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Comparison of Rice Bran and Deoiled Rice Bran as Feed Ingredient for Broiler

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Abstract—*A total of 96 day old Cobb 500 commercial broiler chicks were engaged in a feeding trial to compare the effect of rice bran (RB) and de-oiled rice bran (DORB) based diet on growth performance, carcass characteristics and blood metabolites. All chicks were allocated randomly into two dietary groups (7.0% RB and 7.0% DORB) having 4 replications of 12 birds following completely randomized design. Iso-caloric (3000 kcal/kg) and iso-nitrogenous (23% crude protein) diets were offered ad libitum to the birds for 35 days. Live weight, feed offered and feed refusal was recorded weekly. After a 35 days feeding trial few birds were slaughtered for carcass traits and blood samples were collected. Live weight gain, feed intake and feed conversion ratio of two groups were similar (p>0.05) but dressing percentage was higher for the broilers in RB group (p<0.05). Blood urea and phosphorus levels were higher in DORB group (p<0.05). Feed cost was 1.22 BDT (Bangladesh currency) lower due to the inclusion of DORB. Moreover, cost of production was reduced by 0.84 BDT per kg broiler for DORB group. Considering above findings, inclusion of DORB in the diet of commercial broilers would be effective to reduce production cost without hampering the performance of broiler.*

Introduction

Rice bran (RB) is a by-product of rice milling industry which converts into DORB when its oil content extracted in oil industry. Its composition varies according to the type of milling but it contains 15-22% oil, 11-17% protein, 6-14% fibre, 10-15% moisture and 8-17% ash [1]. It is an abundant source of antioxidant compounds such as tocopherols, γ-oryzanol and other phenolics [2], which helps in health benefits including lowering blood cholesterol, decreasing platelet aggregation and anti-inflammation [3]. It is a good source of lysine and methionine [4]. As such RB is considered a suitable feed ingredient for livestock and poultry. During oil extraction chemical and heat treatments has given to RB. It seems reasonable to infer that, those treatments may change the quality of the nutrients presence in the bran that warrants investigations. On other hand, some nutrient profile would proportionately be higher in the DORB than RB due to oil extraction from RB [5-6]. Other benefits include less susceptibility of DORB to the rancidity. Some researchers found that the nutritional value of DORB is equal to the value of RB in broiler diets when diets are adjusted for metabolizable energy by adding oil [7]. Considering availability of DORB and contains higher amount of protein and carbohydrate, the study was conducted to examine the performance of broiler fed on iso-caloric and iso-nitrogenous diets containing either RB or DORB and assess the economics of its addition in broiler diet.

Materials and Methods

Ration and birds

RB and DORB were collected from the same batch of oil extraction of oil industry to confirm the similarities of the nutrients other than oil and analyzed for chemical composition (Table 1) according to [8]. Then two types of iso-nitrogenous (23%) and iso-caloric (3000 kcal/kg) diets were formulated (Table 2). The amount of protein increased 22.2% in DORB than protein content in RB due to extraction of oil. The main sources of protein in diet was protein concentrate (60% CP), Soybean meal (45% CP), RB and DORB. The ingredients content rearranged to make the ration iso-nitrogenous (Table 3).

Table 1: Chemical composition (g/100gDM) of RB and DORB

Parameter	RB	DORB
DM	90.00	89.00
CP	14.61	17.85
CF	11.05	14.80
EE	17.20	1.60
Ash	9.90	14.30
NFE	47.24	51.45

A total number of 96 one day-old (Cobb 500) commercial broiler chicks collected from CP Bangladesh Ltd. and the feeding trial was conducted for 35 days.

Table 2: Ingredients (%) in ration and their amount

Ingredients	Groups	
	RB	DORB
Maize	51.00	51.00
Protein Conc.	12.50	11.50
Soybean oil	5.00	5.00

Soya meal	22.00	23.00
DCP	1.50	1.50
Vit-Mineral Mixture	0.30	0.30
Salt	0.50	0.50
DL Methionine	0.15	0.15
Choline Chloride	0.05	0.05
Rice bran	7.00	0.00
De-oiled rice bran	0.00	7.00
Total	100.00	100.00

Management practices

Two different diets were offered to the groups (7.0% RB and 7.0% DORB) *ad libitum* for 35 days. All birds were reared in cages having floor space of 0.91 m^2 (120 cm×76 cm). Saw dust was spread as a liter material, wilting and replacement of liter material was performed on regular basis to maintain appropriate moisture level and to reduce level of ammonia production. The chicks were brooded in respective cages using one 100 watt electric bulbs in each cage. Birds were immunized against New Castle Disease, at ages 4 and 19 (booster dose) and Infectious Bronchitis at the age of 11 via intraocular route.

Data collection

Birds were weighed at the first day of experiment (initial body weight) and weekly basis for all birds from each replication. Feed offered and feed refusals were weighed at 7 days interval. Feed conversion ratio was calculated from the data of feed intake and live weight gain (feed intake/Kg live weight gain). Representative birds from each group were slaughtered at the end of the feeding trial and all cut up parts of the birds were recorded.

Collection and analysis of blood plasma

Blood samples (5ml) were taken from the wing vein of each replicate bird. Collected blood samples were centrifuged at 6000 rpm for 10 minutes for plasma separation. The plasma was then transferred into another eppendorf tube and preserved at -20ºC until analysis. Blood urea and phosphorus levels were determined from collected plasma according to the method described by some researchers [9-10].

Table 3: Contribution of different feed ingredients in CP content of ration

Ingredients	Groups	
	RB	DORB
Protein Conc. (%)	8.11	7.46
Soya meal (%)	9.68	10.12
Rice bran (%)	1.02	0.00
De-oiled rice bran (%)	0.00	1.25
Total CP (%) (Out of 23.43%)	18.81	18.83
Chemical composition		
Dry Matter (%)	89.13	90.05
CP (%)	23.43	23.46
CF (%)	3.68	3.57
EE (%)	5.57	5.26
Ash (%)	5.03	6.29
NFE (%)	51.42	51.47

Statistical analysis

All recorded and calculated variables were subjected to analysis of variance (ANOVA) in a Completely Randomized Design (CRD) using SPSS statistical computer package program. Tukey Pairwise Comparisons was used to compare means of the parameters of two groups.

Results and Discussion

Production performance

Live weight gain, feed intake and feed conversion ratio were similar in both groups (Table 4). So, growth performance study is a good indicator to compare the protein quality of RB and DORB, as all other ingredient was added in two diets were in same amount. Some research showed that presence of essential oils in rice bran increase the absorption and digestion of lipoproteins [11-12] which reflected in the FCR of the RB group. The findings also supported by other researchers showing fat from vegetables reduce the passage rate of the ingested feed through the gastrointestinal tract allowing better nutrient absorption and utilization [13].

Blood metabolites

Significant difference observed in concentration of urea and phosphorus level in blood serum between the groups and concentration of blood serum urea and phosphorus was higher in DORB group than RB group (Table 5).

Table 4: Growth performance of broiler during feeding trial

Parameter	Groups	
	RB	DORB
Initial weight (g)	46.5±1.5*	46.5±3.7
Final weight (g)	1351±30	1343±18
Total weight gain (g)	1305±32	1298±21
Feed intake (g)	2192±38	2221±33
FCR (gFI/gWG)	1.68±0.09	1.71±0.03

*Mean±SD; Means of similar parameters are not different ($p<0.05$)

Table 5: Blood parameters of birds at the end of the feeding trial

Parameter	Group	
	RB	DORB
Blood Urea (mg/dl)	*5.56[b]	7.59[a]
Phosphorus (mg/dl)	4.75[b]	5.35[a]

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

Urea level in blood plasma (5.56 mg/dl) was lower in RB group where 7.0% RB were used than DORB group (7.59 mg/dl) contained 7.0% DORB. Presence of any nutrients in blood indicates that they are available for absorption and utilization by the animals. Protein sources with greater biological value lead to greater nitrogen retention and subsequently in higher growth rates in birds. Moreover, it would be expected that a dietary protein source with higher

biological value causes lower concentration of urea and uric acid in blood serum compared to those with lower biological values [14]. Therefore, urea and more decisively uric acid can be used as influential criteria to assess the bio-availability of a protein source alone or in combination with different protein sources for broilers. McCall *et al.,* [15] reported that about 90% of phosphorus in RB is as phytate. Phytate form some complexes with protein, vitamin, and minerals, which decrease the bioavailability of nutrients in poultry diets [16], and lead to reduction in the Fe, Ca, and Zn accumulation of tibia [17]. Phosphorus level of blood plasma of DORB group was high which means that phosphorus availability was high in DORB group. Ali Akbar [18] stated that extrusion (125° C and 40-bar) of RB might be reduced the phytin level, which subsequently makes phosphorus more available in chicks. At the same time high heat treatment causes protein to be degraded in quality in terms of denature of protein of RB increase the phosphorus availability more than 80% reported by Tangendjaja *et al.,* [19] which also supports the result of the present experiment as in the preparation of DORB from RB high heat is used for oil extraction.

Carcass traits

In this experiment it was found that weights of internal organs of broiler are more or less similar between the dietary groups. But dressed yield (Table 6) was comparatively ($p \leq 0.005$) high (62.54%) in RB group than DORB group (60.69%). Jamroz [20] reported that feeding diets with high fibre content increased the volume of the digestive organs and organ development in chickens, ducks and geese and in the present experiment weight of liver, gizzard and giblet were high in DORB group as crude fiber content is high in DORB (>12%) than RB (>6%).

Table 6: Comparative weight (% of body weight) of different organ of dressed carcass

Parameter	Group	
	RB	DORB
Viscera (%)	5.94	6.44
Heart (%)	0.59	0.49
Gizzard (%)	3.57	4.15
Liver (%)	2.54	3.05
Drumstick (%)	4.13	3.55
Thigh (%)	7.67	8.47
Shank (%)	4.05	3.95
Giblet (%)	9.07	10.63
Dressing percentage (%)	62.54[a]	60.69[b]

[ab]Means with dissimilar superscripts are significantly different ($p<0.05$)

Arabinoxylan comprises the bulk of the hemicellulose in rice bran and deoiled rice bran, is mainly responsible for the increased size of the digestive organs [21-22].

Economic study

Price of DORB is lower than RB because it is by product of oil extraction mill. It contains more crude protein than RB. So, RB can be replaced by using DORB as it can supply more protein and reduce the required amount of other protein rich ingredients which are high in price. In the present experiment cost per kg of feed in RB group was 41.46 BDT and in DORB group was lower (40.24BDT). Feed cost per kg live broiler production was 69.66 BDT for RB and 68.82 BDT for DORB group. So, production cost for per kg of broiler was 0.84BDT less required in DORB group. Considering above points DORB found suitable to use in broiler diet in comparison to RB considering its quality and cost effectiveness for production of broiler.

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