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Effect of Differently Treated Rice Polishing on Layers Performance

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Abstract.- This study was designed to investigate the effect of differently treated rice polishing such as autoclaving (T2), extrusion (T3) and oil extraction (T4) on the performance of 20 weeks old white leghorn layers. Results showed that extrusion treatment was significantly ($P<0.05$) better in egg production, egg weight, egg shell weight, and feed conversion ratio than T1, T2 and T4. Among different levels of treatments, experimental birds on diet containing 30% extrusion cooked rice polishing (I) were comparatively better in performance. The non-significant results were observed within all treatments for feed consumption and total egg production. It was concluded that extrusion cooked rice polishing can safely be included in layer diets.

Key words: Rice polishing, autoclaving, extrusion cooking, layer and egg quality.

INTRODUCTION

Poultry meat and eggs provides high quality animal protein produced in comparatively short duration and appropriate cost. The major factor on which poultry production depends is its feed cost. The increasing cost of feed ingredients makes it imperative to look for alternative agro-industrial by-products for use in poultry feeds. Rice polishing (RP) is the by-product of rice milling industry and is abundantly available in Pakistan because rice is the third largest crop (6952000 tons/annum) produced in the country (Anonymous, 2008-09). It is comparatively economical than routinely used grains and rich in essential amino acids as reported by Khalique *et al*. (2004). It is also rich in oil (12-13%) and carbohydrates along with other essential nutrients like water-soluble vitamins especially thiamin and niacin (NRC, 1994). It is reported that amino acid profile of rice polishing protein is better than cereal grain (Farrell, 1994). These qualities lead to a high demand for rice polishing as poultry feed (Piliang *et al*., 1982). Its oil contains higher amount of unsaturated fatty acids which are rapidly broken down to free fatty acid by lipase enzyme, already present in it (Desikachar, 1974). This oxidation process results in severe nutritional and economic losses, if fed after prolonged storage to poultry (Subrahmanyan, 1993). It also contains undesirable anti-nutritive factors such as phytate, trypsin inhibitor and lectin (Kratzer and Payne, 1977; Deolankar and Singh, 1979). These anti-nutritive factors can be rendered non-toxic by modifying their structure or breaking their bonds through physical treatments (Plavnik and Sklan, 1995). The possibilities for improvement in nutritive quality of defatted rice polishing can be achieved by innovative technology, which must be cost effective in terms of animal productivity (Keith, 1996). Various treatments may have different effects on the production performance of poultry birds. Therefore, present study was planned to evaluate the effects of different nature of rice polishing treatment on the production performance of layers.

MATERIALS AND METHODS

Fresh rice polishing was procured from a local rice-processing mill and was divided into four equal portions of 50 kg each. One portion of rice polishing remained untreated which served as control group (T1). The remaining three portions were given treatments like autoclaving (T2), extrusion (T3) and oil extraction (T4). The defatted rice polishing was obtained using solvent (hexane) extraction method. The autoclaving of rice polishing was done by mixing it with water in ratio of 1:2 and then spreading in trays an inch deep to facilitate the process for 30 min at 15 psi at 120 ^{0}C. Whereas, the extrusion cooking of rice polishing was done using

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extruder cooker maintained at 130°C and 20% moisture. The products were sun dried to their original weights and were stored in polythene bags till their utilization in experimental poultry diets. The proximate analysis of the experimental rations was done as method described in AOAC (1990).

Each untreated and treated rice polishing was incorporated at a level of 10, 20, and 30% in twelve, A to L, iso-caloric and iso-nitrogenous layer diets (Table I). One hundred and eight White-Leghorn layers of 20 week age were equally divided into four groups having 27 layers each. Each group was further divided into 3 sub-groups with 9 layers, which were further divided into 3 replicates of 3 layers. The three sub-groups of each layer group were fed on rations containing 10, 20 and 30% levels of rice polishing in each treatment.

The experimental diets were offered at the rate of 110gm /bird/day to layers in galvanized feeding troughs according to 16 hours fixed light schedule throughout the experimental period of 56 days. Fresh and clean water was made available all the time. A recommended vaccination schedule was adopted for layers during experimental period.

Statistical analysis

The data collected were tabulated and subjected to statistical analysis using Completely Randomized Design with factorial arrangement as described by Steel *et al.* (1997). Their means were compared by Duncan multiple range test (Duncan, 1955). The analysis was performed using the software package (SPSS-6.0, 1993).

RESULTS AND DISCUSSION

The layers fed on different experimental diets consumed same amount of feed. The differently treated rice polishing in experimental diets did not affect the feed consumption. The results of Khalique *et al*. (2003) also explained that diets containing differently treated rice polishing did not affect the feed consumption of poultry.

A significant difference was observed for feed conversion ratio in layers fed different experimental diets. Among four treatments (Table II), ration containing extruded cooked rice polishing (T3) was significantly lower ($P<0.05$) in term of feed conversion ratio which is good indicator as far as economic viability in poultry farming is concerned. While, the higher feed conversion value was observed in untreated rice polishing (T1) which indicate the poor performance of birds on this particular diet. It might be due to the presence of anti-nutritive factors i.e. phytic acid, lectin, trypsin inhibitor present in untreated rice polishing. These anti-nutritive factors had depressed the productive performance of experimental layers when fed diets having higher percentage of untreated rice polishing. In a previous study (Tsuda, 1979), it was concluded that untreated rice polishing depressed growth due to presences of anti-nutritive factors present in rice polishing. Among different levels, diet containing 30 % extruded cooked rice polishing (I) was comparatively better than other two levels of extruded cooked rice polishing (G and H) and all other treatments with their respective levels (Table III). The extrusion cooking was best treatment for improved digestibility and performance in poultry (Mujahid *et al*., 2003, 2004) but these treatments did not improve ($P<0.05$) feed consumption in birds fed on rice polishing based diets. The findings are in accordance with the previous studies (Adrizal and Jerry, 1996; Azam and Howlider, 1998). The results of present study revealed that autoclaving treatment was comparatively lower ($P<0.05$) in performance of layers than deoild and extruded treatments but was comparatively better ($P<0.05$) than untreated rice polishing. The better performance of extruded cooked rice polishing is well supported by the author (Aqif, 1998) who deduced that after extrusion free fatty acids percentage remained considerably lower in rice polishing than those of untreated rice polishing. The rice polishing contains 12-13% of oil which is liable to become rancid because during milling the oil is exposed to lipase enzyme present in the rice polishing causing its rapid breakdown to free fatty acids (Desikachar, 1974). The extrusion cooking improved the metabolizable energy (Plavnik and Sklan, 1995) but it also in-activated lipase activity which improved the feed efficiency (Maurice, 1991).

There were significant differences in daily egg production, egg weight, and egg shell weight of layers fed on different experimental diets. The

Table I.- Composition of different experimental diets.

Ingredients %	Raw/untreated RP (T1)			Autoclaved RP (T2)			Extruded RP (T3)			De-Oiled RP (T4)		
	A	B	C	D	E	F	G	H	I	J	K	L
Rice polishing	10	20	30	10	20	30	10	20	30	10	20	30
Rice tips	33	30	21	35	29.5	21	34.5	30	21	33	24	19
Corn	15	10	10	13	10	10	14	10	10	14	12	11
Soybean	19.5	19	19	20	19	19	19.5	19	19	20	22	19
Guar meal	4	3	2	4	3	2	4	3	2	4	3	2
Poultry byproducts	2	2	2	2	2	2	2	2	2	2	2	2
Molasses	3	3	3	3	3	3	3	3	3	3	3	3
Oil	2	2	2	2	2	2	2	2	2	3	3	3
$CaCO_3$	7.5	7	7	7	7.5	7	7	7	7	7	7	7
Di-calcium Phosphate	3	3	3	3	3	3	3	3	3	3	3	3
Vitamin premix	1	1	1	1	1	1	1	1	1	1	1	1
Total	100	100	100	100	100	100	100	100	100	100	100	100
Calculated chemical composition of diets												
ME(kcal/kg)	2840	2843	2841	2855	2842	2842	2852	2860	2865	2858	2845	2841
CP (%)	17.02	16.98	17.11	17.04	16.94	17.11	16.97	16.98	17.11	17.08	17.15	17.01
CF (%)	4.03	4.94	5.97	3.99	4.94	5.97	3.99	4.94	5.93	4.17	5.15	5.95
Ca (%)	3.50	3.43	3.32	3.53	3.50	3.33	3.51	3.43	3.32	3.52	3.49	3.32
Av. P (%)	0.90	0.94	1.0	1.0	0.96	1.0	1.0	0.94	1.0	1.0	1.1	1.0

[+] Supplied per kilogram of diet: Vit. A, 1500 IU; Vit. D_3 200 ICU; Vit. E 10 IU; Vit. K 0.5 mg; Vit. B_1 1.8 mg; Vit B_2 3.6 mg; Vit. B_6 5.5 mg; Vit B_{12} 0.01mg; Biotin 0.15 mg; Choline 1300 mg; Folic acid 0.55 mg; Pentothenic acid 10 mg; Niacin 35 mg.
RP: Rice Polishing

Table II.- Feed consumption, feed conversion ratio, egg production, egg weight, egg shell weight, and eggs cost per dozen of layers fed diets containing differently treated rice polishing

Treatments	Feed consumption per bird per day (g)	Feed conversion ratio (FCR)	Egg production /day (%)	Egg weight (g)	Shell weight (g)	Cost per dozen of eggs (Rs)
Untreated RP	105.10^a±7.93	3.03^a ±0.10	65^d ±0.63	59.99^c±1.47	8.38^b±0.21	26.46
Autoclaved RP	102.46^a ±9.97	2.80^b ±0.75	69^c ±0.68	61.00^b±2.51	8.47^a±0.29	23.87
Extruded RP	108.39^a ±11.03	2.42^d ±0.46	76^a ±0.93	61.44^a±3.41	8.41^a±0.31	19.84
De-oiled RP	105.98^a ±8.54	2.60^c ±0.69	74^b ±0.74	58.89^d±5.57	8.11^c±0.70	22.12

[+] Values with in a column with the same superscript are not significantly different (P>0.05)

maximum daily egg production was observed in layers fed on diets containing extruded rice polishing (Table II). However, within treatments the layers fed on ration I (30% extruded RP) laid maximum eggs (79% ± 0.20) per day (Table III). It is assumed that extrusion cooking did affect the fine structure of rice polishing by gelatinization characteristics of its starch. Moreover, the content of water-soluble sugar might have increased and trypsin inhibitor was denatured. Lectin which is a glyco-protein and contains 27% carbohydrates as reported by Takahashi *et al*. (1973), these treatments might have broken the chemical structure of it and made available the digestible carbohydrates for bird body metabolism.

Among all treatments, the diets containing extrusion cooked rice polishing showed better results in terms of egg weight. The layers fed diet having 20% extrusion cooked rice polishing (Ration H) laid eggs with high weights among all rations. The improvement in egg weight is associated with availability of dietary linoleic acid concentration (Srichai and Balnave, 1981); which is abundantly present in rice polishing and became more available to birds after RP cooking in extruder.

The treatments did affect the egg shell weight (Table II). Ghandhe *et al.* (1988) in his study having similar nature explained that it might be due to

Table III.- Feed consumption, feed conversion ratio, egg production, egg weight, egg shell weight, and eggs cost per dozen of layers fed diets containing different levels of treated rice polishing

Experimental diets		Feed consumption per bird per day (g)	FCR	Daily egg production (%)	Egg weight (g)	Shell weight (g)	Cost/dozen (Pak. Rs.)
A	10% Untreated RP	105.57 ^{a} ± 18.78	2.89^{d} ±0.19	68^{d} ±0.11	61.57 ^{c}±4.55	9.03 ^{a}±1.41	26.36
B	20% Untreated RP	104.50 ^{a} ± 12.74	3.05^{e} ±0.17	64^{d} ±0.12	60.17 ^{c}±4.51	8.14 ^{b}±1.24	25.64
C	30% Untreated RP	105.21 ^{a} ± 19.80	3.15^{e} ±0.27	63^{e} ±0.16	58.24 ^{d}±3.77	7.98 ^{c}±1.09	27.39
D	10% Autoclaved RP	103.09 ^{a} ± 17.24	2.97^{d} ±0.16	67^{c} ±0.15	59.18 ^{d}±3.80	8.05 ^{b}±1.26	25.97
E	20% Autoclaved RP	102.40 ^{a} ± 16.47	2.75^{c} ±0.21	73^{c} ±0.14	62.60 ^{b}±7.32	8.57 ^{b}±1.31	23.17
F	30% Autoclaved RP	101.90 ^{a} ± 13.74	2.69^{c} ±0.22	67^{c} ±0.17	61.22 ^{c}±4.60	8.78 ^{b}±1.32	22.47
G	10% Extruded RP	106.76 ^{a} ± 17.28	2.43^{a} ±0.15	75^{d} ±0.14	60.32 ^{c}±4.57	8.12 ^{c}±1.17	20.85
H	20% Extruded RP	109.20 ^{a} ± 14.78	2.45^{a} ±0.20	74^{b} ±0.16	64.44 ^{a}±3.70	8.72 ^{b}±1.27	20.01
I	30% Extruded RP	109.21 ^{a} ± 16.89	2.39^{a} ±0.18	79^{a} ±0.20	59.57 ^{d}±3.76	8.39 ^{b}±1.29	18.65
J	10% De-oiled RP	105.26 ^{a} ± 17.63	2.58 ^{b} ±0.23	75^{b} ±0.19	59.27 ^{d}±3.85	8.26 ^{b}±1.36	22.81
K	20% De-oiled RP	107.72 ^{a} ± 12.98	2.58^{b} ±0.25	76^{b} ±0.17	59.42 ^{d}±3.79	8.21 ^{c}±1.07	22.00
L	30% De-oiled RP	104.92 ^{a} ± 13.80	2.63^{b} ±0.19	72^{c} ±0.13	58.00 ^{d}±3.90	7.85 ^{c}±1.11	21.56

[+]Values with in a column with the same superscript are not significantly different (P > 0.05)

more calcium availability from rice polishing after extrusion treatment and thus more calcium marbling of egg shells. Among all treatments, the most economical cost per dozen eggs (Rs. 18.65) was recorded in layers fed on ration I, containing 30% extrusion cooked rice polishing because RP is cheapest agro-industrial by-product available for poultry feeding.

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