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Original article

Evaluation of different levels of raw and alkali-treated palm pulp on performance of broiler chicken

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ABSTRACT

This experiment was conducted to evaluate the effects of different levels of raw and alkali-tretead of palm pulp (PP) on broilers perfomance. In this experment 280 male broiler chicks were allocated in 7 treatment and 4 replication per treatment. Experimental diets included in corn-soybean diet (control) and 3, 6 and 9% of raw and alkali-treated of PP. Body weight, feed conversion ratio (FCR) and feed intake were measured at 8, 21 and 42 days of age. Results 8-42 days of age showed that, there were significant differences between treatments in general terms of feed intake, daily weight gain and FCR ($P<0.05$). The highest feed intake was observed for 9% raw PP diet and the lowest was for control diet. As well as, the highest daily weight gain was observed for control diet and the lowest was for diet contaning 9% alkali-tratd PP. There was signifcant diffrences with diets containing PP ($p<0.05$) and control diet on FCR. Among tratments contaning PP, diets containing 3% raw and 3 and 6% alkali-trated PP have FCR similar to the control diet. The result of this study indicated that, up to 3% raw and up to 6% alkali-treated PP can be used in broiler dites without negative effect on performance.

1. Introduction

The food costs in poultry industry is about 70% of all production costs. To reduce this cost, using of agriculture by-product is unavoidable. One of these by-proucts is palm plup (PP) that is a product resulting from waste generated during juice production from date. The production of PP is more than one million ton in a year in Iran (FAO, 1999). Research showed that the PP has substantial nutritional value for poultry; however, the nutritional quality may vary greatly among samples (Aldhaheri etal., 2004). The PP is a good source of vitamins A, B and C and minerals as Fe, K, Ca, Mn and Zn (Al-shahib etal., 2003) and has antioxidant effect because of having Selenium (Hemeda etal., 2002). Sallal (1989) showed that, the PP has the prebiotic effect in poultry diet because of having oligosacharids and has a positive effect on growth performace of broiler chicks. However, the PP has a high level of fiber and that is one of the most important concerns, and often limitation, in its use in poultry diets (Bedford, 1993).

To notice that high fiber of PP is one of the restricted factors in poultry diets, thus any processing of this feedstuff for decline the negative effect of fiber in poultry diets can be useful. Alkali-treated of feed can be reduced the antinutritional effect of fiber in high-fiber feedstuff (as PP; Mcdonald et al., 2011). Some research show that treated of palm kernel meal (PKM) with alkalin result in improvement the performance of broiler chicks (Hussein etal., 1998). In contrast, other research concluded that alkaline treated of PKM has no effect on its nutritive value (Al-masri, 2005). Adrizal et al. (2011) suggested that the use of PKM up to 30% in local (Indonesian) laying hen diets did not have a negative effect on feed intake, feed efficiency, egg production or egg mass. Other researcher showed that PKM may be used up to 40% in the layers diet.

However, three is many about PKM in poultry diets, but there are a few research on PP and its effect on broiler performance, therefore, The objective of the present study was to assess the effect of different levels of PP in broiler rations.

2. Materials and methods

2.1. Ingredient analyses

Palm pulp (PP) was obtained from commercial plant in Tabriz (Iran). sample was analyzed for DM by drying at 102oC for 16 h in a forced air oven, and for CP, crude fat, crude fiber, ash, calcium and phosphorus (Table 1) according to methods 976.06, 920.39, 978.10, 942.05, 968.08 and 965.17, respectively, of AOAC (1990).

Table 1
Chemical composition of palm plup[1].

Nutrient	g/kg
Dry matter	963.2
Crude protein	85.0
Crude fat	64.0
Ash	14.4
Calcium	3.0
Phosphorus	3.6
Crude fiber	516.0

[1]Palm pulp analyzed according to AOAC (1990).

2.2. Chick assay

One-week-old male chicks resulting from the cross of New Hampshire males and Columbian Plymouth Rock females were used in chick assay. Chicks were housed in thermostatically controlled starter batteries with raised wire floors in an environmentally regulated room. Feed and water were supplied for ad libitum consumption and light was provided 24 h daily. The chicks were fed with a 23% CP corn-SBM pretest diet during the first 7 days posthatching. Following an overnight period without feed, the chicks were weighed, wing-banded, and allotted to dietary treatments as described by Sasse and Baker (1973). Chick assay was conducted to evaluate the growth performance of chicks fed diets containing 3, 6 and 9% raw or alkali-trated PP formulated on a total AA basis compared to a corn-SBM diet from 8 to 21 days and 21 to 42 days of age (Table 2). The analytical values for the PP

in Table 1 and NRC (1994) table's values for corn, wheat, Corn gluten meal and SBM were used for the diet formulations. The diets containing PP were formulated to contain levels of energy and other nutrients that were equivalent to levels in the corn-SBM diet or that were equal to the NRC (1994) requirement, whichever was lower. The seven diets were fed to four groups of ten male chicks from 8 to 21 and 21 to 42 days posthatching. Body weight, Feed coversion ratio and feed intake were measured at 8, 21 and 42 days of age.

Table 2
Composition of diets containing palm plup (PP).

Ingredient and composition (g/Kg)	8-21 days of age				21-42 days of age			
	Level of PP [1]							
	0%	3%	6%	9%	0%	3%	6%	9%
Corn	562.8	518.8	474.2	429.9	620.1	575.8	531.5	487.2
Soybean meal	215.5	218.4	221.3	224.2	138.4	141.3	144.3	147.2
Wheat	100	100	100	100	100	100	100	100
Corn gluten meal	70	70	70	70	90	90	90	90
PP	0	30	60	90	0	30	60	90
vegetable oil	9.3	21	32.7	44.5	9.8	21.6	33.3	4.5
Dicalcium phosphate	16.9	16.8	16.8	16.7	16.5	16.5	16.4	16.4
Limeston	10	9.8	9.96	9.4	9.6	9.4	9.2	9.0
Nacl	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
DL-Met	2.3	2.3	2.3	2.3	1.8	1.8	1.9	1.9
L-Lys HCL	4.7	5.6	4.5	4.4	5.2	5.1	5.1	5.0
Mineral premix[2]	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Vitamin premix[3]	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Calculated or analytical composition								
AMEn (Kcal/Kg)	3050	3050	3050	3050	3150	3150	3150	3150
Crude protein (%)	20.34	20.34	20.34	20.34	18.7	18.7	18.7	18.7
Crude fiber(%)	3.13	4.60	6.07	7.55	2.75	4.22	5.69	7.71
Ca (%)	0.87	0.87	0.87	0.87	0.83	0.83	0.83	0.83
Na (%)	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Lysine(%)	1.2	1.2	1.2	1.2	1.07	1.07	1.07	1.07
Met+Cys(%)	0.92	0.92	0.92	0.92	0.85	0.85	0.85	0.85

[1]Diets containing palm plup were fed raw and alkali-treated to chicks.
[2]Provided per kilogram of diet: vitamin A, 9000 IU; cholecalciferol, 2000 IU; vitamin E, 18 IU; vitamin B12, 0.015 mg; riboflavin, 6.6 mg; d-pantothenic acid, 10 mg; niacin, 30 mg; menadione sodium bisulfite, 3 mg.
[3]Provided as milligrams per kilogram of diet: manganese, 100 from manganese oxide; iron, 50 from iron sulfate; zinc, 100 from zinc oxide; copper, 10 from copper sulfate; iodine, 0.99 from ethylene diamine dihydroiodide; selenium, 0.2 from sodium selenite.

2.3. Palm plup processing

The PP sample was treated with 0.04 molar NaOH solution as rate of 1:3 w/v (1 PP : 3 NaOH solution) and kept for 24h in room temperature. This mix washed with water to elimination of residual alkalin and sample then air dried (Squires et al., 1992).

2.4. Statistical analyses

Data from chick assay was subjected to ANOVA for completely randomized designs using SAS (SAS Institute, 1985). Statistical significance of differences among treatments was assessed using the Duncan's test (Steel and Torrie, 1980).

3. Results and discussion

From 8 to 21 days of age, there was no significant difference between treatments in feed intake (Table 3) but there was significant difference between treatments in weight gain ($p<0.05$). The highest weight gain was observed diet containing 6% alkali-treated PP and the lowest was for control diet. As well as, independent comparisons showed that there was significant difference between control diet and diets cotaining PP in weight gain ($p<0.05$), but there was no significant difference between raw and trated PP in this case. Feed conversion ratio (FCR) was significant between experimental treatments ($P<0.05$; Table 3). Diet containing 6% alkali-treated PP had better FCR in comparison to the other diets. It seems, from 8 to 21 days of age, performance of chicks fed diets containing PP was superior ($P< 0.05$) to that of chicks fed the corn-SBM diet.

Table 3
The effect of different level of raw or alkali-treated palm pulp (PP) on broiler performance[1].

Dietary treatment[2]	Level of PP	Feed intake (g)	Weight gain (g)	FCR (g/g)	Feed intake (g)	Weight gain (g)	FCR (g/g)
		8-21 days of age			21-42 days of age		
Control	0%	61.58	32.83^{b}	1.88^{a}	100.52^{b}	62.78^{a}	1.61^{b}
Raw pp	3%	61.51	34.30^{ba}	1.79^{ab}	102.29^{b}	54.48^{b}	1.88^{ab}
	6%	61.07	34.98^{ba}	1.75^{abc}	107.21^{ab}	54.43^{b}	1.98^{a}
	9%	64.28	37.41^{a}	1.71^{abc}	117.84^{a}	56.25^{b}	2.10^{a}
Alkali-treated PP	3%	61.42	37.16^{a}	1.66^{bc}	107.44^{ab}	57.33^{ab}	1.87^{ab}
	6%	60.71	37.92^{a}	1.60^{c}	108.35^{ab}	53.75^{b}	2.02^{a}
	9%	60.71	35.96^{ab}	1.68^{bc}	107.84^{ab}	53.35^{b}	2.02^{a}
SEM	-	0.47	0.05	0.024	1.6	0.89	0.04

[1]Means within a column with no common superscript differ significantly ($P < 0.05$).
[2]Means of four groups of ten male chicks.

From 21 to 42 days of age, only dietary inclusion of 9% raw PP increased feed intake ($P< 0.05$) compared to the corn-SBM diet, other treatments was similar to the control diet (Table 3). Dietary inclusion level of 3% treated PP resulted in similar, but other diets depressed weight gain ($P < 0.05$) compared to corn-SBM diet (Table 3). Among diets containing PP, chicks fed 3% raw or treated PP were not significantly differece in FCR ($P > 0.05$) compared to corn-SBM diet (table 3). As well as, in overall experment (8-42 days of age) there were significant difference between treatments in feed intake, weight gain and FCR (Table 4). Except diet conaining 3% raw or 3 and 6% treated PP, other diets depressed FCR compared to corn-SBM diet (Table 4).

Table 4
The effect of raw or alkaline-treated palm pulp (PP) on broiler performance at 8-42 days of age [1].

Dietary treatment [2]	Level of PP	Weight gain (gr)	Feed intake (gr)	FCR (gr/gr)
Control	0	52.60^{a}	87.82^{b}	1.67^{b}
Raw PP	3%	47.97^{b}	88.90^{b}	1.85^{ab}
	6%	48.20^{b}	91.82^{b}	1.91^{a}
	9%	50.32^{ab}	99.78^{a}	1.98^{a}
Alkali-treated PP	3%	50.90^{ab}	92.10^{b}	1.81^{ab}
	6%	48.95^{ab}	92.39^{b}	1.89^{ab}
	9%	47.92^{b}	92.07^{b}	1.92^{a}
SEM	-	0.51	1	0.029

[1] Means within a column with no common superscript differ significantly ($P < 0.05$).
[2] Means of four groups of ten male chicks.

At 8-21 days of age, The weight gain and FCR in diets containing PP were better than those corn-SBM diet. Also, the FCR in alkali-treated diets improved about 5.9% in comparison with diets containing raw PP. The reason of this difference may be increasing of digestion ability by alkaline processing. Treated the PP with NaOH results in weakness of connection between nutrient and cell wall content (Mcdonald et al., 2011) that increased digestion of PP and improved the FCR. Other researches showed that chicks fed 10% alkali-treated result in FCR improvement (Hussein etal., 1998). In other hand, some of researchers concluded that alkaline processing doesn't have any

noticeable effect on PP nutritional value (Al-masri 2005). Differece in nutritional value of alkali-treated PP among experments, could be due to differences in raw material composition and processing system (Panigrahi etal., 1991 ; Ojewelo etal., 2006). By increasing of PP amount in diet, feed intake increased at 21-42 day of age. When level of PP incresed, crude fiber of diets also incresed (table 2) and It may result in decrease digestibility of nutrient and chicken compensate the decreasing of nutrient digestibility with increasing of feed intake. These results was similar to other reports (Osei etal., 1987; Panigrahi etal., 1991). Also Ezieshi and Olomum (2004) showed that chickes fed diet containing palm kernel meal were higher feed intake than that control diet. Also, Sundu etal. (2006) reported that the reason of higher feed intake in chickes fed palm kernel meal was high passage rate of digestion material from digestive system. Daily weight gain and FCR at 21-42 days of age depreseed in diets contanining PP than those corn-SBM diet. Among treatments, diet inclusion level of 3% raw or trated PP was similar weight gain and FCR to the corn-SBM diet. It seem, This was related to increasing fiber in diets containing 6 and 9% PP (5.7 and 7.7% crude fiber, respectively; table 2) that depressed performance of chicks.

In overall experiment (8-42d) dietary inculsion level of 9% raw PP incresed feed intake than control diet. These result had conform to the other reports (Panigrahi et.al 1991; Onwudike, 1986; Sundu etal., 2006). In 8-42d, weight gain and FCR in control diet was superior than those other diets. Also, diet containing 6% raw and 9% raw or trated PP depressed FCR ($p< 0.05$). These results was agree to Esuga etal. (2008) reports. As well as, other researchers reported that adding the amount of fiber to broiler diet, decreased digestion of starch, protein and fat and has a negative effect on performance of broiler chicks (Iji etal., 2001).

4. Conclusion

The results of this study confirm earlier studies that palm plup has substantial nutritional value for poultry; however, the nutritional quality may vary greatly among samples due to raw material and prossesing system. Our results showed that PP can be used up to 3% raw or to 6% alkali-treatrd in broiler chicks diets with no detrimental effects on performance. Also, because of low AMEn and high fiber of PP, it is better that it use in laying hen or boiler breeder diets.

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