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Research Article

Evaluation of the Productive and Physiological Performance of Japanese quail (*Coturnix coturnix japonica)* Fed Different Levels of Pumpkin (*Cucurbita moschata*) Seeds Oil

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ABSTRACT

The aim of this study was to evaluate the effects of pumpkin seeds oil supplementation to the diet on growth performance, carcass characteristics and some blood biochemical parameters of Japanese quail (*Coturnix coturnix japonica*). A total of 192 day-old of Japanese quail were randomly allocated to four treatments, with 4 replicates per treatment and 12 birds per replicate. The dietary treatments were: Basal diet without supplementation with pumpkin seeds oil (control group) and three of pumpkin seeds oil treatments (5, 10 and 15 g/kg of diet). The results revealed significantly increase ($P<0.05$) of 10 and 15 g/kg of pumpkin seeds oil (PSO) on body weight gain during (1- 6) week period of experiment compared to control and 5 g/kg PSO treatments. There were less ($P<0.05$) feed consumption at 15g/kg of pumpkin seeds oil supplementation during (1-6) week period of experiment compared to other treatment. The addition of 15g/ kg of pumpkin seeds oil to the diet showed better ($P<0.05$) feed conversion ratio during (1-3) week period but addition of 10 and 15 g /kg of pumpkin seeds oils resulted in better ($P<0.05$) feed conversion ratio during (3-6) and (1-6) week period of experiment. Dietary supplementation of pumpkin seeds oil at 10 and 15 g/kg of diet increased ($P<0.05$) carcasses weights as well as decreased ($P<0.05$) total plasma cholesterol concentrations and triglycerides. It was found that body weight at 1, 3 and 6 weeks of age, body weight gain during (1-3) and (3-6) weekly periods, dressing percentage, weights of liver, heart, gizzard, giblets, edible meat, thigh, breast, back, wings and neck, total proteins, urea and creatinine concentration not significantly affected with PSO supplementation. It would have suggested that the supplementation of Japanese quail diets with (10 and 15g/kg) pumpkin seeds oils improved productive performance.

Key words: Pumpkin seed oil, Performance, Biochemical Parameters, Japanese quail

INTRODUCTION

Recently, the world becomes dependent upon pure ingredients, particularly those from the plants which are perceived as natural and safe by consumers (Tucker, 2002). Plant feed ingredients are substances derived chemically from simple processes (usually one-step aqueous or fat extractions) or collected intact from recognized parts of plants such as roots and seeds that are suitable for practical use in animal feed. After the use of the most antibiotic growth promoters as feed additives has been banned by the European Union due to cross-resistance against pathogens and residues in tissues, researchers have searched for alternative to antibiotics. Studies on plant ingredients continue to globally cause a particular attention. In this view, oil plants are becoming more important as natural promoter due to their antimicrobial effects and the stimulating effect on animal digestive system (Valero and Salmeron, 2003). Addition of the essential plant seeds oil to the poultry diets is important due to the appetizing, digestion-stimulating, antimicrobial properties and as natural growth promoters in live birds (Ciftci *et al*., 2005 and Ocak *et al.,* 2008). The plant oils contain high levels of unsaturated fatty acids and are more completely digested by fowl than animal fats. Pumpkin seeds are known to be as rich in oil (37.8-45.4%) and protein (25.2-37%), as well as GLC (gas-liquid chromatography) analysis for the fatty acid composition of the Pumpkin Seed Oil (PSO) showed that the predominant unsaturated were linoleic (42%) and oleic (38%), while the major saturates were palmitic (12,7%) and stearic (6%) (Tsaknis *et al.*, 1997; Esuoso *et al*., 1998). In Pumpkin oil, the saturated fatty acids content was 27.73% and comprise of 16.41% palmitic acid and

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11.14% stearic acid, additionally, unsaturated fatty acids value was 73.03% and consisting mainly of 18.14% oleic acid and 52.69% linoleic acid (Alfawas, 2004). Stevenson *et al.*, (2007) recorded that total unsaturated fatty acid content in Pumpkin Seeds Oil (PSO) ranged from 73.1 to 80.5%, as well as it has high tocopherol content that could potentially improve the nutrition of human diets. Pumpkin seed oil is rich in many antioxidants and beneficial nutritional components such as essential fatty acids, amino acids (especially tyrosine and L phenylalanine), phytosterols (*e.g*. ß-sitosterol), ß - carotenes, lutein and selenium (Yadav *et al*., 2010; Procida *et al*., 2013). Pumpkin oil has antimicrobial components and is effective against a lot of bacteria. Several *in vitro* studies reported significant antimicrobial and antifungal properties of Pumpkin seed oil (Vassiliou *et al.*, 1998; Hammer *et al*., 1999; Xiong *et al*., 2000; Ng *et al*., 2002). Concerning the effect of pumpkin seed oil on poultry performance, Hajati *et al*., (2011) indicated that supplementation of diets with 5g pumpkin seed oil/kg dry matter in corn soybean meal-wheat based diet can be profitable because it reduced broiler chickens mortality and it did not have any adverse effect on the performance of birds. Gaafar *et al.*, (2014) found improvement in live body weight of rabbits received diet supplemented with 5g of pumpkin seed oil/ kg of diet. on the other hand, Tabari *et al*., (2016) investigated that use of diet supplemented with Pumpkin seed oil improved body weight and increased feed consumption in broiler chickens as a result of the positive effect of pumpkin seed oil on the intestine conditions leading to better digestion, absorption and utilization of nutrients and also due to the positive role of Pumpkin seed oil on keeping a balanced microflora in the digestive tract. Therefore, we focused our interest in the objective of this study on the oil of Pumpkin seeds to evaluate its effect as dietary supplementation on the performance of Japanese quail birds.

MATERIALS AND METHODS

This study was conducted at the Quail farm, Department of Animal Production, College of Agriculture, University of Basra during the period from 10/3 /2015 to 21/4 /2015. A total of 192 day-old Japanese quail chicks were weighted and then randomly distributed into four dietary treatments containing 48 birds each. Each group contained four replicates of 12 birds. All birds reared in cages (replicates) of (45×70×75 cm). The birds were allowed free access to food and water and fed the basal diet formulated to meet the nutrient requirements of quail. The following four dietary treatments were used: Group not supplemented with pumpkin seed oil additive served as control; three of pumpkin seed oil treatments (5, 10 and 15 g per kg of feed). The ingredients and chemical composition of the diet are shown in Table 1. All birds were kept under uniform management conditions throughout the experiment period. Body weight (BW) was recorded at 1, 3 and 6 weeks of age. Body weight gain (BWG) was calculated as the change in body weight from (1-3), (3-6) and (1-6) weeks of age. Feed consumption (FC) and feed conversion ratio (FCR) during (1-3), (3-6) and (1-6) weeks of age were determined by cage (replicate). At the end of the experimental period four chick (2 female and 2 male) of similar body weight from each group were slaughtered to determine some carcass traits, dressing percentage, intestinal weight and length, other internal organ weights such as, liver, gizzard, heart and abdominal fat. The weight of carcass cuts (thigh, breast, back, wings, neck) was calculated. Four birds per treatment were randomly selected at the end of the experiment to determine blood serum parameters. Blood sample were collected in heparinized test tubes were centrifuged (3000 rpm, 15 min, 25^{o}C) to obtain plasma. Serum samples were stored at -20^{o}C until assayed to measuring blood parameters. Total serum protein and albumin were determined by a colorimetric method using commercial kits Biolab AS, France). Serum globulin was calculated by subtraction from total serum proteins. Blood serum cholesterol, triglycerides, urea and creatinine concentration were determined according to the methods of (Tietz, 1999) using commercial kits (Biolabo AS, France). All data were subjected to an ANOVA procedure of SPSS (2012). Significant treatment means were separated by using the Least Significant difference (L.S.D.) test (SPSS, 2012).

Table 1: The ingredients and composition of basal diet

Ingredient and composition	%
Yellow Corn	55
Wheat bran	05
Soybean meal (44%)	28
Protein Concentration (50%)	10
Limestone	0.75
Dicalcium Phosphate	0.50
Vitamin/ mineral premix	0.30
Salt	0.30
DL- Lysine	0.15
Total	100
Kcal ME/Kg diet	2910
Crude protein %	23
Ether extract %	4.22
Crude fiber %	4.00
Calorie: protein ratio	126.52
Calcium %	1.28
Phosphorus available %	0.51
Methionine %	0.37
Lysine %	1.36
Methionine + Cystine %	0.75

RESULTS AND DISCUSSION

The effect of dietary supplementation with pumpkin seed oil (PSO) on body weights (BW) and body weight gain (BWG) are presented in Table (2). Although using pumpkin seed oil in the diet at 10 and 15 g/ kg of feed positively influenced ($P<0.05$) body weight gain during the period of (1-6) week of age in comparison with other treatments (5g PSO/ kg) of feed and the control group, all pumpkin seed oil supplementations had not any significant effect on body weight at 1, 3 and 6 weeks of age and on body weight gain during (1-3) and (3-6) weekly periods of the experiment. Data of feed consumption and feed conversion ratio in Table (3) revealed less ($P<0.05$) feed consumption of birds that fed diet supplemented with pumpkin seed oil at the level of 15 g/kg of feed during the period of (1-6) week of the experiment, which reflected in best feed conversion ratio

Table 2: Fed diets containing different levels of Pumpkin seed oil on the body weight and weight gain of quail at 1, 3 and 6 weeks of age (mean ± Se)

Dietary Pumpkin seed oil g/kg	Body Weight (g)			Weight Gain (g)		
	1 week	3 week	6 week	1-3 week	3-6 week	1-6 week
0	60.14±0.23	116.39±1.09	190.89±4.07	56.25±1.08	74.50±3.23	130.75±2.96[b]
5	57.96±1.18	114.00±1.68	187.45±5.01	56.04±0.59	73.45±4.33	129.49±2.72[b]
10	59.18±1.32	116.88±2.21	198.58±4.74	57.70±1.38	81.70±4.13	139.40±4.44[a]
15	56.68±4.79	112.21±5.96	193.54±3.61	55.54±1.39	81.33±7.11	136.86±6.47[a]
Significance	NS	NS	NS	NS	NS	*

[a,b] Means in the same column with no common superscript are different significantly (P<0.05), NS= None significant.

Table 3**:** Fed diets containing different levels of pumpkin seed oil on the feed consumed (g) and feed conversion ratio (g/g) of quail at 1-3, 3-6 and 1-6 weeks of age (mean ± Se)

Dietary Pumpkin seed oil g/kg	Feed Consumed (g)			Feed Conversion Ratio (g/g)		
	1-3 week	3-6 week	1-6 week	1-3 week	3-6 week	1-6 week
0	157.66±16.27	213.35±14.92	371.01±27.08[a]	2.80±0.11[b]	2.88±0.15[b]	2.84±0.16[c]
5	164.63±20.20	185.54±14.83	350.16±26.16[a]	2.94±0.18[b]	2.58±0.15[b]	2.73±0.19[c]
10	163.35±4.11	188.30±10.75	351.76±13.87[a]	2.83±0.02[b]	2.31±0.15[a]	2.52±0.10[b]
15	135.25±15.69	168.89±21.68	304.14±13.34[b]	2.42±0.13[a]	2.17±0.19[a]	2.26±0.12[a]
Significance	NS	NS	*	*	*	*

[a,b, c] Means in the same column with no common superscript are different significantly (P<0.05), NS= None significant.

during this period in comparison with other treatments. The level of 15 (g/kg) of pumpkin seed oil also showed better (P<0.05) feed conversion ratio for birds during (1-3) week period compared to other treatments. Whereas both of 10 and 15 g/ kg of pumpkin seed oil showed better (P<0.05) feed conversion ratio in comparison with other treatments during the period of (3-6) and (1-6) week (Table 3). In agreement with the present results, Martinez *et al*., (2010) found no significant effect of pumpkin seed meal at 10% level on body weight, feed consumption and feed conversion. Hajati *et al*., (2011) pointed out that adding pumpkin seed oil up to 10 g/kg of dry matter decreased body weight gain significantly by affecting the appetite and reducing feed consumption of broiler chickens. Whereas in study on rabbits, Gaafar *et al*., (2014) found positive influence of pumpkin seed oil at the level of 5 g/kg of diet on body weights, body weight gain and reduction of feed consumption which reflected in best feed conversion ratio. On the other hand, Tabari *et al*., (2016) found improvement in body weights and increase in feed consumption of birds that fed diets supplemented with pumpkin seed oil as a result of the improvement in the conditions of the intestine leading to better digestion, absorption and utilization of nutrients. Previous study (Ramakrishna *et al.*, 2003) pointed out to the positive role of the plants oils on keeping balanced microbial ecosystem in the digestive tract and stimulating digestive enzymes secretions which increase nutrient digestion and lead to better growth performance of rats. Other factors which could have contributed to the beneficial effects of plants oils on the growth performance of birds were their probable antioxidant and antibacterial effects in the intestine (Nascimento *et al*., 2000). Carcasses traits of the experimental treatments are shown in Table (4). Dressing percentage and weights of liver, heart, gizzard, giblets, edible meat, thigh and breast were not differing respecting all treatments. However, dietary supplementation of pumpkin seed oil at 10 and 15 g/kg of diet resulted significantly (P<0.05) increase in carcasses weights. The results also revealed significant (P<0.05) proceeding for females compared to males in weights of carcasses, liver heart, gizzard and total giblets. In accordance with the present results, Denli *et al*., (2004) found that supplementation of the diet with thyme essential oil in quail significantly decreased abdominal fat weight and abdominal fat percentage however; carcass yield and carcasses weights were not affected. Yamany *et al*., (2008) showed that either sunflower oil or olive oil improved dressing percentage and did not increase the abdominal fat percentage in Japanese quail. They suggested from the findings of their study that increasing levels in the polyunsaturated fatty acids of the diet did not increase the abdominal fat percentage. Martinez *et al*., (2010) used 0 and 10% levels of pumpkin seed meal as supplementation in the diet and found no significant differences between two levels respecting carcass weight, breast weight and weight of thigh but only the excessive abdominal fat was lower in the treatment with 10% of pumpkin seed meal. Whereas, Hajati *et al*., (2011) found no significant effect of adding pumpkin seed oil on abdominal fat pad and carcass composition in broiler. On the other hand, Gaafar *et al*., (2014) reported that rabbit which fed diets supplemented with combination of pumpkin and black seeds oils (2.5 and 2.5 g/kg diet) showed the best results concerning carcasses traits. In broiler chickens, Tabari *et al*., (2016) had not find significant effect of dietary treatments of pumpkin seeds oil on carcasses weights, carcasses yield and gizzard weight except for thigh weight. Inclusion of pumpkin seeds oil in the diet did not affect (P>0.05) total protein, urea and creatinine but decreased (P<0.05) total plasma cholesterol and triglycerides concentrations at 10 and 15 g/ kg of PSO supplementation compared to other experimental treatments (Table 5). Females showed more (P<0.05) triglycerides concentrations in comparison with males. Our results may be due to the beneficial effects of pumpkin seeds oil on inhibition lipid synthesis and increase fatty acids oxidation and as a result decreased level of lipid metabolites and decrease triglycerides and cholesterol. In this respect in rats, Ramadan *et al.*, (2011) found that after 14 days of feeding with pumpkin seeds oil as adding in diet, plasma triglycerides and total cholesterol decreased in comparison with the control group because of high content of tocopherols and linoleic acid in pumpkin seeds oil which might provided protective antioxidant and cholesterol lowering effects, whereas they found an increase in serum total proteins as a result of the benefits of oleic and linoleic in pumpkin

Table 4: Carcass characteristic at 6 weeks of age of quail received pumpkin seed oil diets (mean ± Se)

Characteristic	Sex	Treatments				Mean
		Control 0 g/kg	Pumpkin seed oil 5g/kg	Pumpkin seed oil 10g/kg	Pumpkin seed oil 15g/kg	
Dressing percentage without giblets	Male	78.72±0.14	78.07±1.69	77.98±0.67	77.45±1.50	78.05±0.48^{A}
	Female	67.47±1.32^{b}	68.62±1.31^{a}	69.12±1.54^{a}	71.3±1.19^{a}	69.13±1.26^{B}
	Mean	73.09±3.69	73.35±3.12	73.54±2.64	74.38±2.07	73.59±1.32
Carcass weight (g)	Male	141.91±0.37	145.20±1.05	144.48±1.56	145.43±1.98	144.25±1.02^{B}
	Female	147.88±1.81^{b}	135.91±1.83^{b}	168.67±1.07^{a}	175.26±1.75^{a}	156.92±1.09^{A}
	Mean	144.89±1.20^{b}	140.56±1.58^{b}	156.57±1.22^{a}	160.34±1.75^{a}	150.59±1.17
Liver weight (g)	Male	4.55±1.34	4.34±0.30	4.50±0.09	3.28±0.36	4.17±0.33^{B}
	Female	7.16 ±0.85	6.80±0.10	9.64±1.63	8.52±0.88	8.14±0.55^{A}
	Mean	6.08±1.09	5.57±0.75	7.07±1.62	5.90±1.56	6.15±0.60
Heart weight (g)	Male	1.88±0.03	2.00±0.07	1.84±0.15	2.06±0.59	1.95±0.04^{B}
	Female	1.96±0.29	2.08±0.04	2.92±0.08	2.48±0.47	2.37±0.35^{A}
	Mean	1.93±0.12	2.04±0.04	2.38±0.31	2.27±0.22	2.16±0.10
Gizzard weight (g)	Male	2.51±0.16	2.14±0.23	2.34±0.25	2.34±0.31	2.33±0.21^{B}
	Female	3.32±0.77	3.27±0.13	3.42±0.24	3.53±0.24	3.38±0.17^{A}
	Mean	2.91±0.39	2.70±0.34	2.88±0.35	2.94±0.53	2.86±0.16
Total giblets (g)	Male	8.94±1.21	8.47±0.60	8.67±0.50	7.68±0.63	8.44±0.34^{B}
	Female	12.91±1.92	12.14±0.07	15.97±1.46	14.53±0.58	13.89±0.73^{A}
	Mean	10.92±1.47	10.31±1.08	12.32±2.20	11.12±2.01	11.17±0.80
Total edible meat (g)	Male	150.84±7.59	153.63±5.38	153.16±5.06	153.11±3.61	152.68±2.15
	Female	160.78±3.74	148.06±6.74	184.64±22.54	189.78±18.15	170.81±8.60
	Mean	155.81±4.48	150.84±3.86	168.89±13.08	171.44±12.99	161.75±4.87
Abdominal fat weight (g)	Male	3.44±2.10	4.06±0.41	4.74±0.09	6.57±1.52	4.70±0.66
	Female	2.68±0.51	1.69±0.50	4.63±0.12	4.44±1.52	3.36±0.56
	Mean	3.06±0.91^{ab}	2.88±0.73^{b}	4.68±0.07^{ab}	5.50±1.07^{a}	4.03±0.46
Thigh weight (g)	Male	30.59±1.28	30.73±0.56	31.61±3.34	31.98±0.17	31.23±0.71
	Female	34.73±3.29	34.97±3.50	30.79±3.97	37.35±3.09	34.46±1.58
	Mean	32.66±1.87	32.45±1.89	31.20±2.13	34.66±1.99	32.89±0.93
Breast weight (g)	Male	42.45±0.60	48.59±0.60	44.36±4.56	48.29±3.66	45.92±1.49
	Female	51.09±1.02	47.93±4.06	48.81±4.82	60.94±10.50	52.19±3.07
	Mean	46.77±2.54	48.26±1.91	46.59±2.99	54.61±5.81	49.06±1.83
Back weight (g)	Male	29.02±1.41	29.49±4.25	26.17±3.07	25.06±1.92	27.43±1.29
	Female	25.68±0.99	20.98±2.71	34.84±11.77	30.13±7.31	27.95±1.29
	Mean	27.35±1.19	25.23±3.20	30.51±5.55	27.68±3.43	27.69±1.71
Wings weight (g)	Male	8.69±0.10	8.15±0.89	8.28±1.95	9.16±0.08	8.57±0.43
	Female	9.03±0.43	7.80±0.08	8.32±0.43	8.39±0.73	8.38±0.43
	Mean	8.68±0.20	7.97±0.37	8.30±0.81	8.77±0.37	8.47±0.24
Neck weight (g)	Male	6.05±2.00	5.75±0.35	6.47±1.29	5.87±0.74	6.03±0.48
	Female	5.57±0.08	5.90±0.87	5.85±0.83	7.24±0.64	6.14±0.35
	Mean	5.81±0.82	5.82±0.38	6.16±0.65	6.56±0.56	6.09±0.29

^{a,b} Means in the same row with like superscripts letters were not significantly different (P>0.05).

Table 5: Some blood characteristic at 6 weeks of age of quail fed pumpkin seed oil (mean ± Se)

Parameters	Sex	Treatments				Mean
		Control 0 g/kg	Pumpkin seed oil 5g/kg	Pumpkin seed oil 10g/kg	Pumpkin seed oil 15g/kg	
Total Protein (g dL^{-1-})	Male	4.48±0.21	4.34±0.35	4.50±0.37	4.45±0.26	4.44±0.12
	Female	4.23±0.10	4.21±0.09	4.34±0.42	4.09±0.12	4.22±0.09
	Mean	4.35±0.12	4.27±0.15	4.42±0.23	4.27±0.16	4.33±0.07
Cholesterol (mg dL^{-1})	Male	178.08±0. 11	178.58±0.37	174.08±0.11	174.70±0.80	176.36±0.77
	Female	178.32±0.20	178.79±0.13	174.03±0.37	174.46±0.34	176.44±0.84
	Mean	178.20±0.12^{a}	178.77±0.20^{a}	174.06±0.19^{b}	174.58±0.36^{b}	176.40±0.55
Triglycerides (mg dL^{-1})	Male	331.58±1.53	318.80±1.48	311.23±1.48	300.79±2.64	315.60±4.31^{B}
	Female	327.82 ±12.58	332.79±1.70	324.44±1.46	316.04±1.41	325.27±3.35^{A}
	Mean	329.70±1.09^{a}	325.79±4.41^{ab}	317.83±3.90^{bc}	308.41±4.55^{c}	320.43±2.91
Urea (mg dL^{-1})	Male	15.44±3.40	20.41±1.64	15.65 ±4.20	15.24±3.25	16.68±1.47
	Female	20.58 ±1.46	15.74±3.74	12.79±2.78	19.14±7.49	17.06±2.04
	Mean	18.01±2.11	18.08±2.14	14.22±2.20	17.19±3.51	16.87±1.21
Creatinine (mg dL^{-1})	Male	1.46±0.14	1.08±0.70	1.80 ±0.01	0.73±0.10	1.27±0.20
	Female	1.55 ±0.24	0.91±0.24	0.84±0.45	1.11±0.08	1.10±0.14
	Mean	1.50 ±0.12	0.99±0.31	1.32±0.33	0.92±0.12	1.18±0.12

$^{a, b, c,}$: Values in the same row with different superscripts differ significantly (P<0.05).

seeds oil. Mohmoud *et al*., (2013), also demonstrated that feeding broiler on diets supplemented with olive oil had significant (P<0.05) increase in serum total protein as a result of the positive effect of plant oils on the immune system because of the presence of flavonoids which have antimicrobial activity. El-Yamany *et al*., (2008) investigated decrease in serum cholesterol and triglycerides which might related to the important

cholesterol and triglycerides reducing role of monounsaturated fatty acids in sunflower seeds oil and olive seeds oil as supplementation in diet of the growing Japanese quail. Our results of blood biochemical parameters agreed with those obtained by Hajati *et al.*, (2011) and Miraghaee *et al.*, (2011), who recorded that PSO significantly decreased serum levels of cholesterol and triglyceride in plasma and in the serum of broilers. On the contrary to our results Nworgu (2007) reported that birds served fluted pumpkin leaf extract had the highest value of cholesterol and urea in blood serum.

Conclusion

It could be concluded from the result of this study that supplementary pumpkin seeds oils at a level 10 and 15 (g/kg) have a beneficial effect on productive trait, with no significantly effect of carcass characteristics, also PSO in same levels reduced total plasma cholesterol concentrations and triglycerides in Japanese quail.

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