USING RICE BRAN IN LAYING HEN DIETS

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ABSTRACT

Rice bran is an energy and protein rich ingredient used in poultry feeding. To balance energy and protein requirements. The purpose of this study is to examine the effects of rice bran on performance and egg quality during peak production of a commercial White laying strain of 22 week of age. Dietary treatments were consisted by inclusion of rice bran at 0, 5, 10 and 15% levels. Each treatment had 6 reps in which 12 birds were randomly assigned in wired floor battery cages equipped with nipple drinkers and through feeders. Layers accessed to feed and water freely. Lighting regimen was adjusted to 16h light/8h dark. The experiment lasted for 10 weeks.

Overall results of the present experiment indicated that rice bran could be included up to 10% without any adverse affect on laying performance, egg quality and digestive organs.

Key words: Rice Bran, laying hens, egg production, egg quality

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INTRODUCTION

Rice bran is a powdery fine, fluffy material that consists seeds or kernels, in addition to particles of pericarp, seed coat, aleurone, germ and fine starchy endosperm. Rice bran is rich in B-vitamins and tocopherols and its nutrient density and profiles of amino acids and fatty acids, including 74% of unsaturated fatty acids, are superior to cereal grains. Both rice bran protein and fat are of relatively high biological value [7]. Adding hulls back to bran significantly change its nutrient composition particularly for poultry. It was reported [10] that hulls adulteration appears to be the most important constraint to the utilization of rice bran particularly when the hull content is greater than 10% of the rice bran.

Yet rice brans' full nutrient potential can not be utilized due to the presence of anti-nutritional factors, particularly endogenous lipase and peroxidase enzymes that rapidly oxidase fats and oils released during milling process [11]. It was reported that further deterioration through hydrolytic and oxidative rancidity may result in poor livestock acceptability and growth depression particularly in chicks [6, 4]. It was also reported that storage reduced metabolizable energy content of the rice bran by 148 Kj/kg per week [1]. It was reported that 50-60% of the oil was affected within 4-6 weeks depending upon storage temperature and humidity demonstrated that 250 ppm of ethoxyquin was effective in reducing rancidity for up to 4 weeks even when the temperature and humidity were high. Extrusion cooking process has been reported to be the only viable method of stabilizing the oil in rice bran [8]. Heat processing must be applied as soon as possible after milling and should be heated up to 130-140 ºC and held at 97-99 ºC before cooling. Then the oil is stabilized for 30-60 days without an appreciable increase in free fatty acids [8].

Rice also contains triypsin chemo-trypsin inhibitors, phytate and hemaglutinin-lectin. Its toxic or indigestible components, rice bran is not ready a human food source, although it is incorporated into poultry and cattle feeds as a low quality ingredient [7]. Today, however, knowledge and technological advances have made it possible to tackle these toxicity problems in a better way. A significant development was achieved by application of heat treatment in the alleviation of the adverse effects of the toxicities caused by raw rice bran. This method includes acetic acid (1%) treatment plus wet extrusion cooking at 135ºC for 10 seconds [7]. With this technique chicks gained 29% more weight and 13% better feed conversion ratio than birds on the control diet.

Among other factors limiting the maximum utilization of rice bran in poultry diets is phytin content. About 90% of the phosphorus in rice bran is in the form of phytic acid or phytate making complex with several other and only 18% of this is available. Phytate not only reduce phosphorus availability, but also impairs the utilization of other minerals such as Ca, Fe, Zn, Cu and Co [9] and has a negative effect on protein digestibility and energy utilization, probably due to inhibition of digestive enzymes icluding pepsin, tripsin and α-amilase [2, 9].

The results of a study carried out with layers using rice bran at 0, 5, 10, 15, 20 and 25% levels indicated that use of 25% of mixed rice bran in layer diets had no adverse effect on the productive performance. In this study it was also reported that egg weight appeared to have increase as the level of rice bran increased due probably to the elevated level of linoleic acid in the diet [5].

In Turkey rice production is important for human consumption and yield was about 400 000 ton in 2004. The highest yield was obtained in Edirne province with 82 455 tons [3]. The objective of this study was to examine the effects of different levels of unprocessed rice bran on productive performance and digestive organs of while commercial layers.

MATERIAL AND METHODS

This experiment was carried out to examine the effects of inclusion of rice bran on laying hen performance, egg characteristics and intestinal organs weights of commercial layers during peak production. Two hundred and eighty-eight of 22-week-old Bovans White strain laying hens were obtained from a local parent stock supplier and randomly transferred to commercial compact-type wire cages (50x44x46 cm) providing 4 hens per cage. Battery cages were equipped with nipple drinkers and trough feeders. The experiment was set up in a completely randomized design where 72 hens were randomly assigned to each of four treatments with six replicates per each. Each replicate represented three cages in which the hens were fed from the same feed trough. Laying hens were maintained in a house with windows and received additional artificial light to provide 16 h light and 8 h dark daily. Dietary treatments were consisted by inclusion of rice bran at 0, 5, 10, and 15%, respectively. The proximate composition used in the present study is presented in Table 1.

Table 1- Proximate composition of rice bran

D. matter, %	E. extract, %	C. Protein, %	C. Fiber, %	Ash, %
87.90	16.98	14.93	11.42	8.64

Experimental diets were formulated to contain 17.5% CP and 2800 Kcal/kg metabolizable energy, and all were

Table 2. The ingredient and chemical composition of experimental diets

Ingredients, %	**Rice bran, %**			
	0	**5**	**10**	**15**
Corn	61.97	57.76	53.53	49.30
Rice Bran	**0**	**5**	**10**	**15**
Full-fat soybean	8.13	8.68	9.23	9.77
Soybean meal	15.89	14.58	13.28	11.98
Gluten Meal	2.00	2.00	2.00	2.00
Fish meal	1.00	1.00	1.00	1.00
Limestone	9.29	9.29	9.3	9.31
Monocalcium phosphate	0.99	0.97	0.95	0.94
Salt	0.24	0.23	0.22	0.21
$NaHCO_3$	0.10	0.10	0.10	0.10
Vitamin + mineral mix[A]	0.25	0.25	0.25	0.25
DL-Methionine	0.12	0.12	0.12	0.12
Phytase	0.02	0.02	0.02	0.02
Calculated analysis, %				
Metabolizable Energy,	2800	2800	2800	2800
kcal/kg	11.72	11.72	11.72	11.72
MJ/kg				
Crude protein,%	17.5	17.5	17.5	17.5
Ether extract, %	4.94	5.69	6.44	7.19
Crude fiber, %	3.06	3.47	3.88	4.29
Calcium, %	3.85	3.85	3.85	3.85
Available phosphorus, %	0.42	0.42	0.42	0.42
Lysine, %	0.91	0.90	0.89	0.89
Methionine, %	0.42	0.42	0.42	0.42

[A]Provided per kg of diet: vitamin A, 8000 IU; vitamin D3, 2500 IU; vitamin E, 30 mg; vitamin K3, 2.5 mg; vitamin B1, 2 mg; vitamin B2, 5 mg; vitamin B6, 2 mg; vitamin B12, 0.01 mg; niacin, 30 mg; calcium-D-pantothenate, 8 mg; folic acid, 0.5 mg; D-biotin, 0.045 mg; choline chloride, 800 mg; vitamin C, 50 mg; Mn, 70 mg; Fe, 35 mg; Zn, 70 mg; Cu, 8 mg; I, 1 mg; Co, 0.2 mg; Se, 0.25 mg

Table 3. Effects of rice bran on laying performance (22-30 week of age)[A]

Rice bran levels %	Egg production (%)	Feed intake (g/hen/day)	Egg weight (g/egg)	Egg mass (g/hen/day)	Feed conversion ratio (g feed/g egg)
0	93.6 **a**	104.8 **a**	63.0	59.0 **a**	1.778
5	91.0 **ab**	101.1 **ab**	62.3	56.7 **ab**	1.790
10	92.3 **ab**	101.7 **ab**	61.7	56.9 **ab**	1.791
15	87.8 **b**	98.1 **b**	62.0	54.4 **b**	1.805
P level	1.110	1.050	0.435	0.647	0.022
SEM	0.216	0.177	0.689	0.090	0.984

[a-b] Means in the same column with different letters differ significantly (*$P < 0.05$*).
[A] Means represent 6 replicates and 12 birds in each, comprising 72 birds per treatment.

Table 4- Effect of rice bran on the organ weights (% body weights, g) of laying hens

Rice bran levels %	Heart	Liver	Gizzard	Pancreas	Proven-triculus	Duo-denum	Jeju-num	Ileum	Cecum
0	0.40	2.65	1.59	0.21	0.33	0.65 **b**	1.29	1.06	0.81
5	0.43	2.46	1.50	0.23	0.35	0.63 **b**	1.35	1.13	0.71
10	0.42	2.36	1.62	0.29	0.33	0.67 **b**	1.24	1.09	0.78
15	0.40	2.45	1.72	0.22	0.36	0.82 **a**	1.46	1.14	0.84
P level	0.641	0.172	0.421	0.257	0.620	0.068	0.185	0.879	0.760
SEM	0.010	0.047	0.042	0.015	0.009	0.028	0.036	0.035	0.041

[a-b] Means in the same column with different letters differ significantly ($P < 0.05$).

Table 5- Effects of rice bran on egg quality (22-30 week of age)[A]

Rice bran levels %	Haugh unit	Yolk weight (g)	Albumen weight (g)	Shell thickness (μ)	Shell weight (g)
0	96.0 **b**	14.8	35.9	301.6	8.4
5	101.8 **ab**	14.0	38.5	308.9	8.2
10	100.1 **ab**	14.0	35.8	320.0	7.7
15	102.2 **a**	14.1	37.4	306.7	8.1
P level	0.123	0.255	0.232	0.455	0.449
SEM	0.902	0.100	0.488	2.379	0.094

[a-b] Means in the same column with different letters differ significantly ($P < 0.05$)
[A] Means represent 6 replicates and 4 eggs in each, comprising 24 eggs per treatment.

isocaloric and isonitrogenous (Table 2). All the diets were fed and in ad libitum in mash form to the laying hens from 22 to 30 week of age during which the performance of laying hens was monitored.

The birds were weighed at the start (22 week of age) and end (30 week of age) of the trial. The initial and final weights of hens were 1446±27 g and 1656±128 g, respectively. Feeds intake was recorded weekly. Egg production was determined daily. Egg weight was determined weekly by weighing all the collected eggs from the experimental groups. Egg quality parameters were determined on 4 randomly selected eggs from each replicate at the end of each week (24 eggs per treatment per week). After individually weighing the eggs they were broken, than the shells were washed and dried at room temperature for the determination of shell weight. The shell thickness was measured by taking the mean of three pieces-from the two ends and from the middle, using a micrometer. Feed conversion ratio was calculated as g feed consumption per d per hen divided by g egg mass per d per hen.

All the collected data were recorded on a weekly basis and statistically subjected to the test of ANOVA procedure in a Windows-based statistical package program. The differences between the means of groups were separated by Duncan's Multiple Range Test. The significant level used for the group comparisons was set at $P < 0.05$.

RESULTS AND DISCUSSION

The results of the present experiment demonstrated that increasing the rice bran levels significantly ($P<0.05$) affected laying performance. Egg production was reduced from 93.6 to 87.8% as the rice bran level increased from 0 to 15%. The groups fed with 5 and 10% rice bran did not differ from the control group with egg production respectively at 91.0 and 92.3%. Feed intake and egg mass were also significantly ($P<0.05$) reduced by the increased level of rice bran in the same manner. Decrease in feed intake as the level of rice bran increased can be explained by increased fiber level seen in the diet containing 15% rice bran. Increase the fiber level from 3.06 to 4.29% by inclusion of 15% rice bran might be responsible for the decreased feed intake. Increased fiber level resulted in bulky feed, consequently layers might not been able to consume enough feed since their crop capacities were limited. Feed conversion ratio and egg weight, however, did not affected by the dietary treatments.

Heart, liver gizzard, proventriculus, jejunum, and ileum weights were not affected by inclusion of rice bran except duodenum (Table 4). Duodenum weight significantly increased ($P < 0.05$) by increased rice bran levels, respectively being 0.65, 0.63, 0.67 and 0.82 g. This increase can be explained by increased fiber level as well. Another possible explanation can be elevated level of fat by the increased levels of rice bran. Ether extract level increased to 7.19% in 15% rice bran containing diet compared to 4.94% of the control diet. Increased level of fat is likely to prolong and increase at digestion which might resulted in elevated duodenum weight.

Data with respect to egg quality indicated that only Haugh Unit was significantly ($P<0.05$) affected by increased rice bran levels whereas yolk and albumen %, and shell thickness were not (Table 5). Haugh Unit was 102.2 in the group fed with 15% rice bran and was 96.0 in the group fed with control diet. This increase might be related to higher biological value of rice bran proteins and fat as reported by Khan (2004) as well.

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