Haryana Vet. (December, 2021) **60(2),** 258-262 **Research Article**

EFFECT OF FEEDING RICE GLUTEN MEAL (RGM) WITH AND WITHOUT ENZYME ON GROWTH PERFORMANCE, CARCASS TRAITS, SERUM BIOCHEMICAL PARAMETERS AND COST ECONOMICS IN BROILERS

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ABSTRACT

This experiment was conducted to evaluate the effects of feeding of rice gluten meal (RGM) with and without enzyme on growth performance, carcass traits, serum biochemical parameters and cost economics of broiler production. 240 day-old broiler chicks were randomly allocated to six groups with four replicates having 10 birds in each. During this experiment starter, grower and finisher period experimental diets were fed to birds which were isonitrogenous and isocaloric and formulated with different levels of RGM. They were T_1 (control, without RGM and enzyme), T_2 (control, without RGM and with cocktail of enzymes @100g/q feed), T_3 (10% RGM), T_4 (10% RGM with cocktail of enzymes @100g/q feed), T_5 (15% RGM), T_6 (15% RGM with cocktail of enzyme @100g/q feed). Significantly higher body weight gain was observed in 10% and 15% RGM supplemented with and without enzyme groups as compared to control during first week and third week of study. During third week, feed intake was significantly higher than control group in all the treatments. During first and third week, all the treatments had significantly lower FCR as compared to control. Carcass traits in terms of eviscerated, dressing, gizzard and giblet percentage did not show any significant (P>0.05) difference but liver and abdominal fat percentage was higher in 10% RGM supplementation treatment as compared to control. Serum biochemical parameters i.e. SGPT, BUN and creatinine did not exhibit any significant (P>0.05) difference but SGOT levels were on higher side in 15% RGM supplementation treatment as compared to control. The RGM supplemented groups yielded more profit than without RGM supplemented birds. It was concluded that as a protein source, RGM can be supplemented in broiler diets up to 15% without any negative effect on growth performance, carcass traits and serum biochemical parameters.

Keywords: Biochemical parameters, Broiler, Carcass, Cost economics, Growth, Rice gluten meal

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Since both maize and soybeans are scarce at reasonable prices, therefore there is an urgent need to explore different agro-industrial waste and other unconventional feed resources for an economically viable development of poultry (Bhatt and Sharma, 2001). India is one of the world's largest rice producers, producing around 112.91 million tonnes of rice every year (GOI, 2018). A lot of by-products from the rice processing industry are available among which Rice gluten meal (RGM) has the ability to be integrated into livestock and poultry feed. Rice gluten meal is a high protein and high energy alternative feed resource that can be used for economic development for livestock and poultry feeding (Dinani *et al.*, 2020). Rice gluten meal contains 46 per cent crude protein and has metabolizable energy of 3152 kcal/kg (Kumar *et al.*, 2016). Rice gluten meal may be an efficient and relatively less costly substitute feed ingredient in the diet of broilers based on feed cost. Inclusion of RGM at higher level and with and without enzyme supplementation needs to be studied.

Therefore, this study was carried out to evaluate the supplementary effects of different levels of RGM with or without enzyme on weekly growth performance, carcass traits, serum biochemical parameters and production cost of broilers.

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MATERIAL AND METHODS

The study was carried out at Department of Animal Nutrition, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India (300562 N, 750522 E, 247 m above sea level). RGM was procured from prodigy foods, Zirakpur, Punjab. The product was then analyzed for proximate principles and phosphorous by AOAC methods (2000) and calcium as per the modified method given by Talapatra *et al.* (1940). RGM contained 91.7% dry matter, 46.13% crude protein, 3.46% ether extract, 1.95% crude fibre, 0.25% calcium, and 0.45% phosphorus. Whereas chemical composition of soybean meal was 87.17% dry matter, 45.78% crude protein, 1.45% ether extract, 9.10% crude fibre, 0.32% calcium and 0.28% phosphorus. Each gram of multizyme contains : β-Glucanase : 100000 U, Xylanase : 70000 U, Pectinase : 13000 U, Cellulase : 4000 U, Acid Protease : 1000 U, Neutral Protease : 1000U, Mannanase : 800 U, α-Glucosidase : 800 U, Amylase : 1000 U, Lipase : 200 U, Phytase : 100 U, α-Galactosidases : 20U.

42 days feeding trial including 7 days of metabolic

trial was conducted to determine the effect of feeding RGM in broiler performance. The feeding of the experimental birds was carried out in 3 phases i.e. starter (1-14 days), grower (15-21 days) and finisher (22-35 days) as given in Table 1 as per ICAR (2013). 240 sexed chicks were distributed randomly into 6 treatment groups of 4 replicates having 10 birds each.

The chicks of all experimental groups were weighed individually at the start of experiments and then at weekly intervals. Average feed intake (AFI), average body weights and average body weight gains (ABG) were recorded on weekly interval. Feed Conversion Ratio (FCR) was calculated as a ratio of grams of average feed consumed per grams of average body weight gain per bird. The efficiency of protein utilization expressed as protein efficiency ratio (PER) was calculated as grams of body weight gain per gram of protein consumed on phase basis. The efficiency of energy utilization expressed as calorie efficiency ratio (CER) was calculated as body weight gain per kilo calories consumed.

At the end of feeding trial, 4 birds of comparable body weight from each treatment were selected. The birds were off-fed overnight to empty the intestinal content and sacrificed to assess the effect of various dietary treatments on the dressing percentage, abdominal fat and giblet weight. Blood sample of four birds from each treatment was collected from jugular vein on 42nd day. The serum was separated and used for estimating SGOT, SGPT, BUN and Creatinine content. The cost economics was also calculated to observe the net profit in various groups. The collected data of different experimental groups were subjected to statistical analysis using Statistical Analysis System software (SAS, version 9.3) and One way ANOVA in Software Package for Social Sciences (SPSS, version 24.0) to test the difference between various treatments.

RESULTS AND DISCUSSION

The data pertaining to the weekly growth performance in terms of ABG, AFI, FCR, PER and CER are presented in Table 2. The data regarding carcass parameters and serum biochemical parameters and production cost are given in Table 3 and Table 4, respectively.

Significantly higher body weight gain was observed in 10% and 15% RGM supplemented with and without enzyme groups as compared to control during first week and third week of study. During fifth week, RGM supplementation at 15% with and without enzyme had almost similar weight gain as compared to control but RGM supplementation at 10% with and without enzyme had significantly lower body weight gain as compared to control but almost similar to control supplemented with enzyme treatment. Significantly higher body weight gain were also observed during starter phase and overall period by Singh *et al.* (2020). Seyedi and Hosseinkhani (2014) studied that group fed with 12% corn gluten meal (CGM) had better body weight gain as compared to control and rest of groups. But Wani *et al.* (2018) found no significant difference in weight gain in experimental groups but during starter phase group fed with 7.5% RGM had higher weight gain as compared to control. Metwally and Farahat (2015) also reported no significant difference in weight gain due to RGM supplementation in broiler diet during various growth periods and overall period. Sherazi *et al.* (1995) reported that group fed with 2.5% RGM showed significantly better body weight gain as compared to control. However, weight gain was depressed when inclusion of RGM was increased up to 10%. Agena *et al.* (2019) studied that experimental diets containing RGM had no significant change in final body weight and total average body weight gain during the whole experimental period if compared to control one and can be included in broiler diets at a level of up to 12% without negative effects on body weight.

During first week, feed intake was almost similar to control in all the treatments but lower feed intake was observed in control supplemented with enzyme treatment. During third week, feed intake was significantly higher than control group in all the treatments but similar to each other. During fourth week, significantly higher feed intake was observed in RGM supplementation at 15% with and without enzyme as compared to control, which was similar to control supplemented with enzyme. However, RGM supplementation at 10% with and without enzyme had higher feed intake as compared to control. During fifth week, feed intake was almost similar to control in all the treatments but was significantly lower in RGM supplementation at 10% with enzyme as compared to control. Wani *et al.* (2018) studied that feed intake was lower during pre-starter phase in 15% RGM group which was similar to control and 5% RGM group but was higher in 10% RGM group which was similar to 12.5 and 7.5% RGM group. During overall phase, 15% group had lower feed intake but rest of groups had almost similar feed intake. Metwally and Farahat (2015) found no significant difference in feed intake due to RGM supplementation in broiler diet. Seyedi and Hosseinkhani (2014) studied that group fed with 6% corn gluten meal lowered the feed intake in broiler as compared to control. Sherazi *et al.* (1995) reported that group fed with 10% RGM had significantly lower feed intake as compared to control. Agena *et al.* (2019) reported that RGM can be included in broiler diets at a level of up to 12% without negative effects

Table 1

Percent ingredient composition of experimental diets for RGM

Ingredients %	Starter						Grower						Finisher					
	T_1	T_2	T_3	T_4	T_5	T_6	T_1	T_2	T_3	T_4	T_5	T_6	T_1	T_2	T_3	T_4	T_5	T_6
Maize	55.38	55.5	49.51	49.59	47.4	47.5	57.2	57.1	53.54	53.44	50.8	51	61.75	61.6	57.6	57.6	55.2	55.32
DORP	1.80	1.58	11.0	10.7	15.0	14.8	1.06	1.06	8.35	8.35	13.2	12.8	3.0	3.0	10.8	10.6	15.22	15.0
GNC	6.2	6.2	8.7	8.7	7.41	7.41	6.0	5.9	9.2	9.2	6.7	6.9	3.0	2.76	6.0	6.1	3.7	3.7
SBM	30.0	30.0	13.7	13.8	8.0	8.0	28.9	29.0	12.1	12.1	7.4	7.3	25.7	26.0	9.0	9.0	4.2	4.2
Oil	3.1	3.1	3.5	3.5	3.5	3.5	3.55	3.55	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6
RGM	0	0	10.0	10.0	15.0	15.0	0	0	10.0	10.0	15.0	15.0	0	0	10.0	10.0	15.0	15.0
DCP	0.8	0.8	1.0	1.0	1.0	1.0	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6
LSP	2.0	2.0	1.8	1.8	1.8	1.8	2.0	2.0	1.9	1.9	1.9	1.9	1.7	1.7	1.7	1.7	1.7	1.7
Lysine	0	0	0.27	0.29	0.37	0.37	0	0	0.19	0.19	0.28	0.28	0	0	0.18	0.18	0.26	0.26
Methionine	0.2	0.2	0	0	0	0	0.17	0.17	0	0	0	0	0.13	0.12	0	0	0	0
Enzymes**	0	0.1	0	0.1	0	0.1	0	0.1	0	0.1	0	0.1	0	0.1	0	0.1	0	0.1
Additives*(g)	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Total (Kg)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

*Additives include Salt 300 g, Vitamin AB_2D_3K 15g, Vitamin B complex 15 g, Trace minerals 65 g, Toxin binder 50 g, Vitamin B_{12} 20 g, Coccidiostat 60 g.; **Each gram contains: β-Glucanase: 100000 U, Xylanase: 70000 U, Pectinase: 13000U, Cellulase: 4000 U, Acid Protease: 1000 U, Neutral Protease: 1000U, Mannanase: 800 U, α-Glucosidase: 800 U, Amylase: 1000 U, Lipase: 200 U, Phytase: 100 U, α-Galactosidases: 20 U.

Table 2

Effect of RGM supplementation on weekly growth performance

Variables	T_1	T_2	T_3	T_4	T_5	T_6	S.E.M.	P value
			Weekly body weight gain					
1st week	83.79^{a}	86.22^{ab}	94.60^{cd}	95.15^{d}	89.53^{bc}	91.93^{cd}	0.981	≤0.05
2nd week	229.25	231.31	237.96	241.61	234.96	236.31	1.359	0.084
3rd week	301.21^{a}	324.52^{b}	330.41^{b}	331.50^{b}	324.93^{b}	329.22^{b}	2.331	≤0.05
4th week	376.60	387.02	384.87	390.25	386.68	387.97	1.853	0.389
5th week	388.89^{b}	361.22^{a}	352.60^{a}	347.65^{a}	373.78^{ab}	371.18^{ab}	3.621	≤0.05
			Weekly feed intake					
1st week	186.83^{b}	171.50^{a}	182.74^{ab}	178.14^{ab}	177.49^{ab}	181.74^{ab}	1.384	≤0.05
2nd week	461.01	455.68	458.60	463.39	458.30	460.65	0.954	0.264
3rd week	623.06^{a}	647.13^{b}	642.20^{b}	642.79^{b}	642.68^{b}	645.83^{b}	1.962	≤0.05
4th week	683.88^{a}	719.99^{c}	706.65^{b}	712.05^{bc}	720.44^{c}	720.12^{c}	2.890	≤0.05
5th week	779.48^{b}	768.41^{ab}	770.65^{ab}	762.68^{a}	768.14^{ab}	770.05^{ab}	1.422	≤0.05
			Feed conversion ratio					
1st week	2.23^{b}	1.99^{a}	1.93^{a}	1.87^{a}	1.98^{a}	1.98^{a}	0.0264	≤0.05
2nd week	2.01	1.97	1.93	1.92	1.95	1.95	0.0103	0.100
3rd week	2.07^{b}	1.99^{a}	1.94^{a}	1.94^{a}	1.98^{a}	1.96^{a}	0.0108	≤0.05
4th week	1.82	1.86	1.84	1.83	1.86	1.86	0.0083	0.515
5th week	2.01^{a}	2.13^{ab}	2.19^{c}	2.20^{c}	2.06^{ab}	2.08^{ab}	0.0196	≤0.05
			Protein efficiency ratio					
1st week	2.04^{a}	2.28^{b}	2.35^{bc}	2.43^{c}	2.29^{bc}	2.30^{bc}	0.0275	≤0.05
2nd week	2.26	2.31	2.36	2.37	2.33	2.33	0.0122	0.107
3rd week	2.25^{a}	2.33^{b}	2.39^{b}	2.40^{b}	2.35^{b}	2.37^{b}	0.0125	≤0.05
4th week	2.82	2.76	2.79	2.81	2.75	2.76	0.0129	0.503
5th week	2.56^{b}	2.41^{ab}	2.35^{a}	2.34^{a}	2.50^{ab}	2.47^{ab}	0.0220	≤0.05
			Calorie efficiency ratio					
1st week	0.1497^{a}	0.1676^{b}	0.1726^{bc}	0.1781^{c}	0.1681^{bc}	0.1687^{bc}	0.0020	≤0.05
2nd week	0.1658	0.1692	0.1729	0.1738	0.1709	0.1710	0.0009	0.107
3rd week	0.1585^{a}	0.1644^{b}	0.1687^{b}	0.1691^{b}	0.1658^{b}	0.1671^{b}	0.0009	≤0.05
4th week	0.1776	0.1734	0.1757	0.1768	0.1731	0.1738	0.0008	0.503
5th week	0.1609^{b}	0.1517^{ab}	0.1476^{a}	0.1471^{a}	0.1570^{ab}	0.1555^{ab}	0.0014	≤0.05

Means with different superscripts differ significantly.

Table 3

Effect of RGM supplementation on carcass traits and blood biochemical profile

Variables	T_1	T_2	T_3	T_4	T_5	T_6	S.E.M.	P value
Eviscerated %	68.61	70.80	68.50	68.51	71.51	69.40	0.436	0.286
Dressing %	55.98	56.49	56.48	56.50	56.50	56.64	0.238	1.000
Heart %	0.51^{a}	0.71^{b}	0.54^{a}	0.51^{a}	0.52^{a}	0.53^{a}	0.019	≤0.05
Liver %	2.21^{ab}	2.67^{ab}	2.17^{ab}	2.07^{a}	2.74^{b}	2.03^{a}	0.081	≤0.05
Abdominal Fat %	2.23^{ab}	1.83^{a}	2.06^{ab}	2.46^{ab}	3.34^{b}	2.92^{ab}	0.159	≤0.05
Giblet %	5.20^{a}	6.24^{b}	4.95^{a}	4.91^{a}	5.89^{ab}	5.00^{a}	0.148	0.135
Gizzard %	2.48	2.86	2.23	2.32	2.63	2.42	0.074	0.007
SGPT	6.44	6.42	6.55	6.63	6.53	6.56	0.056	0.918
SGOT	263.09^{a}	261.86^{a}	265.60^{a}	267.19^{a}	276.70^{ab}	283.90^{b}	2.129	≤0.05
BUN	6.34	6.37	6.33	6.35	6.34	6.34	0.042	1.000
Creatinine	0.46	0.47	0.46	0.49	0.47	0.47	0.009	0.961

Means with different superscripts differ significantly.

Table 4

Effect of RGM supplementation on economics and net profit

Variables	T_1	T_2	T_3	T_4	T_5	T_6
Total feed cost (Rs.)	68.56	69.56	67.42	67.79	66.18	67.12
Chick cost (Rs.)	16.0	16.0	16.0	16.0	16.0	16.0
Total cost (Rs.)	84.56	85.56	83.42	83.79	82.18	83.12
Finisher body weight (Kg)	1.422	1.434	1.444	1.450	1.454	1.460
Selling price (@ 65/Kg)	92.48	93.25	93.90	94.29	94.53	94.96
Profit	7.91	7.69	10.48	10.50	12.35	11.84

on feed intake at grower and finisher rearing stages as well as cumulative period.

During first and third week, all the treatments had significantly lower FCR as compared to control. During second and fourth week, there was no significant difference in FCR among various dietary treatments. During fifth week, RGM supplementation at 15% with and without enzyme had almost similar FCR as compared to control but RGM supplementation at 10% with and without enzyme had significantly higher FCR as compared to control. Singh *et al.* (2020) reported non-significant FCR for overall period in RGM supplemented treatments. Wani *et al.* (2018) and Metwally and Farahat (2015) also observed that FCR was almost similar and had no significant difference by adding RGM into diet at various levels. Seyedi and Hosseinkhani (2014) studied that group fed with 12% corn gluten meal (CGM) had better FCR as compared to control. Agena *et al.* (2019) studied that in broiler diets with 12% RGM had no negative effects on FCR.

During first week, all the dietary treatments had significantly higher PER and CER as compared to control but were similar to each other. During third week, PER and CER were significantly higher in all the dietary treatments as compared to control and were similar to each other. During fifth week, PER and CER in RGM 10% group with and without enzyme were lower than control group but in RGM 15% group with and without enzyme, PER was similar to control group. Singh *et al.* (2020) also reported better PER and CER in starter and grower phase but similar values for overall period.

The RGM supplementation at 10% without enzyme (T_3) and with enzyme (T_4) had almost similar eviscerated, liver, dressing and gizzard percentage. Giblet percentage was almost similar to control group (T_1) but lower than control group supplemented with enzyme (T_2). However, at 15% supplementation of RGM (T_5 and T_6) had almost similar eviscerated, dressing and gizzard percentage. In T_5, abdominal fat percentage was higher as compared to control and other groups but liver percentage was almost similar to control. T_6 had similar giblet percentage as compared to T_1 but lower than T_2. Moreover, enzyme supplementation with respect to their non-enzyme groups had significant effect in T_2 on heart and giblet percentage only. Wani *et al.* (2018) observed no significant difference among different carcass traits with addition of RGM at different levels in broiler diet. Metwally and Farahat (2015) found no significant effect on carcass dressing and relative organ weights with addition of RGM at different levels. Seyedi and Hosseinkhani (2014) studied that addition of low levels (upto 6%) of corn gluten meal (CGM) into broiler diets had no effect on carcass characteristics but higher levels improved empty body weight, breast weight and reduced abdominal fat of the birds. Agena *et al.* (2019) found no significant change in weight percentages of dressing, intestine, gizzard, proventriculus, liver, heart, lung, spleen, crop and kidney relative to live body weight. Sherazi *et al.* (1995) reported no significant difference in dressing percentage on addition of different levels RGM into broiler diets. Dinani *et al.* (2018) concluded that the feeding of rice DDGS and RGM in combination levels of 12.5% and 15%, respectively with or without enzyme supplementation do not have any adverse effects on the carcass traits, but adversely affect abdomen fat, feather percentage, small intestine weight, length and density of broiler chickens.

There was no significant difference among SGPT, BUN and creatinine values among various groups. The supplementation of RGM at 15% without enzyme had significantly higher SGOT values as compared to control. Wani *et al.* (2017); Agena *et al.* (2019); Dinani *et al.* (2019) and Metwally and Farahat (2015) reported that serological parameters had no significant difference with addition of RGM into broiler diet. Kumar *et al.* (2016) also reported no significant difference in different haematological parameters on inclusion of RGM up to 21% in the diet of growing dairy calves. The possible reason for higher SGOT level may be non-specific as other parameters like SGPT, BUN and creatinine were normal.

The RGM supplemented groups yielded more profit than without RGM supplemented birds. This was due to RGM supplemented birds had higher body weight gain than without RGM supplemented birds. The highest profit of margin was observed in T_5 treatment (15% RGM supplementation) and least profit of margin was observed in T_2 treatment (control treatment supplemented with enzymes). Similarly, Sherazi *et al.* (1995) reported that broiler chicken ration containing 10.0% rice gluten protein was the most economical. But, Agena *et al.* (2019) revealed no significant difference in the total returns and net profit among dietary treatments as compared with the control.

CONCLUSION

It was concluded that RGM can be supplemented into broiler diets up to 15% replacing soybean meal and other protein sources efficiently without any negative effect on weekly growth performance, carcass, serum biochemical parameters and cost economics. Moreover, enzyme supplementation did not show any significant impact in RGM based diet.

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