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THE EFFECTS OF TOMATO PULP POWDER SUPPLEMENTATION ON PERFORMANCE AND SOME BLOOD PARAMETERS IN JAPANESE QUAIL (COTURNIX JAPONICA)

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ABSTRACT

This experiment was conducted to evaluate the effects of feeding tomato pulp powder on performance and some blood parameters of Japanese quail. A total of 180 one day old quail chicks with an average weight of 18.50 g were divided into five treatments with 3 replicates. The treatments were divided as basal diet with no tomato pulp powder kept as control, and for others 2% (T1), 4% (T2), 6% (T3) and 8% (T4) of tomato pulp powder were used respectively. The live body weight gains and feed consumption of birds were measured individually feed conversion efficiency were calculated weekly. At the end of the trial for investigating the effect of using tomato powder supplementation on performance of quails, 2 birds form each replicates were slaughtered and some blood samples were taken for blood parameters determination. Data showed that using of tomato pulp powder didn't increased feed intake (FI) in comparison to control groups. Also body weight BW (g/d) and Pre-slaughter weigh (g) were higher in T2 than other experimental groups compared to the control. There were significant differences ($p<0.05$) for feed coefficient (FC) among treatments. Data showed that using of tomato pulp powder could reduce wings. Breast, drumstick and carcass yield (g) and also showed that triglyceride, cholesterol, Zn, Cu and Fe level had decreased in the T1, T2, and T3 except T4. There were significant differences ($p<0.05$) for triglyceride and protein levels amount treatments. Data from this study showed that dried tomato pulp may be used as ingredient in quails ration up to level of 4-6% without harming weight gain and feed conversion of birds.

Keywords: tomato pulp powder, performance, blood parameters, Japanese quail.

INTRODUCTION

Tomato pulp is a byproduct obtains from the processing of tomatoes for concentrated paste, juice, sauce and ketchup and contains skin and seeds. Tomato pulp is a fibrous material and small proportion is dried and use as an animal feed (Rezaeipour *et al.* 2012). The high fiber content of dried tomato pulp indicates that it can be use in poultry diets at low inclusion rates as an alternative to cereal byproducts (Dotas *et al*,1999). Tomatoes and tomato products are the major dietary source of lycopene, folate, vitamin C, vitamin A, phenolics, and flavonoids as potential bioactive compounds (Sahin *et al.* 2008). Recent studies have suggested a protective role for lycopene, an antioxidant carotenoid, in the prevention of environmental stress and lead to better performance for birds (Sahin *et al.* 2008; Donkoh, 1989). Tomato pulp is a good source of protein, vitamins and minerals but may be limited in energy due to the high fiber content (Mansoori *et al.* 2008). Substitution of tomato pulp instead of other dietary ingredients shows comparable performance parameters in laying hen (Jafari *et al.* 2006). The objective of this study was conducted to evaluate the effects of tomato pulp powder on performance and some haematological parameters in Japanese quail (Coturnix japonica).

MATERIALS AND METHODS

This experiment was carried out at the Aviculture farm of Najafabad, Isfahan, Iran. A total of 180 one day old quail chicks with an average weight of 18.50 g were divided into 5 treatments and were further subdivided into 3 replicates with 12 birds on each. Tomato pulp powder was purchased from Caspian animal feed factory in Karaj-Iran. Corn , soybean meal and tomato pulp powder samples were analyzed in the lab for determine amount of dry matter, crude protein, calcium, phosphorus and Its crude fiber with Association of Official Analytical Chemists (AOAC) methods as shown on Table-1.

The basal diet was balanced on the basis of corn and soybean meal as recommended by National Research council (NRC, 1994). The treatments were divided as basal diet with no tomato pulp powder kept as control, and for others 2 kg/100 kg (T1), kg/100 kg (T2) and 6 kg/100 kg (T3) and 8 kg/100 kg (T4) of tomato pulp powder were used respectively. The compositions of basal diet are shown in Table-2. Diets and fresh water were provided adlibitum during this experiment. The live body weight gains and feed consumption of quails were measured individually, feed conversion efficiency were calculated weekly. At the end of experimental period, 2 birds form each replicates (totally 30 birds) were slaughtered for determination of other parameters. Also dressing percentage was calculated free from giblets and some organs were weighed separately as percentage of carcass weight.

Table-1. Chemical composition and proximate analysis of the tested diets (Dry Matter).

Samples	Dry matter %	Crude protein %	Crude fat %	Crude fiber %	Ca %	P %
Corn	90.77	8.5	5.09	3.1	0.43	0.15
Soybean meal	90.55	46	3.45	7.31	0.69	0.45
Dried tomato pulp	94.16	19.77	10.03	36.16	1.1	0.21

Table-2. Composition of the experimental diets for quails.

Ingredients %	Control	T1	T2	T3	T4
Corn	47	45.5	45	44	43
Soybean meal	46	45.5	44	43.3	42.4
Oil	3	3	3	3	3
DCP	1.8	1.8	1.8	1.8	1.8
Calcium carbonate	1.2	1.2	1.2	1.2	1.2
Methionine D-L	0.15	0.15	0.15	0.15	0.15
Lysine-L	0.15	0.15	0.15	0.15	0.15
Nacl	0.25	0.25	0.25	0.25	0.25
Vitamin Premix*	0.25	0.25	0.25	0.25	0.25
Mineral Premix*	0.25	0.25	0.25	0.25	0.25
Tomato pulp powder	0	2	4	6	8
Calculated nutrient content					
ME (Kcal/Kg)	2900	2900	2900	2900	2900
CP (%)	24.1	24.2	24	24	24
Ca (%)	1.5	1.5	1.5	1.5	1.5
Available Phosphorus (%)	0.50	0.50	0.50	0.50	0.50
Lysine (%)	1.1	1.1	1.1	1.1	1.1
Methionine (%)	0.48	0.48	0.48	0.48	0.48
Methionine+Cystine (%)	0.88	0.88	0.88	0.88	0.88

Control with no tomato pulp powder, and 2 kg/100 kg (T1), 4kg/100 kg (T2) and 6 kg/100 kg (T3) and 8 kg/100 kg (T4) of tomato pulp powder were used respectively.

*Supplied Per Kilogram Of Feed: 9000 IU of vitamin A, 20000IU vitamin D3, 18000IU vitamin E, 2000IU vitamin K3,3000IU Vitamin B3, 3000IU Vitamin B5, 1000IU Vitamin B9, 3000IU Vitamin B6. 200Mg Se,8000 Mg Fe,100000 Mg Mn,100µg Se,100000Mg Zn, 10000 Mg Cu.

Evaluation of some blood parameters

After 12 h of fasting, blood samples were taken from the brachial vein from four birds per replicate and stored at refrigerator at 4°C. Individual serum samples were analyzed for total Protein, Cholesterol, Triglyceride, Cu, Zn and Fe by an automatic biochemical analyzer following the instructions of the corresponding reagent kit (Pars Azmoon Co., Teheran, Iran).

Data analysis

The GLM procedure of SAS software (SAS, 2001) was used for data analysis of variance as completely randomized design. The significant difference among the mean were calculated by Duncan's multiple range tests.

RESULTS

Table-3 data showed that use of tomato pulp increased feed intake (FI) none significantly in comparison to other groups except T1 (Table-3). BW (g/d) and Pre-slaughter weigh (g) were higher in T2 than other experimental groups compared to the control.

Table-3. The effects of tomato pulp powder supplementation on quail's performance.

Treatments	FI (g/d)	BW(g/d)	FC	FI(g)	Pre-slaughter weigh (g)
Control	24.55	5.19	4.73^{c**}	1154.1	244.02
T_1	24.47	5.04	4.85^{abc}	1150.3	237.19
T_2	26.98	5.25	4.79^{bc}	1268.1	246.74
T_3	24.97	4.89	5.10^{ab}	1173.6	230.13
T_4	24.74	4.81	5.14^{a}	1163.2	226.30
MSE	0.95	0.31	0.099	0.96	16.97
P Value	1.24	0.70	0.097	0.44	0.96

Feed intake (FI), body weight (BW), feed coefficient (FC), *control with no tomato pulp powder, and 2 kg/100 kg (T1), 4kg/100 kg (T2) and 6 kg/100 kg (T3) and 8 kg/100 kg (T4) of tomato pulp powder were used respectively.**Means within row with no common on letter are significantly different ($p<0.05$).

Data from Table-4 showed that wings weight (g) was induced were quails fed with tomato pulp powder. Also weight of breast and drumstick were lesser in the treatments and it was at the lowest on T1 in comparison to control group. Carcass weight was at the lowest on T2 and at the highest on control group. There were significant differences ($p<0.05$) for wings weight between treatments.

Table-4. The effects of tomato pulp powder supplementation on carcass traits of quails.

Treatments	Wings (g)	Breast (g)	Drumstick (g)	Carcass (g)
Control	14.16^{a}	91.66	57.83	222.67
T_1	11.15^{b}	83.83	52.66	206.00
T_2	12.16^{b}	80.33	53.50	196.17
T_3	12.83^{ab}	85.16	55.00	210.00
T_4	12.63^{ab}	81.00	56.33	197.00
MSE	0.186	6.95	4.18	13.26
P Value	0.009	0.317	0.337	0.005

Feed intake (FI), body weight (BW), feed coefficient (FC), *control with no tomato pulp powder, and 2 kg/100 kg (T1), 4kg/100 kg (T2) and 6 kg/100 kg (T3) and 8 kg/100 kg (T4) of tomato pulp powder were used respectively.**Means within row with no common on letter are significantly different ($p<0.05$).

Table-5 data showed that the Cu, Zn and Fe level decreased in the treated groups compared to the control group. Triglyceride was at the highest on T1 and at least on T2 significantly ($p<0.05$). Also There were significant differences ($p<0.05$) for protein level between treatments. Data showed that cholesterol level was at the highest on T4 and at least on T1.

Table-5. The effect of tomato pulp powder supplementation on some blood parameters.

Treatments	Triglyceride (Mg/dl)	Cholesterol (Mg/dl)	Protein (Mg/dl)	Cu (Mg/dl)	Zn (Mg/dl)	Fe (Mg/dl)
Control	376.3^{ab}	228	4.30^{ab}	79.5	415.1	392.7
T_1	424.5^{a}	227.8	4.21^{ab}	77.3	355.5	273.5
T_2	214.8$_{b}$	197.5	3.90^{ab}	73.3	331.8	222.3
T_3	361.7^{ab}	228.2	4.40^{a}	70.3	336.8	384.3
T_4	255.8^{ab}	324	3.66^{b}	61.6	413.0	362.7
MSE	88.19	57.45	0.349	12.03	62.25	125.3
P Value	0.0001	0.168	0.014	0.535	0.002	0.003

Feed intake (FI), body weight (BW), feed coefficient (FC), *control with no tomato pulp powder, and 2 kg/100 kg (T1), 4kg/100 kg (T2) and 6 kg/100 kg (T3) and 8 kg/100 kg (T4) of tomato pulp powder were used respectively.**Means within row with no common on letter are significantly different ($p<0.05$).

DISCUSSIONS

In the present study, tomato powder supplementation had no significant effects on the measured values in growing Japanese quails. The usage of the tomato pulp wasn't significant influences on FI, BW, FCR and Pre-slaughter weigh.

These results agree with the Rahmatnejad *et al.* (2008) that the supplementation of dried tomato pomace to broiler diets up to 16% had no significant effects on FI, BWG and FCR during the starter, growing and entire experimental periods.

If inconsistent with the results described below show, Ayhan *et al.* (2004) found that It was observed that especially 10 and 15 % dried tomato pomace levels in both ages resulted lower live Weight than control group ($P<0.01$). However there is no significant difference between control and 5 % dried tomato pomace supplemented diet groups. They also observed that there is no significant differences among groups fed with diets

contain different levels of dried tomato pomace. Rezaeipour *et al*. (2012) nutrient digestibility decreased by increasing the levels of dried tomato pomace in diets without enzyme supplementation (P<0.05). Sahin *et al*. (2008) indicated that 2.5 and 5% inclusion rate of tomato powder improved the gain and feed conversion ratio in Japanese quails.

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The most important factor in the tomato pulp is their ability to bind with bile salts and acids, restricting the formation of micelles and finally decreasing of lipid digestibility (Pavel, 1999). It is appear that binding to fibrous matter increases excretion of bile acids and reduce their re absorption into the liver, resulting by a feedback mechanism. However, in contrast to this study, Kavitha *et al.* (2003) reported that the fat digestibility is improved by increasing tomato pulp in diets.

The influence of dietary fiber components on lipid metabolism in animals has been studied. There is a negatively interaction between fiber and fat digestibility in birds (Smith, 1996).

Kavitha *et al.* (2003) indicated that increasing of tomato pulp levels in diets of broilers led to decrease of nitrogen utilization, So, it is suggested that use of high fiber diets can reduce the digestibility of protein in broilers.

Dietary supplementation with tomato products increased serum lycopene levels and reduced endogenous levels of oxidation of lipids, proteins and lipoproteins (Sahin *et al.* 2008).

Cavalcante Lira *et al*. (2010) showed that carcass weight (g) and weight of the noble parts, breast, drumstick and thighs decreased linearly in function of the use of tomato waste in poultry on pre initial and initial phase. They also showed that use of tomato waste in ration of broiler chickens during the period from 1 to 28 day may decrease weight gain and worsen food conversion. They also showed that there was no difference between diets of tomato waste for absolute weight and wing yield, back and abdominal fat. Jalili nasab *et al*. (2011) showed that using dried tomato pomace up to 16% of their diets, not only did not have any adverse effects on their performance, egg traits and blood parameters, but also increases some of them.

Feeding dried tomato pomace to laying hens had no effect on plasma cholesterol and low-density lipoproteins (Nobakht *et al.* 2007) serum albumin, globulin, glucose and triglyceride contents (Rahmatnejad *et al.* 2009). Melkamu (2013) showed that carcass yield values were higher for a group fed on 5% dried tomato pomace compared with other treatment groups. But statistically there were no significant difference between the groups. This result is in agreement with El-Hassan (1999) who indicated that at the levels of 2.5 and 5.0% dietary tomato pomace exhibited higher values of carcass dressing weight of chick. Also This result agrees with Ghazi and Drakhshan (2002) who showed that the dressing percentage was not significantly affected by the inclusion of dried tomato pomace on the diet.

In the present study a positive effect of dried tomato pulp on cholesterol concentration in the blood plasma of broiler cockerels was observed. Similar results were reported by Sahin *et al.* (2006) in Japanese quail when the supplementation of lycopene increased HDL concentration whereas VLDL and LDL concentrations were reduced by lycopene supplementation ($P \leq 0.01$).

Rao and Shen (2002) found that the plasma level of total cholesterol was reduced by lycopene supplementation. In contrast Frederiksen *et al* (2007) showed that dietary supplementation with an extract of lycopene rich tomatoes had no effect on cholesterol and trigylcerol levels measured in rabbit's plasma.

CONCLUSIONS

The use of tomato pulp in quail rations during the period from 1 to 47 days may decrease weight gain and worsen feed conversion. Dried tomato pulp may be used as ingredient in quails ration up to level of 4-6% without harming weight gain and feed conversion of birds. However further studies are needed for more explanations.

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