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GROWTH PERFORMANCE, CARCASS QUALITY, AND ECONOMICS OF PRODUCTION OF JAPANESE QUAILS FED WITH POMEGRANATE PEEL POWDER

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ABSTRACT

Carcass quality and product performance are major determinants of profitability and sustainability of any poultry enterprise. This study was undertaken on Japanese quails to evaluate the possibility of the effect of pomegranate peel powder (PPP) on growth performance, carcass quality, sensory evaluation, and economic return. A total of ninety-day old Japanese quail were randomly and equally assigned to three treatments (n=30). The results showed that birds fed 1% and 1.5% PPP had higher (P<0.05) dressing, liver and heart percentage than control group. The birds fed with 1% PPP had the highest revenue and net return and also gave the least cost-benefit ratio. Results indicate that the addition of PPP had beneficial effect on carcass quality, health of bird and economical return.

1. INTRODUCTION

The global increasing human population puts great pressure on arable land, water, and bioresources to provide an adequate supply of food while maintaining the integrity of the ecosystem (Kendall and Pimentel, 1994). Quail (*Coturnix japonica* synonym *C. Coturnix japonica*) of eastern Asia that is sometimes keeping for its meat or eggs and is used in laboratory research, Japanese quail (Coturnix coturnix) were used in the present study not only because they are considered an important agricultural species for meat and egg production in many countries but also because they are one of a useful animal model for the extrapolation of data to chickens and other birds.

Many studies have been focused on pomegranate as having antimicrobial activity against a wide range of microorganisms including bacteria (Gram-positive, Gram-negative), fungi, yeasts and viruses (Naz *et al.* 2007). Several investigators reported that pomegranate peel has antioxidant and antibacterial properties (Reddy *et al.* 2007, Opara *et al.* 2009, Al-Zoreky 2009). Pomegranate (Punica granatum L.) peel is a nutritive, antioxidant-rich by-product, easily available after production of

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pomegranate juice and ready to eat arils (Sayed, 2014). A large quantity of pomegranate peel waste is produced, and its disposal is an environmental problem Pomegranate peels which constitute up to 40% of the whole fruit remain as a by-product after pomegranate juice production (Kanatt *et al.* 2010). Pomegranate peel is a good source of tannin's, flavonoids, phenolic and other polyphony's compounds (Li *et al.* 2006). Quail rearing for meat and egg production all over the world has become an economically viable activity and has increasingly developed. From the technical and economic viewpoints, quail rearing is attractive due to their rapid growth and early onset of lay, high reproduction rates, and low feed intake.

The target of this study was to determine and compare the influence of Pomegranate Peel Powder on the growth performance, carcass quality, sensory evaluation, and economics production, due to the importance of quail production generally and meat product especially.

2. METHODOLOGY

2.1 DESIGN OF EXPERIMENTAL

The study was conducted in Zharawa Quail Farm, in northern Iraq. In this experiment, 90 day-old Japanese quail chicks are divided into three treatments each treatment with three replications of 10 birds for each replicate. The control group includes basal diet feed, (T1) basal diet + %1 pomegranate peel powder, (T2) basal diet + %1.5 pomegranate peel powder all treatments fed on a diet up to 35 days of age. Figure 1 shows the experimental Japanese quails during the experiment.

2.2 HOUSING

The cages used for the study was divided into 9 parts of equal dimensions each cage (31 x 76 x 45) cm. The quail chicks were distributed to the cages according to the breeding system (10 birds / each cage). The hall was closed. The floor of the cage was then sprayed with a thickness of 3-4 cm. The lighting was used as yellow incandescent light bulbs (100 watts) distributed evenly on the rooms for the lighting and warming the room and provide the thermometers to determining temperature.

2.3 FEEDING

The feeding was started from 1 day to 35 days, feed and water were freely available throughout the experiment. Pomegranate peel powder was prepared by dry the pomegranate peels in sun for a week and when they were completely dried then ground them into the grinder to make the fine powder. Take a sieve and filter the powder and pomegranate peel powder was ready.

2.4 GROWTH PERFORMANCE

On a weekly basis, body weight and feed intake were recorded and the parameters which calculated were feed conversion ratio and body weight gain. Twelve birds were taken randomly per treatment at the end of the experiment for sampling and then slaughtered.

2.5 MORTALITY PERCENTAGE:

Losses were recorded daily for each replicate, at the end of the experiment, the number of birds per group was calculated and the percentage was calculated according to the following equation.

Mortality percentage = Number of dead birds in a group /Initial number of birds in the group × 100

Figure 1: Japanese quails during the experiment.

2.6 DRESSING PERCENTAGE:

At the end of experiment birds were weighed individually before slaughter and then slaughtered and cleaned and removed from the inner viscera dressing percentage was calculated by using

D.P = Carcass weight (g)/ Live body weight (g) × 100 (1).

2.7 PERCENTAGE AND WEIGHTS OF CARCASS CUTS

Carcass yield, breast, wings, thighs, back, neck, giblets (heart, liver, gizzard) were measured.

Percentage of carcass cuts= Part weight (g) / Carcass weight (g) × 100 (2).

2.8 SENSORY EVALUATION

The meat samples were cooked and prepared for evaluation based on the method described by Cross et al. (1978) in the preparation of samples of meat slices and cubes and putting these samples to roast in an electric oven at a temperature of 165°C for 15 minutes. The meat samples had evaluated to flavor, tenderness, juices, and general acceptance.

2.9 COST AND ECONOMIC RETURN OF LIVE BIRD

Wholesale prices were relied upon when buying feedstuffs and selling production.

2.9.1 ECONOMIC COST CALCULATIONS

The total cost was calculated depends on the basis that the feed cost constitutes 70% of the total cost in our experimental conditions. The cost of the feed was calculated according to the types of feed. The price of one kilogram of control group feed is 450 ID and 451ID for T1 and T2. The cost of one kilogram of feed was multiplied with the amount of feed consumed (kg) for one bird which is equal to the total cost of feed for the bird

The final output of the total cost of feed multiply to 1.43 (100 ÷ 70) and the total economic cost of the live bird depends on the total cost of feed according to the following formula:

The total production cost of live weight/bird = total cost of feed/bird **x** 1.43 (3).

2.9.2 CALCULATING ECONOMIC RETURN

The price one live bird of it was sold at marketing is (2500) ID. The economic return depends on live bird price of groups it can be calculated by subtracting the economic cost from the sale price of one bird to produce a net profit. As in the following equation:

The economic return of one live bird = sale price of one bird - the economic cost of one bird

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2.10 STATISTICAL ANALYSIS

The experiment followed a completely randomized design. The data were analyzed using the General Linear Model (PROC GLM) of the Statistical Analysis System, computer software version 9.4 (SAS Institute, Inc., 2014). Means were separated by the Duncan multiple range test at a significance level of $P < 0.05$.

3. RESULTS AND DISCUSSION

3.1 PRODUCTIVE TRAITS

The effect of pomegranate peel powder on growth performance is shown in Table 1. There was no significant difference ($p>0.05$) between quails supplemented with PPP and the control groups on each of body weight and body weight gain. Birds fed with 1% PPP had lower feed intake ($p<0.05$) in comparison with control and birds which fed with 1.5% PPP. There was no significant difference between control and treatment one which they fed 1% PPP for Feed Conversion Ratio (FCR) while treatment two which the birds fed 1.5% PPP had the highest ($p<0.05$) FCR. The decreasing body weight with a group of birds that they fed PPP supported the findings with Abbas *et. al.* (2017) who reported that the birds fed with PPP lead to decrease body weight and improve feed conversion ratio. The reason for decreasing feed intake maybe because of peel powder contains tannin content reflects in its odor which makes it unpleasant and bitter due to which poultry may dislike it (Kushwaha *et al.* 2013).

In addition, the birds in the control group consumed more feed than other groups which is (505.88g), however, there were significant differences of mortality with the birds fed pomegranate peel powder in comparison with the control group, maybe refer to the effect of antioxidants to reduce cold stress.

Table 1: Effect of diets containing different levels of pomegranate peels powder on Growth performance.

Parameters	Treatments*			SEM[1]
	Control	T1	T2	
Body weight (g)	161.66[a]	155.00[a]	156.83[a]	39.42
Body Weight gain(g)	154.33[a]	147.16[a]	149.33[a]	39.46
Feed Intake(g)	505.88[a]	485.29[b]	505.62[a]	72.17
FCR	3.28[b]	3.30[b]	3.38[a]	0.77
Mortality%	1.01[a]	0.0[b]	0.0[b]	7.06

[ab] means within a row for each parameter with different superscripts are significantly different ($p < 0.05$). [*]Control group includes basal diet feed, (T1) basal diet + %1 pomegranate peel powder, (T2) basal diet + %1.5 pomegranate peel powder. [1]SEM, standard error of the means (pooled).

3.2 CARCASS TRAITS

Table 2 shows the effect of different levels of pomegranate peel powder on carcass quality of quail. It can be noticed that there were no significant differences in carcass weight for the control group in comparison with treatment groups however, there are significant differences for dressing percentage and percentage of carcass cuts. Percentage of liver, heart, and gizzard were higher in PPP replaced diets 1% of PPP (T2) as compared to control. But dressing percentage of back and neck were higher in PPP replaced diets 1.5% of PPP (T3) as compared to control (T1). This finding is consistent with Abbas *et al.* (2017) who revealed that liver and heart percentage were higher compared with treatment groups which include different levels of PPP.

Table 2: Effect of different levels of pomegranate peels powder on dressing percentage and percentage of carcass cuts of quails.

Parameters	Treatments*			SEM[1]
	Control	T1	T2	
Carcass weight (g)	137.45[a]	134.59[a]	136.26[a]	38.64
Dressing percentage %	85.08[b]	86.80[a]	86.85[a]	15.70
Breast %	32.74[a]	31.37[b]	30.89[b]	10.50
Thigh %	20.21[a]	19.83[ab]	19.64[b]	4.55
Back %	18.73[a]	19.05[a]	18.94[a]	5.55
Neck %	4.10[a]	3.41[a]	4.10[a]	8.31
Wing %	7.38[a]	7.34[a]	7.35[a]	2.47
Heart %	1.17[a]	1.20[a]	1.21[a]	0.72
Liver %	3.01[b]	3.35[a]	3.18[ab]	2.94
Gizzard%	2.57[a]	2.56[a]	2.09[b]	2.42

[ab] means within a row for each parameter with different superscripts are significantly different ($p < 0.05$). *Control group includes basal diet feed, (T1) basal diet + %1 pomegranate peel powder, (T2) basal diet + %1.5 pomegranate peel powder. [1]SEM, standard error of the means (pooled).

3.3 ECONOMICAL RETURN

The effect of dietary PPP supplementation on economical return showed in Table 3. The results revealed that the addition of PPP (1%) significantly ($P<0.01$) decreased feed cost. Similarly, the total cost was significantly reduced ($P<0.01$) with the addition of PPP. While there were no significant differences between control groups and the group that fed 1.5 % PPP. Birds fed T1 had higher ($P<0.01$) total return compared with control group and T2. Birds fed 1% PPP gave the least cost-benefit implying that it's the best level from the economic point of view; since there were no significant between treatments and control group at the same time birds fed 1% PPP consumed lower amount of feed-in return for each unit of feed intake is the aim of raising commercial poultry (Raeesi et al., 2010).

Table 3: Effect of different levels of pomegranate peels powder on feed cost, total cost and a total return of quails

Parameters	Treatments*			SEM[1]
	Control	T1	T2	
Feed cost/ bird	227.64[a]	218.86[b]	228.28[a]	1.03
Total cost/ bird (ID)[2]	325.53[a]	312.98[b]	326.45[a]	1.47
Total return/ live bird	2174.46[b]	2187.01[a]	2173.54[b]	1.47

[ab] means within a row for each parameter with different superscripts are significantly different ($p < 0.05$). *Control group includes basal diet feed, (T1) basal diet + %1 pomegranate peel powder, (T2) basal diet + %1.5 pomegranate peel powder. [1]SEM, standard error of the means (pooled). [2]ID: Iraqi dinar.

3.4 SENSORY EVALUATION

Table 4 shows the sensory evaluation of meat of birds fed diets containing PPP with different levels. There were no significant differences ($P>0.05$) between birds that fed PPP by different levels and control group for flavors, tenderness, juiciness and total acceptance. The results were in

Table 4: Effect of different levels of pomegranate peels powder on sensory evaluation of quail meat.

Parameters	Treatments*			SEM[1]
	Control	T1	T2	
Flavorness	3.72[a]	4.11[a]	4.05[a]	0.18
Tenderness	3.55[a]	3.83[a]	3.72[a]	0.24
Juiciness	3.44[a]	3.38[a]	3.55[a]	0.23
General acceptation	3.66[a]	3.83[a]	4.05[a]	0.19

[a] means within a row for each parameter with different superscripts are significantly different ($p < 0.05$). *Control group includes basal diet feed, (T1) basal diet + %1 pomegranate peel powder, (T2) basal diet + %1.5 pomegranate peel powder. [1]SEM, standard error of the means (pooled).

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accordance with findings of Sasidhar et al., (2016) who reported that no significant results to tenderness and juiciness for quails that fed PPP.

4. CONCLUSION

From this study, adding pomegranate peel powder did not lead to increase weight because of its odor which makes it unpleasant and bitter to poultry. While offering the pomegranate peel powder to birds feed leads to a significant effect on the mortality, and dressing percentage for treatment groups. Treatments with 1% PPP showed the best results, especially feed cost, mortality, total cost, and total return. Economically, PPP supplementation 1% is preferred to be used as an optimal level.

5. DATA AVAILABILITY AND MATERIAL

Data involved in this study can be requested to the corresponding author.

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