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Performance and carcass quality of broiler chickens in response to Prosopis juliflora seed (PJS) as a by-product

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Abstract An experiment was conducted to study the effect of *Prosopis juliflora* seed (PJS) on the performance and carcass quality of broiler chickens. Based a randomized completely design, 160 day old Ross 308 broilers were distributed into 16 floor pens and reared for 42 days. Treatments included 0, 2, 4 and 6 % PJ. Feed intake (FI), BW gain (BWG), and feed conversion ratio (FCR) were measured weekly during starter (1 to 21 d), growing (22 to 42 d), and entire experimental (1 to 42 d) periods. The PJS used in this study contained 90% DM, 12% CP, 7% EE, 22% CF, 0.6% Ca, 0.16% P, 4% Ash and 5% tannin. The supplementation of PJS to broiler diets up to 2% had no significant effects on FI at all periods. But treatments containing 4 and 6% PJS had significant lower FI with compared to control treatment. BWG of treatment containing 6% PJS significantly decreased than those of others at starter period. Treatments containing 4 and 6% PJS had lower FI than others at starter and entire experimental periods. The dietary treatments did not significantly affect FCR. The dietary treatments did not significantly affect energy efficiency ratio (EER) and protein efficiency ratio (PER). European efficiency factor (EEF) for control treatment significantly was higher than treatments containing 4 and 6% PJS.

Key words: *Prosopis juliflora seed*, by-product, performance, broiler.

Introduction

There is an increasing demand in engineering food process wastes to reduce their pollution effects and to increase their value by conversion into useful by-products. Animal protein requirement in developing countries has become critical due to rapid population growth. This creates adverse consequences on food security and has resulted in high incidence of hunger and

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malnutrition, consequently efforts are geared towards increasing the animal production component of agriculture, and this fact has become prominent because of the malnutrition condition that characterized developing countries (Igbedioh, 1996). PJ tree is found in the arid areas of Iran where it provides fodder, fuel, shade and improvement of soil and stabilizes sand dunes. The PJ tree is extremely drought, salinity and heat tolerant. This tree responds well to irrigation, tolerating up to 50% sea water. PJ leaves are not edible to animals but its seeds are consumed especially during nutritional shortage periods. The PJ tree readily drops its seeds on the ground, which provide a good feedstuff for livestock. The major disadvantage of PJS is the high content of anti-nutritive factor such as fiber, tannins, haemaglutinins, prosopine and toxic amino acids which are capable of inducing adverse effect on simple stomached animals when consumed (Cheeke and Shull, 1985), Yusuf *et al*. (2008) reported that inclusion of decorticated fermented *Prosopis* seed meal with soybean meal could be used in broiler chickens diet. There are only a few studies have evaluated the use of PJS in poultry nutrition. So, the objective of current experiment was to investigate the effects of various levels of PJS on performance, EER and PER of broiler chickens.

Materials and methods

All experimental procedures were approved by the Animal Research Ethics Committee of the Islamic Azad University - Saveh branch, Saveh, Iran.

Prosopis juliflora seed

Prosopis juliflora seed (PJS) was analyzed for dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), calcium (Ca), phosphorous (P) Ash, and tannin using methods of the AOAC (AOAC, 1980). The PJ used in this study contained 90% DM, 12% CP, 7% EE, 22% CF, 0.6% Ca, 0.16% P, 4% Ash and 5% tannin.

Bird Management and Diets

On hundred sixty day-old male and female broiler chicks (Ross 308) were randomly assigned to 4 treatments with 4 replicates and 10 chicks per each replicate pen in a 42-d study. Birds were raised on floor pens. They received feed and water *ad libitum*. Light was provided continuously (24 h) throughout the experimental period and the initial room temperature was set at approximately 32 ℃ and then gradually reduced based on normal management practices until reaching 22 ℃. Throughout the study, mortality and the weight

of dead birds were recorded. A completely randomized design was used with four levels of PJS (0, 2, 4, and 6%). Compositions of diets are shown in table 1. The nutrient specifications were lower than those recommended by NRC (NRC, 1994) for broiler starter (0 to 21 d) and growing (22 to 42 d) diets. All diets were provided as a coarse. FI, BWG and FCR were measured weekly during experimental period. The performance of the birds was evaluated on the basis of FCR and EEF. The FCR and EEF were calculated using the following formulas:
FCR= feed consumed (g) / weight gain (g), EEF = (Livability (%) x live weight (kg)) / (age (days) x FCR) x 100, at the end of the experimental period (42 days) the EER and PER were calculated:-EER = energy intake / BWG and PER = protein intake / BWG.

Statistical analysis

Data were subjected to analysis of variance in a completely randomized design using the General Linear Models (GLM) procedure of SAS® (SAS Institute, 2004), and when treatment means were significant (P<0.05), Duncan's multiple range test (Duncan, 1955) was used. Percentage data were transformed to arcsine percentages prior to analysis.

Results and discussions

The PJS used in this study contained 90% DM, 12% CP, 7% EE, 22% CF, 0.6% Ca, 0.16% P, 4% Ash and 5% tannin. Results were in good accordance with those of Yusuf *et al*. (2001) who reported PJS chemical composition. The differences between our chemical composition data and those reported previously could be due to the species of PJ cultivars, growing condition, maturity and the processing conditions. Addition of 2, 4, and 6% of PJS in the experimental diets resulted in increases in dietary crude fiber (Table 1). The effects of PJ on live performance are shown in Table 2. The supplementation of PJS to broiler diets up to 2% had no significant effects on FI at all periods (0-21d, 22-42d and 0-42d). But treatments containing 4 and 6% PJS had significant lower FI with compared to control treatment. Also, the effect of treatments on BWG of broiler chicks was significant. BWG of treatment containing 6% PJS significantly decreased than those of others at starter period and treatments containing 4 and 6% PJS had lower FI than others at starter and entire experimental periods. The dietary treatments did not significantly affect FCR. There are only limited researches available on the effect of PJS on poultry nutrition. However, there are many experiments (Rahmatnejad *et al.,* 2011; Mushtaq *et al.,* 2006; Dotas *et al.,* 1999) that have investigated the effect of

similar fibrous feedstuffs on the performance of poultry. In all of these experiments reported that performance of poultry is decreased by using fibrous feedstuff in diets. The growth depression of broilers fed diets containing 4 and 6 % levels of PJS may be explained by the reduction in feed consumption. This effect could be because of the greater crude fiber in these diets, especially at starter period, compared with the control diet. Therefore, that is leads to the worse FCR of bird fed with diets containing 4 and 6 % levels of PJS.

The effect of PJS on EER, PER and EEF of broiler chickens are shown in Table 3. The dietary treatments did not significantly affect EER and PER. EEF for control treatment significantly was higher than those of treatments containing 4 and 6% PJS. The EEF depression of broilers fed diets containing PJS may be explained by the greater crude fiber in these diets, particularly at starter period, compared with the control diet.

Table 1. Ingredient and calculated composition of broiler diets

Ingredient	**Starter (0-21d)**				**Grower (22-42d)**			
PJS[1]	0.00	2.00	4.00	6.00	0.00	2.00	4.00	6.00
Corn	52.93	51.10	49.00	49.44	59.75	58.36	56.97	55.60
Soybean meal	38.30	38.25	39.00	36.66	31.6	31.00	30.40	29.80
Fish meal	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
DCP[2]	2.10	2.04	1.70	1.66	2.17	2.17	2.18	2.20
Salt	0.30	0.30	0.17	0.18	0.30	0.30	0.30	0.30
Calcium Carbonate	1.18	1.07	0.89	0.82	1.14	1.10	1.06	1.03
Vegetable oil	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
DL-Met[3]	0.25	0.25	0.25	0.25	0.06	0.07	0.08	0.01
L-lysine	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Vit & Min[4]	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Calculated								
ME[5], kcal/kg	2900.00	2900.00	2900.00	2900.00	2980.00	2980.00	2980.00	2980.00
CP[6],%	20.85	20.85	20.85	20.85	18.63	18.63	18.63	18.63
CF[7],%	2.56	2.82	3.07	3.56	2.23	2.52	2.83	2.23
Ca[8],%	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AP[9],%	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Lys[10],%	1.3	1.3	1.3	1.3	1.29	1.29	1.29	1.29
Met[11] + Cys[12],%	0.93	0.93	0.93	0.93	0.80	0.80	0.80	0.80

[1] Prosopis juliflora seed; [2] Dicalcium phosphate; [3] DL-methionine; [4] Vitamin and Mineral premix, provided per kilogram: vitamin A, 360,000 IU; vitamin D_3, 800,000 ICU; vitamin E, 7,200 IU; vitamin K_3, 800 mg; vitamin B_1, 720 mg; vitamin B_9, 400 mg; vitamin H_2, 40 mg; vitamin B_2, 2,640 mg, vitamin B_3, 4,000 mg; vitamin B_5, 12,000 mg; vitamin B_6, 1,200 mg; vitamin B_{12}, 6 mg; choline chloride, 200,000 mg, manganese, 40,000 mg, iron, 20,000 mg; zinc, 40,000 mg, copper, 4,000mg; iodine, 400 mg; selenium, 80 mg; [5] Metabolizable Energy; [6] Crude Protein; [7] Crude Fiber; [8]Calcium; [9] Available phosphorus; [10] Lysine; [11] Methionine; [12] Cysteine.

Table 2. The effect of Prosopis juliflora seed on performance of broiler chickens

Diet	***FI*[2]**			***BWG*[3]**			**FCR[4]**		
PJS[1], %	0-21d	22-42d	0-42d	0-21d	22-42d	0-42d	0-21d	22-42d	0-42d
0 (control)	1096.08[a]	3518.96[a]	4615.04[a]	597.08[a]	1859.75[a]	2455.35[a]	1.96	1.89	1.90
2	1099.17[a]	3590.17[a]	4689.33[a]	601.25[a]	1803.75[a]	2419.35[a]	1.96	1.99	1.98
4	1048.29[b]	3390.29[ab]	4438.58[b]	580.00[a]	1639.00[b]	2216.32[b]	1.94	2.07	2.03
6	978.75[c]	3219.42[b]	4198.17[b]	509.75[b]	1585.16[b]	2094.91[b]	2.08	2.03	2.04
SEM	14.19	57.08	67.92	10.28	36.04	43.88	0.01	0.01	0.00
P-value	0.00	0.08	0.02	0.00	0.00	0.00	0.16	0.28	0.22

[1] Prosopis juliflora seed; [2] FI= Feed intake; [3] BWG= Body weight gain; [4] FCR = Feed conversion ratio.
[a,b, c] means in each column with different superscripts are significantly different ($p<0.05$).

Conclusion

The results of this study revealed that PJS can be included in diets for broiler chickens up to 6% without any adverse effect on the performance and carcass quality of broiler chickens. Finally, in order to probable better performance of poultry, other experiments regarding PJS processing such as supplementation multiple-enzyme mixture are recommended.

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