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Utilization of Mixed Rice Bran in Laying Hen Diets

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Abstract: The increasing price of feedstuffs used for poultry diets imposes nutritionists to look for new cheaper ingredients able to replace the expensive feeds. Use of mixed rice bran in layer ration was studied during the period of 13 weeks in an experiment with Completely Randomized Design (CRD). After determination of chemical composition, six diets were formulated by using of 0, 5, 10, 15, 20 and 25% of mixed rice bran (diets 1-6). During the experiment, feed intake, egg production, egg mass, egg weight, feed: egg, egg specific gravity, haugh unit score, body weight changes and mortality were measured. The results indicated that use of mixed rice bran up to 25% is profitable and had no significant effect on each of above traits except for egg mass ($p<0.05$). Diets containing 10 and 15% of mixed rice bran (diets 3, 4) had the best values for egg weight, egg mass and feed conversion ratio. It is concluded that feeding laying hen with maize-soybean meal diets containing 25% mixed rice bran was practically feasible without compromising performance.

Key words: Laying hen, mixed rice bran, egg production, egg quality

INTRODUCTION

Rice bran is a major cereal by-product, which is widely used in rice-producing countries as a feed ingredient in layer diets. It contains considerable amounts of fat, protein, amino acids, metabolizable energy and a good source of B- group vitamins. Because rice bran is relatively less expensive than corn, its feeding value has been investigated in poultry (Kratzer *et al*., 1974; Warren and Farrell, 1990a). In most paddy grinding mills in Iran, outer layer (rice hull) and inner rice bran are mixed, thus the level of crude fiber in mixed rice bran increases. Rice hulls have no nutritional value for poultry (Warren and Farrell, 1990b).

Among factors limiting the maximum utilization of rice bran in poultry diets is the phytin content (Attia *et al*., 2001; CVB, 2000). The total P content of rice bran is 1.6 to 1.8% and more than 80% is in the form of phytate-P (Ravindran *et al*., 1995). Phytin not only reduce P availability, but also impairs the utilization of other minerals such as Zn, Fe, Ca and Mn and has a negative impaction on protein digestibility and energy utilization, probably partly due to inhibition of digestive enzymes, including pepsin, Trypsin and α-amylase (Kies *et al*., 2001; Ravindran *et al*., 1995). In some experiments rice bran was successfully used in laying hens (Din *et al*., 1979; Farrell, 1994). Piliang *et al*. (1982) and Farrell (1994) showed that rice bran could be included up to 40 to 45% in diet of commercial breeds of layer without adverse effect on productive performance. In contrast, Attia *et al*. (2001) reported that, use of rice bran at 40% in layer diet, increased feed intake and feed conversion ratio in comparison with maize-soybean meal diet ($p<0.05$). In another experiment, use of rice bran above 17% in layer diets decreased the performance (El-Full *et al*., 2000). The objective of the present study was to determine the chemical composition of mixed rice bran and set up new layer diets formulated based on maize, soybean meal and mixed rice bran (hull and inner bran) and compare the effects of these diets on productive performance of leghorn egg type layer.

MATERIALS AND METHODS

This experiment was conducted from September to December 2002 in Poultry Center, School of Agriculture in Sari, Iran. At first thirty samples of mixed rice bran were obtained from rice milling units in Mazandaran province and analyzed according to AOAC (1990) individually for chemical composition (Table 1). The metabolizable energy of rice bran measured with Farrell (1978) method. In this method 30 adult cockerels with 3.5 kg average body weight were distributed in individually cages in a completely randomized design with 6 treatments and five replicates per treatment. The rooster was adapted to consume 100 g feed in 1 h. After this period they fed basal diets with 0, 5, 10, 15, 20 and 25% of mixed rice bran. After 48 h of feeding total excreta was collected (Sibald, 1979). Feed and excreta were maintained in freezer at -3°C until analyzing. The dry mater, gross energy and

Table 1: Chemical composition and metabolizable energy content of mixed rice bran

Nutrients	Dry matter	Crude protein	Ether extract	Crude fiber	Ash	NFE	Me_n (Kcal kg^{-1})	Ca	P	Na
(%)	88.95	8.91	6.09	29.06	16.32	39.62	2.038	0.33	0.44	0.006

Table 2: Composition (%) and calculated analysis of experimental diets

Diets ingredients	1	2	3	4	5	6
Maize	69.96	64.90	58.35	51.74	45.08	35.51
Soybean meal	20.56	20.52	20.70	21.00	21.24	21.48
Rice bran	0.00	5.00	10.00	15.00	20.00	25.00
Fat	0.00	0.19	1.56	2.94	4.31	5.68
Limestone	7.86	7.90	7.86	7.83	7.79	7.76
Di-calcium phosphate	0.85	0.73	0.71	0.70	0.69	0.67
NaCl	0.25	0.25	0.25	0.25	0.25	0.25
DL-methionine	0.10	0.11	0.12	0.13	0.14	0.15
Vit+Min mix[1]	0.50	0.50	0.50	0.50	0.50	0.50
Washed sand	0.13	0.00	0.00	0.00	0.00	0.00
Total	100	100	100	100	100	100
Composition						
ME (kcal kg^{-1})	2800	2750	2750	2750	2750	2750
Crude protein (%)	15.00	15.00	15.00	15.00	15.00	15.00
Calcium (%)	3.25	3.25	3.25	3.25	3.25	3.25
Available phosphorus (%)	0.25	0.25	0.25	0.25	0.25	0.25
Lysine (%)	0.73	0.74	0.75	0.75	0.75	0.75
Methionine(%)	0.35	0.34	0.35	0.35	0.35	0.35
Methionine + Cystine (%)	0.58	0.58	0.58	0.58	0.58	0.58
Threonine (%)	0.59	0.59	0.59	0.59	0.59	0.59
Tryptophan (%)	0.19	0.19	0.20	0.20	0.20	0.20

[1] Vit+Min mixture provides per kilogram of diet: vitamin A, 12,000 IU; vitamin E, 20 IU; menadione, 1.3 mg; Vitamin. D_3, 2,500 ICU; riboflavin, 5.5 mg; Ca pantothenate, 12 mg; nicotinic acid, 50 mg; choline chloride, 600 mg; vitamin B_{12}, 10 μg; vitamin B_6, 3 mg; thiamine, 3 mg; folic acid, 1.00 mg; d-biotin, 0.50 mg. Trace mineral (milligrams per kilogram of diet): Mn, 80; Zn, 60; Fe, 35; Cu, 8; Se, 0.60

Table 3: Effects of experimental diets on performance of laying hen

Traits diets	Feed intake (g/hen/day)	He-day egg production (No./100 bird day)	Egg weight (g)	Egg mass (g)	Feed: egg	Egg specific gravity	Haugh unit score	Mortality (%)
1	118.85	85.49	58.88	50.36^{a}	2.24	1.085	88.01	0.00
2	112.13	82.05	59.33	48.68^{c}	2.30	1.084	87.0	0.00
3	113.07	87.23	59.47	51.87^{bc}	2.20	1.074	86.5	4.17
4	113.83	89.65	60.70	54.42^{b}	2.20	1.070	85.4	0.00
5	114.31	85.76	59.70	51.20^{c}	2.28	1.073	87.3	4.17
6	116.39	84.07	58.70	49.35^{c}	2.30	1.074	88.4	0.00
SEM	4.06	3.58	0.95	1.02	0.12	0.006	0.54	-

Means with different superscripts in each column are significantly different ($p<0.05$)

nitrogen in excreta were measured. The metabolizable energy of mixed rice bran was calculated by differences between metabolizable energy of basal diet and diets containing rice bran. Leghorn-type laying hens were housed in individual cage and kept under similar management condition. In second phase 6 diets containing 0, 5, 10, 15, 20 and 25% of mixed rice bran were fed to commercial leghorn-type laying hen for 13 weeks (24 to 37) weeks of age. The hens were allocated in individual cages (41×23×43) cm and 4 cages were considered to be one replicate. Diets were formulated basis on linear programming by using of UFFDA software. Compositions of diets are shown in Table 2. Metabolizable energy, crude protein and other nutrients in all diets were similar. During the experiment daily feed intake, egg weight, egg mass, egg production, feed conversion ratio, egg specific gravity, haugh unit score, body weight changes and mortality were measured. The data from this experiment were subjected to one-way analysis of variance with 6 treatments and 6 replicates per treatment. The differences among means were compared by the Duncan's multiple range test at $p<0.05$ by using MSTATC software (Russel, 1990).

RESULTS AND DISCUSSION

The results indicated (Table 3) that there were no statistically significant differences for hen-day egg production, feed intake, egg weight, feed: Egg, egg specific gravity, haugh unit score, body weight changes and mortality between hens fed with the mixed rice bran diets and hen fed the control maize-soybean meal diets. Diets containing 10 and 15% of mixed rice bran had the best value for hen-day egg production, but the

differences were not statistically significant. The present results are in agreement with those reported by other researchers (Piliang *et al*., 1982; Farrell, 1994). They showed that rice bran could be included up to 40 to 45% in the diet for commercial layers without adverse effect on productive performance. Tangendjaja *et al*. (2002) reported that feeding diets containing 22% rice bran to Brown-egg layer from 23 to 48 weeks of age had not adverse effect on productive performance. Due to high level of phytate-P in rice bran, use of microbial phytase in this trial was effective in improving P utilization in layer fed low-P layer diets. Phytase supplementation could replace at least 0.12% total P from dicalcium phosphate.

In contrary some researches found that egg production, egg mass and egg size were reduced on the diet with 38.5% rice bran. Data from the literature indicate that usually the weight of broiler chicks reduced as the amount of rice bran in the diet increases and this depends on in part on the effect of diet has on feed intake (Farrell, 1994; Kratzer *et al*., 1974). Similarly, the feed conversion ratio is usually poorer with increasing concentration of rice bran in the diet. The point, at which this occurs, however, varies. Variation in the fiber, protein and oil content, rancidity of the lipid fraction and other constituents in rice bran may be responsible for this effect (Sibald, 1979). There was not significant difference in egg weight between hens fed the control diet and hens fed the rice bran diets ($p>0.05$). With increasing rice bran in the diet, the amount of fat in diets increased and this may have caused the elevation in egg weight. Diets containing 10 and 15% mixed rice bran had the best value for egg mass and feed: egg. Higher levels of crude fiber in diets containing high levels of rice bran may be as an important factor for reducing digestibility of these diets. Diets containing 20 and 25% mixed rice bran had the highest value for feed: Egg and this may be due for higher crude fiber and anti-nutritional factor content of these diets. No negative effect of feeding rice bran up to 25% of the diet on the mortality was shown and these are similar to the results reported by Piliang *et al*. (1982). In their experiments egg shell quality was significantly decreased when rice bran was fed at 40 or 76% of the diet compared to maize-soybean diet. Use of 25% rice bran in layer diet had no adverse effect on egg shell quality parameters such as, egg specific gravity and haugh unit score. Piliang *et al*. (1982) reported that hens fed rice bran containing-diets produced eggs with similar interior and shell quality as the control diet. Yolk pigmentation was significantly decreased due to decreased intake of carotenoids. This negative effect could be reversed by using xantophyll rich ingredients (Attia *et al*., 2001). Results are in agreement with findings of other studies (Farrell, 1994; Piliang *et al*., 1982). In conclusion mixed rice bran can be included up to 25% in the diets of laying hen without negative effect on productive performance. It also shown that with proper processing many anti-nutritive factor in rice bran will be inactivated and use of this feed in poultry diet increased (Attia *et al*., 2001; Kies *et al*., 2001). For improving P utilization and reducing the cost of layer diets, it is suggested that use of high level of mixed rice bran in layer diets can be investigated with supplementation of diets with microbial phytase.

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