Short Communication

Shelled acorn seed (*Quercus cerris*) as a diet ingredient on the performance of growing Japanese Quail

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Abstract

This study was carried out to investigate the effects of dietary inclusion of shelled acorn seed (*Quercus cerris*) on the growth performance and carcass yield of Japanese quail (*Coturnix coturnix japonica*). Four hundred four-day old quail chicks were used in this study. Experimental diets contained 0, 5, 10, 15 or 20% shelled acorn seed. The experiment lasted 38 days. There were no differences between treatments in body weight, body weight gain, feed intake and feed conversion ratio. Furthermore, the mortality rate and carcass yield were not affected by the inclusion in the diet of different levels of shelled acorn seed. The inclusion of shelled acorn seed to the quail diets did not cause any harmful effect on the health of the birds. These results suggested that up to 20% shelled acorn seed could be included as an energy source in quail diets.

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Feed is the major cost item in the production of poultry meat and eggs. Traditionally the majority of energy in poultry diets consisted of cereals that could also be consumed by humans. Therefore, investigating alternative energy sources not suitable as human food should receive a high priority in research. Acorn, the fruit of the oak tree, is such a new and unconventional energy source (Saffarzadeh *et al*., 2000).

Few laboratory analyses have been performed on acorns. Proximate analyses have revealed the chemical composition of acorns to be similar to that of chaffy cereals (Wanio *et al*., 1941; Baumgrass, 1944) with starch being the main component, constituting over 55% of the seed (Wanio *et al*., 1941). Apparently no chemical analyses have been performed and published on the nutrient content of acorn seed from the different oak species in Turkey. According to De Boer & Bickel (1988) diets containing 25% or more acorn meal produced eggs with coloured yolks and resulted in low hatchability of the eggs. Saffarzadeh *et al*. (1999) reported that up to 20% acorn seed could replace maize in the diet of laying hens with no serious adverse effects on performance. The result of a trial on the feasibility of substituting maize by rice germ meal, acorns and denatured sugar in the diets of broilers suggested satisfactory technical and economical results only with a one third substitution of maize. Total substitution of maize by the mentioned mixture produced broiler meat with a better taste, but adversely affected all other performance parameters such as growth rate, feed conversion ratio and carcass yield (Cicogena *et al*., 1972).

The aim of the present experiment was to evaluate the effects of the inclusion of shelled acorn seed at different levels in quail diets on their growth performance and carcass yields.

The representative sample used in this investigation was acorn from the *Quercus cerris* species, a famous Turkey oak that belongs to the *Fagaceae* family. The pooled sample of acorns were collected from approximately 300 individual *Quercus cerris* trees grown at different locations in the Taşkesti district of the Bolu Province of Turkey. Shells were removed from the acorns that have been dried in the sun for about a

week. The naked seeds were again left in sun to dry further. Finally, the seed coat (testa) was removed and the remainder was used in the study. The shelled acorn seeds were ground through a 2 mm sieve.

Four hundred four-day old Japanese quail chickens of mixed sex were fed for 42 days on the experimental diets containing 12.6 MJ metabolisable energy/kg and 190 g crude protein/kg. The treatments were: a control without shelled acorn seed and four treatments containing 5, 10, 15 or 20% shelled acorn seed. Diets were formulated to meet or exceed nutrient requirements (NRC, 1994) of quails. The composition of the experimental diets is shown in Table 1.

Table 1 Dietary ingredients (kg/1000 kg) and chemical composition of experimental diets

	Shelled acorn seed (% in diet)				
	Control	5	10	15	20
Ingredients					
Maize	495.0	455.0	475.0	415.5	352.0
Barley	100	80	-	-	-
Soyabean meal (44 % CP)	341	345	355	357	362
Shelled acorn seed	-	50	100	150	200
Sunflower oil	28	34	34	42	50
Limestone	15	15	15	15	15
Dicalcium phosphate	12.5	12.5	12.5	12.5	12.5
Salt	3	3	3	3	3
DL-Methionine	2.0	2.0	2.0	2.5	2.5
Vitamin-mineral premix[1]	3.5	3.5	3.5	3.5	3.5
Total	1000	1000	1000	1000	1000
Chemical analysis (g/kg dry matter basis)					
Dry matter	892	903	884	886	894
Crude protein (CP)	193.3	190.5	190.4	185.9	187
Ether extract	53.8	63.6	67.5	75.6	83
Crude fibre	36.4	31.3	33.4	30.6	32.4
Crude ash	55.0	57.7	55.7	58.5	62.4
Metabolisable energy[2] (MJ/ kg)	12.6	12.6	12.7	12.6	12.6

[1] Provided per kg diet: 15000 IU vitamin A; 1500 IU vitamin D_3; 20 IU vitamin E; 3 mg vitamin K; 3 mg thiamine; 5 mg riboflavin; 20 mg niacin; 20 mg calcium pantothenate; 5 mg pyridoxine; 1 mg folic acid; 15 µg vitamin B_{12}; 5 mg biotin; 0.1 mg choline chloride; 50 mg manganese; 80 mg zinc; 20 µg cobalt; 60 mg iron; 6 mg copper; 1.5 mg iodine; 0.2 mg selenium.
[2] Metabolisable energy content of diets was calculated according to TSI (1991).

Each treatment constituted four replicates containing 20 quails each and each replicate was housed in a pen of 60 cm x 40 cm x 20 cm within an experimental poultry house. The birds were weighted and assigned to cages according to a randomized complete design. The facilities were heated electrically. At the onset of the investigation the temperature in the experimental house was 33 °C. Temperature was gradually decreased by about 3 - 4 °C per week to reach 22 °C at 21 days, and then kept at this temperature for the rest of the study. Feed and water were provided *ad libitum.* Light was provided throughout the day.

The chemical composition of the shelled acorn seed (*Quercus cerris*) is presented in Table 2. Feed intake, body weight, body weight gain, feed conversion ratio and mortality rate were recorded weekly. Eight quails from each treatment were randomly selected and slaughtered at the end of the experiment to determine the weight and yield of individual cold carcasses.

Nutrient composition of diets and shelled acorn seed was determined according to AOAC (1990). The metabolisable energy values of shelled acorn seed and the experimental diets were estimated from their composition according to Turkish Standard Institute (TSI, 1991). Condensed tannin content of the shelled acorn seeds was determined spectrophotometrically using the Folin-Denis reagent (Waterman & Mole, 1994).

Table 2 The chemical composition (g/kg dry matter) of the pooled shelled acorn, *Quercus cerris*, seed

Analysed parameters								
Dry matter	Crude protein	Ether extract	Crude fibre	Crude ash	Starch	Sugar	ME MJ/kg	Condensed tannin
909.0	67.6	32.1	22.2	24.4	467	94	11.46	0.84

ME - Metabolisable energy

All data were analyzed statistically by one-way ANOVA using a Statistical Computer Program (SPSS, 1999). Differences between treatments were determined using the Duncan's multiple range test (Duncan, 1955) with a 5% level of probability. Effects of dietary treatments on mortality rate were evaluated using the chi square test.

Mean body weights, body weight gains, feed intakes and feed conversion ratios of the experimental groups are presented in Table 3. The weights and yields of the cold carcasses are shown in Table 4. Data in the table demonstrate that dietary inclusion of shelled acorn seed did not influence (P >0.05) parameters examined in this study.

Table 3 Performance of quails fed diets containing different levels of acorn seed for 4 - 42 days

Performance parameters	Shelled acorn seed (% in diet)						
	Control	5	10	15	20	Pooled s.e.m	P Value
Initial body weight, (g)	12.3	12.4	12.4	12.6	12.3	0.06	P >0.05
Final body weight, (g)	175.8	174.7	173.7	170.3	168.6	0.95	P >0.05
Total weight gain, (g)	163.5	162.1	160.9	157.2	155.9	1.25	P >0.05
Total feed intake (g)	587.5	593.8	594.0	589.0	590.6	4.00	P >0.05
Feed conversion ratio, (g feed/g gain)	3.59	3.66	3.69	3.74	3.79	0.02	P >0.05
Mortality rate (%)	9	10	11	13	14	0.65	P >0.05

s.e.m. - Standard error of the differences between means.

Table 4 Slaughter weight, carcass weights and carcass yield of the birds at 42 days of age after receiving diets containing different levels of acorn seed

Slaughter parameters	Shelled acorn seed (% in diet)						
	Control	5	10	15	20	Pooled s.e.m	P Value
Slaughter weight, (g)	174.6	171.8	171.0	167.4	170.4	1.28	P >0.05
Cold carcass weight, (g)	121.8	119.1	118.1	117.3	118.0	1.04	P >0.05
Cold Carcass yield, (%)	69.7	69.3	69.1	70.1	69.3	0.28	P >0.05

s.e.m. - Standard error of the differences between means.

This study was conducted to determine the possibility of using shelled acorn seed obtained from the Turkey oak (*Quercus cerris*) as an alternative feedstuff in diets of Japanese Quails. Unfortunately, no related study on nutrient values and tannin levels of foliage and acorn seeds of oak species of Turkey could be found in the literature. The chemical composition of acorn seed used in this experiment showed that it contained 67.6 g crude protein/kg, 32.1 g ether extract/kg, 467 g starch/kg, 0.84 g condensed tannin/kg and 11.46 MJ metabolisable energy/kg feed. These values correspond with minimum and maximum values published by Bainbridge (1986). Bainbridge (1986) reported that acorns from 18 different species in the Californian region contained between 23 and 86 g crude protein/kg, 11 to 313 g ether extract/kg, 327 to 897 g soluble carbohydrate/kg and 1 to 88 g tannins/kg. Additionally, metabolisable energy concentrations varied from 11.08 to 24.14 MJ/kg for the 18 acorn species.

In the present study no significant differences were obtained in final body weight, body weight gain, feed intake and feed conversion ratio of the quails consuming the control diet that contained no acorn and those containing 5, 10, 15 and 20% acorn meal. Throughout the experimental period the shelled acorn seed showed no effect ($P > 0.05$) on the mortality rate between treatments, and was 9, 10, 11, 13 and 14% for the 0, 5, 10, 15 and 20% shelled acorn seed treatments, respectively. It was concluded that the tannin content of the shelled acorn seeds did not have any harmful effect on the health of Japanese quails. At the end of the study carcass weight and carcass yield in Japanese quails from the different treatments were compared and no differences were detected between treatments.

Results obtained in the present study suggest that acorn seed up to level of 20% could be included in quail diets. Shelled acorn seeds may be used as an energy source in quail diet and are comparable with those of cereal grains in diets. However, more trials are needed to determine the effect of shelled acorn seeds in diets on the performance of quails with regard to different management conditions, including different stress factors.

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