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Growth Performance and Blood Profile of Broiler Fed Fermented Rice Bran by Rumen Inoculums and Supplementation of Urea and Molasses

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Abstract—*Rice bran is available feed ingredients in rice-producing countries but it contains some anti-nutritional substances like fiber, phytate-Petc, those are not available by the non-ruminant animals due to lack of related enzymes. To make those available it was fermented by rumen inoculates (10%) expecting enzymatic action, production of organic acid, bioactive components and single cell protein. Fermented rice bran was analyzed for CP (crude protein), CF (crude fiber) and P (phosphorus). Feeding trial was conducted using a number of 150-day old unsexed broilers (Cobb 500) allocated in five dietary groups having 10 birds in each. Dietary groups were 1-RB (rice bran); 2-FRB (fermented rice bran); 3-UFRB (2% urea fermented rice bran), 4-MFRB (5% molasses fermented rice bran) and 5-UMFRB (2% urea and 5% molasses fermented rice bran). Body weight and feed refusal were recorded weekly. Blood sample were collected after 35 days trial. The protein content of diet increased in groups offered FRB (22.55%), UFRB (23.11%), MFRB (22.85%) and UMFRB (23.67%) in comparison to RB group (22.43%). Body weight was 1074, 1120, 1166, 1112 and 1137 g/bird respectively where every cases RB showed highest weight gain ($p<0.05$). Feed intake was 1793, 1790, 1777, 1774 and 1756g/birds respectively, among them lowest was in UMFRB group of the broiler. Feed conversion ratio was low (1.61) in UFRB group ($p<0.05$). Cholesterol concentration was low in all the groups where rice bran was fermented (with or without additive) in comparison to unfermented group. Weight of dressed carcass was more or less similar in all the groups ($p>0.05$). So it would be concluded that addition of non-protein nitrogen substances during fermentation process of rice bran by rumen inoculate improve growth performance of broiler.*

Keywords*: Rice bran, fermentation, urea, broiler, production performance, blood profile.*

1. INTRODUCTION

Rice bran is one of the most promising and abundant milling by-products having 12 to 15% protein [29] and a good source of well-balanced amino acid [26]. Considering limitation of the rice bran as feed for non-ruminant animal different fermentation process would improve quality and quantity of protein [1,18] as well as increase availability of different minerals [25]. During fermentation microbial inoculums produce various enzymes such as α-amylase, α-acetolactate, decarboxylase, β-endoglucanase, hemicellulase, phytase, maltogenic amylase and xylanase which possess a potential to degrade fiber [7, 24 and 25]. *Bacillus amyloliquefaciens*produces phytase enzyme during fermentation which is important to reduce phytate-P of rice bran [15]. The inclusion of fermented rice bran also enhances production performance of broiler [5, 6]. Moreover microbes present in fermented rice bran from rumen liquor may serve as probiotic for poultry. Those microbes entered into the gut and digested as protein to the amino acid as end product. Urea-ammonia treatment of crop residues has been reported to improve digestibility, milk yield, weight gain and feed efficiency in animals [9]. Rice milling waste was treated with urea, poultry droppings and water, while untreated waste served as control. Urea treated RMW diet improved body weight, weight gain and dressed weight of broilers. The increase in crude as a resultant effect of the non-protein nitrogen contribution from urea as reported by Fontenot [11]. Considering rumen microorganism as a user of nonprotein nitrogenous substances aided by soluble sugar for proliferation as well as fiber simplifier and for phytase enzyme activities it was grown in rice bran considering as substrate. Fermented rice bran was further studied in the broiler for growth performance and blood profile to know its nutritive value.

2. MATERIALS AND METHODS

2.1. Fermentation of rice bran:

Rumen fluid collected from a mature cow was filtered using cheesecloth and the filtrate was considered as inoculum diluted by the buffer (9.8g $NaHCO_3$, 0.04g $CaCO_3$, 0.47g NaCl, 0.57g KCl, 3.3g Na_2HPO4, 0.12g $MgSO_4.7H_2O$ in 1 liter carbonated distilled water) at 1:1 ratio. Diluted inoculums

was added at 10% level for control and was further added 2% urea, 5% molasses, 2% urea plus 5% molasses for other groups. Different groups of rice bran were fermented for 48 hours anaerobically in plastic container at 39°C. Fermented rice bran was dried under the sunlight.

2.2. Feeding trial:

One hundred and fifty day old broiler chicks (Cobb 500) were allocated divided into five dietary groups (RB, FRB, UFRB, MFRB and UMFRB) having 3 replications of 10 birds in each. Feed and water were available ad libitum throughout the experimental period. Chicks were housed in wire netted battery cages with mesh grate floors above excreta collection tray. Birds were vaccinated for Newcastle Disease-infectious Bronchitis (ND-IB) at 7 days and Infectious Bursal Disease (IBD) at 14th days of age.

The control diet was formulated according to table 1 where unfermented RB was included at 10%. For other diets RB was completely replaced by (FRB)-Fermented rice bran; (UFRB)-2% urea added fermented rice bran, (MFRB)-5% molasses added fermented rice bran, (UMFRB)-2% urea and 5% molasses added fermented rice bran.

Table 01: Formulation of experimental diets and chemical composition

Ingredients(%)		Dietary groups					
		Components	RB	FRB	UFRB	MFRB	UMFRB
Maize	48.50	CP (%)	22.43	22.55	23.11	22.85	23.67
Protein Conc.	13.00	CF (%)	3.95	3.91	3.84	3.89	3.72
Rice bran	10.00	Phosphorus	0.89	0.87	0.77	0.84	0.67
Soya Meal	22.00	Calculated Value					
DCP	1.50	ME (kcal/kg)	3180	3165	3170	3195	3183
Soybean oil	4.00						
Salt	0.50	[1]Vitamin contains in the following per kg: Vitamin A: 2400000 IU, Vitamin D: 1000000 IU, Vitamin E: 16000 IU, Vitamin K: 800 mg, Vitamin B1: 600 mg, Vitamin B_2: 1600 mg, Vitamin B_6: 1000 mg, Vitamin B_{12}: 6 mg, Niacin: 8000 mg, Folic acid: 400 mg, Pantothenic acid: 3000 mg, Biotin: 40 mg and Antioxidant: 3000 mg.[2]Mineral mixture contains in the following per kg: Cobalt: 80 mg, Copper: 2000 mg, Iodine: 400, Iron: 1200 mg, Manganese: 18000 mg, Selenium: 60 mg and zinc: 14000 mg.					
DL-Methionine	0.15						
Choline Chloride	0.05						
Mineral Mixture[2]	0.05						
Vitamin[1]	0.25						
Total	100						

N.B: RB-Control; FRB-Fermented rice bran; UFRB-2% Urea treated fermented rice bran; MFRB-5% molasses treated fermented rice bran; UMFRB- 2% urea and 5% molasses treated fermented rice bran.

Feed offered, feed refusal and live weight were recorded weekly. Mortality was recorded daily. At the end of 35 days feeding trial blood samples were randomly collected from 2 birds from each cage. After collection, blood samples were centrifuged at 6000 rpm for 15 minutes to separate serum and stored at -20°C for further analysis. One bird from each cage were selected randomly and slaughtered to determine the carcass traits of broiler.

3. CHEMICAL ANALYSIS

The proximate analysis of ingredients was measured by AOAC [3]. The crude protein content was measured by macro kjehdahl digestion unit using Kjeltec 1030 Auto analyzer. Total phosphorus was measured according to AOAC [4]. The concentration of plasma glucose was enzymatically determined by the method of Huggett and Nixon [13]. Cholesterol was determined by Cholesterol oxidase method [2]. Blood urea level was determined from serum according to Fawcett[10].

4. STATISTICAL ANALYSIS

All recorded and calculated variables were subjected to analysis of variance (ANOVA) [8] in a Completely Randomized Design (CRD) by following a statistical package using statistical computer package program (SPSS). Tukey Pairwise Comparisons was used to compare treatment means [22].

5. RESULTS AND DISCUSSION

5.1 Growth

The inclusion of FRB has a positive effect on growth performance of broiler ($p<0.05$). Live weight gain increased (1107g) and feed conversion ratio improved in UFRB group (1.61) of birds. Dressing percentage of broiler in different dietary groups of birds was not different but numerically it was high in MFRB group ($p>0.05$).

Table 2: Weight gain (g/b), feed intake (g/b), FCR (gFI/LWG) and dressing percentage of birds

Parameters	Dietary groups				
	RB	FRB	UFRB	MFRB	UMFRB
Initial weight	*54.6±2.11	55.2±1.98	59.6±2.56	53.6±2.43	54.5±1.67
Final weight	1074^{c}±21	1120^{b}±27	1166^{a} ±7	1112^{b}±15	1137^{ab}±21
Live weight gain	1020^{c}±16	1065^{ab}±19	1107^{a}±33	1058^{bc}±20	1082^{ab}±20
Feed intake	1793^{a}±42	1790^{ab}±19	1777^{ab}±22	1774^{ab}±36	1756^{b}±38
FCR	1.75^{a}±0.02	1.67^{ab}±0.08	1.61^{b}±0.05	1.68^{ab}±0.02	1.62^{ab}±0.03
Dressing (%)	60.3±2.03	60.0±2.55	60.2±1.95	63.0±1.46	60.1±1.77

N.B: RB-Control; FRB-Fermented rice bran; UFRB-2% Urea treated fermented rice bran MFRB-5% Molasses treated Fermented rice bran UMFRB- 2% urea and 5% molasses Treated Fermented rice bran

*Mean±SD; [abc]Means with dissimilar superscripts are significantly different ($p<0.05$)

Bacteria that are present in rumen inoculums were responsible for fermentation of rice bran may act as probiotic bacteria to improve growth performance and health status of animals[12]. Live weight gain was higher in UFRB group of broilers but feed intake had no difference, so from this result, it could be stated that nutrient availability in the diet may be responsible for weight gain. The result also supported that the most of the agricultural by-products contain cellulose as the major component, which is best for the growth of microorganisms and the production of single cell protein biomass [28] which increase the crude protein content of rice bran [20]. Addition of urea in the FRB using cellulolytic bacteria *B. amyloliquefaciens*as an inoculum improved fermentation and its microbial population [25]. Protein content was also increased after fermentation of cassava waste Supriyati [21] that agree with the result of the present experiment as protein content was increase when urea and molasses were added during fermentation. The main effects of fermented rice bran on the growth performance of broiler chicken may be due to its high concentrations of protein, vitamin, minerals, complex carbohydrates, phytonutrients, phospholipids, essential fatty acids [14, 19 and 23]. Fermented rice bran contains single cell protein which have high protein digestibility, balanced amino acid composition [17]. Some researcher stated that the rumen inoculum contains microbes which have phytase activity [25]. Considering above points like increased protein and its quality, action of phytase enzyme, probiotic effect of microorganism grown during fermentation reflected in the growth performance of broiler.

5.2 Blood metabolites

The concentration of glucose, creatinine, albumin and cholesterol in blood serum was different among the groups ($p<0.05$). In blood serum of birds glucose (4.69 mmol/L), albumin (5.05 g/dL) level was maximum in FRB group (Table 3). Creatinine concentration was lower in UFRB group (0.027 mg/dL) and maximum in RB group (0.15 mg/dL).

Table 3: Glucose (mmol/L), Creatinine (mg/dL), Urea (mg/dL), Albumin (g/dL) and Cholesterol (mg/dL) level of birds' blood.

	Dietary groups				
	RB	**FRB**	**UFRB**	**MFRB**	**UMFRB**
Glucose (mmol/L)	*3.17^{c} ±0.008	4.69^{a} ±0.38	3.48^{c} ±0.11	3.57 ^{bc}±0.26	4.38^{ab} ±0.14
Creatinine (mg/dL)	0.15^{a} ±0.01	0.077^{b} ±0.004	0.027^{c} ±0.005	0.18^{a} ±0.014	0.09^{b} ±0.007
Urea (mg/dL)	17.32^{a} ±1.34	16.68^{a} ±1.59	15.61^{a} ±1.76	17.27^{a} ±0.37	16.61^{a} ±3.78
Albumin (g/dL)	3.59^{c} ±0.12	5.05^{a} ±0.14	4.71^{ab} ±0.43	3.88^{bc} ±0.14	4.23^{abc} ±0.31
Cholesterol (mg/dL)	108.60±6.2	97.75±3.97	98.46±2.98	93.37±2.98	94.47±5.30

N.B: RB-Control; FRB-Fermented rice bran; UFRB-2% Urea treated fermented Rice Bran; MFRB-5% Molasses treated fermented rice bran; UMFRB- 2% Urea and 5% Molasses treated fermented rice bran.
*Mean ± SD; [abc] Means with dissimilar superscripts are significantly different ($p<0.05$)

Kitawaki[16] reported that rats fed with *Lactobacillus* fermented soymilk and soy yogurt exhibited a decrease in serum cholesterol concentrations. In humans, a diet containing milk products fermented by *Bifidobacterium longum*has also been reported to decrease cholesterol level [27]. Bidura[6] reported that a diet supplemented with rice bran fermented by *Saccharomyces spp*. decreased total cholesterol in male ducklings.

6. CONCLUSION

Fermentation of rice bran using rumen inoculums enhance performance of broiler which was further increased when 2% urea was added along with rumen inoculums. Addition of molasses has no further effect on the performance but still better than control either added alone or with urea during fermentation. Fermentation using rumen inoculums with or without additives reduces cholesterol in the blood of broiler an indicator of health status.

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