NDF) 43.41, Acid detergent fiber (ADF) 16.24, Acid detergent soluble (ADS) 27.17, Acid detergent lignin (ADL) 1.54 and Gross energy (kcal/kg) 4742 on as basis. *In vitro* pepsin-pancreatic digestibility (IVPPD) of RGM was found 81.92% while IVPPD of soybean meal was observed 88.15%. No detectable aflatoxin B1 and ochratoxin has been found in RGM.

Metwally and Farhat (2015) reported higher value of RGM in terms of protein (57.60%), but lower values of RGM in terms of EE (3.16%) and CF (1.45%) as compared to our results. Similarly Kumar *et al.*, (2016) reported lower values of RGM in terms of protein (46.40%) and EE (3.40%) as compared to our results. 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 RGM feeding to broilers on haematological parameters have been presented in table 3. 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.

Table.1 Ingredients and nutrient composition of pre-starter starter diets for different level of RGM

Pre-Starter Diets (0-2 wk)							Starter Diets (2-3 wk)					
Ingredients	D1	D2	D3	D4	D5	D6	D1	D2	D3	D4	D5	D6
Maize	54.32	58.0	59.8	61.0	59.0	57.5	55.63	59	59.92	61.42	62.7	60.75
SBM	38	26.50	20.40	14.60	8.60	2.20	37.1	25.2	19.3	13.24	7.2	1.2
DORB	0	0	0.00	0.00	2.90	5.70	0	0	0.5	0.7	1	3.8
Oil	3.10	1.40	0.60	0.00	0.00	0.00	3.5	2	1.4	0.65	0	0
RGM	0	10	15.00	20.00	25.00	30.00	0	10	15	20	25	30
LSP	1.40	1.30	1.30	1.30	1.30	1.30	1.35	1.37	1.32	1.3	1.27	1.26
DCP	1.82	2	2	2	2	2	1.55	1.6	1.7	1.76	1.8	1.85
Lysine	0	0	0.1	0.2	0.3	0.5	0	0	0.06	0.16	0.26	0.37
Methionine	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.06	0.03	0	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
Total	100.00	100.00	99.995	99.975	100.015	100.015	100.00	100.00	100.00	100.00	100.00	100.00
Nutrient composition (%)												
CP	21.97	22.01	21.97	21.98	22.04	21.98	21.51	21.52	21.53	21.51	21.49	21.53
ME (kcal/kg)**	3003.2	3000.4	2998.2	3000.1	2998.6	3002.3	3049.7	3053.4	3053.4	3050.4	3051.0	3049.2
Ca	1.03	1.00	1.00	1.02	1.03	1.03	0.95	0.95	0.95	0.95	0.95	0.96
P	0.45	0.45	0.44	0.45	0.45	0.45	0.40	0.39	0.40	0.40	0.40	0.40
Lysine	1.18	1.20	1.19	1.19	1.19	1.18	1.31	1.15	1.09	1.08	1.07	1.07
Methionine	0.52	0.52	0.52	0.51812	0.52	0.54	0.48	0.48	0.48	0.48	0.50	0.51
Threonine	0.81	0.83	0.82	0.81	0.81	0.81	0.80	0.79	0.78	0.79	0.78	0.78
Cost (Rs.per kg)	28.60	25.67	24.58	23.67	23.00	22.32	28.03	25.60	24.56	23.47	22.62	22.07

In prestarter diet *Constant 0.765 includes salt 0.4%, trace mineral premix 0.10%, 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 Ingredients and nutrient composition of finisher diets (3-6 wk)

Ingredients	D1	D2	D3	D4	D5	D6
Maize	62	65.36	67.07	68.51	67.82	67.82
SBM	31.3	19.4	13.4	7.5	1.4	1.4
DORB	0	0	0	0	1.9	1.9
oil	3.2	1.7	0.9	0.2	0	0
RGM	0	10	15	20	25	25
Marbal Chips	0.7	0.63	0.64	0.6	0.56	0.56
LSP	0.5	0.5	0.5	0.5	0.5	0.5
DCP	1.45	1.6	1.6	1.7	1.75	1.75
Lysine	0	0.02	0.12	0.22	0.3	0.3
Methionine	0.06	0.02	0	0	0	0
Constant*	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
Nutrient composition (%)						
CP	19.50	19.51	19.49	19.50	19.49	19.49
ME (kcal/kg)**	3100.2	3101.9	3099.1	3098.1	3101.3	3101.3
Ca	0.86	0.85	0.85	0.85	0.85	0.85
P	0.38	0.38	0.38	0.38	0.39	0.38
Lysine	0.98	0.97	0.98	0.97	0.96	0.96
Methionine	0.42	0.42	0.43	0.45	0.46	0.46
Threonine	0.68	0.67	0.68	0.69	0.67	0.68
Cost (Rs./ kg)	26.71	26.89	25.83	25.00	24.31	24.31

In finisher diet *Constant 0.77 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.3 Effect of feeding different levels of RGM on haematological parameters

Treatment	T1	T2	T3	T4	T5	T6	Pooled SEM	P value
RGM (%)	0	10	15	20	25	30		
WBC	22.7	22	22.7	22.7	21.8	19.7	0.461	NS
Neutro.	5.1	5.3	5.7	5	5.1	5.1	0.145	NS
Lym.	15	14.2	14.7	15.4	14.1	12.4	0.35	NS
Mono.	1.3	1.1	1.1	1.1	1.2	1.1	0.033	NS
Neutro.%	22.3	24.2	24.8	22.2	23.3	26.2	0.533	NS
Lym%	66.5	65	64.8	67.4	64.3	63	0.647	NS
Mono.%	5.8	5.2	5	5	5.6	5.7	0.179	NS
H:L	0.34	0.38	0.39	0.33	0.37	0.42	0.011	NS
RBC	2.2	2.3	2.3	2.3	2.4	2.3	0.02 8	NS
Hb	9.3	10.4	9.6	10	10.2	9.5	0.143	NS
PCV%	24.1	25.8	25.8	26.2	26.6	25.1	0.328	NS
MCV	110	111	111	113	111	112	0.5 38	NS
RDWc	12.2	11.3	12.6	12.4	11.6	12.6	0.262	NS
MCH	42.6	44.7	41.4	43.3	42.8	42.5	0.373	NS
MCHC	38.6	40.2	37.2	38.1	38.4	37.8	0.275	NS
PDWc	32.7	32.4	31.6	32.5	31.3	31.4	0.383	NS
PLT	29.3	27.8	27.3	28.3	30.5	24.8	0.746	NS
PLT %	0.29	0.28	0.27	0.28	0.31	0.25	0.007	NS
MPV	8.9	8.6	7.9	8.6	9.6	8.2	0.173	NS

Units: WBC (X 10⁴ul), RBC (X10⁶ul), Hb (g/dl), MCV (fl), MCH (pg), MCHC (g/dl) and PLT (X10³ul), NS-Non significant (P>0.05)

Table.4 Effect of feeding different levels of RGM on serum biochemical parameters

Treatment	RGM (%)	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	204	4.83 ^b	1.78 ^{bc}	3.03	0.59	130 ^b	117	179a	10	52
T2	10	201	4.66 ^b	1.95 ^c	2.92	0.60	121 ^{ab}	114	182a	13	63
T3	15	201	4.85 ^b	1.68 ^b	3.15	0.55	119 ^{ab}	112	179a	12	62
T4	20	206	4.85 ^b	1.76 ^{bc}	2.92	0.67	124 ^{ab}	123	180a	11	53
T5	25	201	4.00 ^a	1.36 ^a	2.63	0.53	117 ^a	118	186b	10	49
T6	30	202	4.08 ^a	1.38 ^a	2.72	0.51	113 ^a	115	189b	10	51
	Pooled SEM	1.009	0.089	0.046	0.060	0.016	1.692	1.640	0.812	0.394	1.975
	P value	NS	(P<0.01)	(P<0.01)	NS	NS	(P<0.05)	NS	(P<0.01)	NS	NS

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

Table.5 Effect of feeding different levels of RGM 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	3.75	5.25	2.9	9.3	0.21	0.13	0.31	10.3	15.8	8.2	4.9
T2	7.5	4.00	4.75	3.1	9.3	0.24	0.10	0.25	10.6	16.2	8.5	4.9
T3	10	4.00	5.25	2.8	9.3	0.26	0.11	0.28	10.7	15.8	8.5	4.9
T4	12.5	4.00	5.25	3.5	9.3	0.25	0.10	0.25	9.9	16.2	8.3	4.7
T5	15	4.00	5.50	2.8	9.1	0.25	0.12	0.35	10.4	16.7	8.2	4.5
	Pooled SEM	4.25	5.50	2.7	8.8	0.25	0.13	0.30	10.0	16.3	8.8	4.8
	P value	0.15	0.11	0.084	0.078	0.009	0.006	0.012	0.087	0.111	0.067	0.051
		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS-Non-significant (P>0.05)

Haematological parameters did not show any significant ($P>0.05$) difference as compared to control and other dietary treatments. All the values of various haematological parameters were ranges between normal physiological values up to 30% inclusion level of RGM. No references are available in the literature regarding effect of RGM on haematological parameters of broiler.

Serological parameters

The data pertaining to influence of different levels of RGM feeding to broilers on serological parameters have been presented in table 4. Serum glucose, globulin, triglycerides, serum enzymes SGPT and alkaline phosphatase did not exhibit any significant ($P>0.05$) difference as compared to control. Serum total protein, albumin and SGOT decreased significantly ($P<0.01$) in 25 and 30% RGM groups as compared to control. Serum cholesterol decreased significantly ($P<0.05$) in 25 and 30% RGM groups as compared to control. All the values of various serological parameters were ranges between normal physiological values up to 20% inclusion level of RGM. Lower serum total protein and albumin levels at 25 and 30% inclusion levels may be due to poor digestibility of RGM protein as compared to soybean meal at higher inclusion levels. Metwally and Farhat (2015) who reported no significant ($P>0.05$) difference in serum biochemical parameters (serum lipid profile, glucose, total protein, albumin and globulin) up to addition of 12.5% RGM in diet of broiler chicken. Kumar *et al.*, (2016) also reported no difference in the serological variables (glucose, blood urea nitrogen, plasma proteins and non-esterified fatty acids) on addition of RGM up to 21% level in the diet of growing dairy calves. Our results were in agreement with Metwally and Farhat (2015) and Kumar *et al.*, (2016). All the values of various serological parameters were

ranges between normal physiological values up to 20% inclusion level of RGM.

Carcass traits

The data pertaining to influence of different levels of RGM feeding to broilers on carcass traits have been presented in table 5. 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 Sherazi *et al.*, (1995) who reported no significant ($P>0.05$) difference in dressing percentage on incorporation of RGM up to 10% level. Metwally and Farhat (2015) also reported no significant ($P>0.05$) difference in dressing percentage and internal organs on addition of RGM up to 12.5% level in the diet of broiler chicken. It can be concluded that inclusion of RGM up to 30% in the diet had no adverse effects on carcass traits, cut-up parts and internal organs of broiler chicken.

Thus, it is concluded that rice gluten meal (RGM) can safely incorporated at the inclusion level of 20% in broiler diet without any adverse effect on haematological, serum biochemical and carcass traits.

Acknowledgement

ICAR-Central Avian Research Institute, Izatnagar, Utter Pradesh-243122 for providing all necessary inputs and facilities.

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How to cite this article:

Dinani, O.P., Pramod Kumar Tyagi, A.B. Mandal, Praveen Kumar Tyagi, J.S. Tyagi and Dukare Sagar Popat. 2018. Effect of Feeding Rice Gluten Meal (RGM) on Haematological, Serum Biochemical and Carcass Traits in Broilers. *Int.J.Curr.Microbiol.App.Sci.* 7(05): 378-386. doi: <https://doi.org/10.20546/ijcmas.2018.705.049>