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Carcass Characteristics and Meat Chemical Composition of Japanese Quails Fed Diet Supplemented With Dietary Enzyme

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A B S T R A C T

To evaluate the effects of dietary enzyme supplementation on carcass characteristics and chemical composition of meat of Japanese quails, a total of two hundred forty healthy Japanese quails of mixed sexes were arranged into four dietary treatments. The first group of chick was considered as control group and fed the basal diet without supplementation of dietary enzyme. Second group was fed basal diet supplemented with 0.5g Kemzyme plus dry®/kg diet. Third group was fed basal diet supplemented with 0.1g phytase/kg diet. Fourth group was fed basal diet supplemented with Kemzyme® plus phytase. Carcass characteristics in term of dressing percentage, breast yield percentage, gizzard, spleen, liver and heart weight percentages of carcass weight were not affected significantly by dietary enzyme supplementation, but addition of enzyme increase significantly ($P<0.05$) the intestinal length. The crude protein percentage of meat increased significantly ($P<0.05$) by the addition of enzyme to diet and fat percent of meat decreased slightly by enzyme supplementation.

Key words: Japanese quails; carcass characteristics; dietary enzyme

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INTRODUCTION

Corn-soybean meal contains high nutritional value, however, soybean meal contains oligosaccharide that has been shown to decrease bird health and growth (Iji and Tivey, 1998). There is strong evidence that some nutrients in corn are not completely digested in the small intestine and considerable amounts of starch and protein escape digestion, reach the midgut and undergo fermentation with a relatively low energy yield (Noy and Sklan, 1995). Non-starch polysaccharides (NSP) comprises about 70-90% of the plant cell wall (Knudsen, 2001). Moreover, the NSPs gel may act as a physical barrier between substrates, enzymes and digestion end-products (Petterson and Aman, 1989). NPS may cause disturbance of intestinal microflora (Preston *et al.*, 2001).

Enzymes degrading complex compounds such as cellulases and other NSPs are not secreted in digestive systems of poultry. For this reason, poultry cannot make use NSPs in feeds in high amount efficiently (Annison, 1995). Supplementation of NSPs degrading enzymes may not only reduce the anti-nutritive effects of NSPs, but also releases some nutrients from these, which could be utilized by the birds (Balamurugan and Chandrasekaran, 2009). Dietary supplementation of multi-enzyme improves nutritive value of corn-soyabean diet in broiler chicks (Shirmohammad and Mehhri, 2011). The anti-nutritive effect is manifested by depressed nutrient utilization accompanied by poor growth. This adverse effect can be overcome by supplementation of exogenous carbohydrase (xylanase) enzymes which have been shown to lower viscosity of intestinal contents and to improve digestibility of starch, protein, fat and apparent metabolisable energy (AME) in broilers fed on diets containing wheat (Annison and Choct 1991; Bedford, 1995).

Phytate has the potential to bind with proteins at low and neutral pH which reduces protein digestibility (Ready *et al.,* 1982). Phytate, being a strong acid, can also form salts with important minerals thereby reducing their solubility (Eardman, 1979). The addition of the exogenous enzyme phytase has been used to reduce the pollutant residues, through improving the utilization of phytate–bound minerals in pig and poultry diets and decreasing the use of inorganic sources (Zanini and Sazzard, 1999). Phytase improves the digestibility of essential amino acids, crude protein and nitrogen retention (Zhang *et al.,* 2000; Ravindran *et al.,* 2001; Sharlie, 2005). The aim of this sstudy was to find the effect of enzyme supplementation on the carcass characteristics of Japanese quails.

MATERIALS AND METHODS

The present study was conducted at the Faculty of Veterinary Medicine, Benha, University to investigate the effect of dietary enzyme supplementation as feed additive for quail chicks on carcass characteristics and meat chemical composition. Two types of dietary enzymes were used (Kemzyme plus dry® and Phytase). A total of

two hundred forty healthy Japanese quails of both sexes were randomly allocated to four dietary treatment groups. Each treatment group contained 60 birds which were allotted into three replicates, each replicate contained 20 birds. The first group of chick was considered as control group and fed the basal diet without supplementation of any dietary enzyme, while the other three groups were fed on the basal diet supplemented with dietary enzyme as described in Table 1. Feed and water were provided *ad libitum*. Nutrient requirements of the rations were determined according National Research Council (NRC, 1994)..

At the end of experiment (45 days of age), 2 birds were chosen randomly from each replicate (total 6 birds from each dietary treatment group) were slaughtered to complete bleeding after fasting for 12 hours, carcass without feather percentage, carcass without leg and head, dressing percentage, breast yield percentage were determined. Gizzard, heart, liver and spleen were removed, weighed and expressed as a percentage of live body weight.

Intestinal length and width were recorded. Analysis of quail chick's meat was performed using the standard methods according to AOAC (2002). The chemical analysis included the moisture, dry matter, ether extract, crude protein, and ash in each sample from all groups. Data obtained throughout the trial were analysed using SPSS version 10 (2000) pocket programme and difference between the averages were examined by Duncans multiple-range test (Duncan, 1955).

RESULTS AND DISCUSSION

The present data in Table 2 showed that there were insignificant differences in carcass weight without legs and head, dressing percentage, breast percentage, heart, and gizzard, liver, spleen weights among dietary treatments. These results were similar to Arumbackam *et al*. (2004) who found that carcass characteristics in terms of blood loss, feather loss, eviscerated carcass, giblet, lower gizzard, small intestinal length and caecal length did not differ significantly either due to enzyme supplementation in quails. These results are supported with Hana *et al.* (2010) who stated that carcass characteristics showed no significant effects on whole carcass weight and/or dressing percent, weight and percent of breast, thighs and wings. While no significant differences were reported for heart, gizzard and abdominal fat pad. These results are harmony with other reports (Biswas *et al*., 1999; Kidd *et al*., 2001; Saleh *et al*., 2005; Hang *et al*., 2008) while these result were in disagreement with Jamroz *et al.* (1996) and Wang *et al*. (2005) who observed that exogenous dietary enzyme supplementation increased meat yield of broilers significantly. Enzyme supplementation had no effect on the relative weights of all organs (Kongbuntad e*t al*., 2006; Hajati *et al*., 2009).

The present data in the Table 4 showed that there was significant (P<0.05) increase in intestinal length of all dietary treatment when compared with control group. Concerning small intestinal diameter, the present data showed that there was significant (P<0.05) increase in diameter in group supplemented with Kemzyme® plus phytase when compared with control group. This may be attributed to carbohydrase enzymes which improve nutrient digestion and absorption (Bedford and Apajalahti, 2001). Our results were similar to finding of Junior (2005) who fed the birds phospholipase-supplemented diet resulted in the greatest intestinal weight and length. On the other hand these results disagree with Santos *et al.* (2004) who stated that endoxylanase supplementation resulted in the lowest relative intestinal length and weight along with the lowest viscosities, but highest body weight.

Meat chemical composition

The analysis of variance of obtained data in the Table 5 showed that there was insignificant difference between all dietary treatment groups in moisture percent and dry matter of meat. It was observed that these results were similar to Hajati *et al*. (2009) who found that dietary enzyme supplementation had no significant effect on moisture and dry matter percentage of meat but disagree with Hana *et al.* (2010) who found that addition of enzyme to diet of broiler lead to significant increase of dry matter percentage of meat.

The analysis of variance of obtained data from the Table 5 showed that there was significant increase (P<0.05) in crude protein percentage of group supplemented with Kemzyme® plus phytase and Kemzymeplus dry® when compared with control group. It was observed from the obtained result that the lowest percentage of crude protein of meat was for control group. This may be due to the improved digestion coefficient of crude protein. Enzyme supplementation in birds improved the AID apparent ileal digestibility of protein and amino acids (Ravindran *et al.,* 2007), also feed enzymes have the ability to alter the bacterial population by digesting the bacteria that colonize the tract and increase the quantity of protein digested in the pre cercal section of the tract (Bedford, 1997; Gunal and Yasar, 2004).

The analysis of variance of obtained data from the Table 5 showed that there was insignificant decrease in ether extract percentage of Japanese quails fed on diet supplemented with dietary enzyme when compared with control group. It was observed that the lowest percentage of ether extract was for chicks supplemented with Kemzyme®plus dry and the highest percentage of ether extract of meat was found in the control group. These results are in agreement with Hssan *et al.* (2011) who found that the supplementation of dietary enzyme slightly reduced the fat deposition in broilers. These results were in harmony with Szymczyk *et al.* (2007) who found that addition of enzyme caused a decrease of fat content in chicken meat (P<0.05) but no significant differences in fat content between experimental and control birds were found. Also these results were in agreement with other reports (Pishnamazi and Pourreza 1999; Youssef *et al*., 2011), who found that enzyme supplementation decreased adnominal fat. Decreased fat in meat due to dietary enzyme supplementation produced meat low in fat content and consequently makes the meat healthy for human.

Data present in Table 5 showed that there was significant decrease in ash percentage of quail's meat supplemented with Kemzyme plus dry and Kemzyme plus phytase when compared with control and other treatment groups. These results were supported by the findings of

Table 1: Experimental design

Groups	Number of birds	Diets	Supplemented levels of dietary enzyme (g /kg diet)	
			Kemzyme plus dry®	Phytase
T1(Control)	60	Basal diet	-------	-------
T2	60	Basal diet	0.5 g Kemzyme plus dry® /Kg diet	-------
T3	60	Basal diet	-------	0.1 gPhytase /Kg diet
T4	60	Basal diet	0.5 g Kemzyme plus dry® /Kg diet	0.1 gPhytase /Kg diet

Table 2: The effect of dietary enzyme supplementation on dressing weight, breast yield percentage, Carcass Weight without feather (percentage of live weight), Carcass Weight without head and feet, gizzard and heart Wight (percentage of live weight) (means ± SE)

Parameters	T1	T2	T3	T4
Carcass Weight without feather (%)	92.47± 0.75^{a}	90.83± 0.32^{b}	91.85± 0.28^{ab}	92.71± 0.35^{a}
Carcass Weight without legs and head (%)	83.85± 0.87^{a}	83.08± 0.67^{a}	84.25± 0.20^{a}	83.99± 0.58^{a}
Dressing (%)	69.26± 0.92^{a}	70.24±0.72^{a}	70.70±.17^{a}	70.18±0.57^{a}
Breast muscles yield (%))	23.99± 0.81^{a}	23.88± 1.19^{a}	23.90± 0.69^{a}	22.34± 0.75^{a}
Gizzard weight (%)	1.82±0.16^{a}	1.67±0.056^{a}	1.83±0.078^{a}	1.79±0.065^{a}
Heart weight (%)	0.960±0.067^{a}	0.952±0.076^{a}	0.916±0.07^{a}	0.984±0.059^{a}

$^{a, b, c}$ Mean values having different letters in a column differ significantly (P<0.05)

Table 3: The effect of dietary enzyme supplementation on organs weights proportion to live body weight of Japanese quail (means ± SE)

Prameters	T1	T2	T3	T4
Liver weight %	1.78±0.04^{a}	1.67±0.06^{a}	1.824±0.09^{a}	1.83±0.09^{a}
Spleen weight %	0.057± 0.001^{a}	0.056± 0.002^{a}	0.060± 0.00^{a}	0.058± 0.001^{a}

$^{a, b, c}$ Mean values having different letters in a column differ significantly (P<0.05)

Table 4: The effect of dietary enzyme supplementation on length and width of the small intestine (centimeters) of Japanese quail (means ± SE)

Parameters	T1	T2	T3	T4
Small intestine length (cm)	51.00±1.30^{b}	60.00± 3.50^{a}	58.00± 0.70^{a}	60.80±2.39^{a}
Small intestine diameters (cm)	0.76±0.05^{b}	0.82±0.037^{b}	0.88±0.02^{ab}	0.94±0.024^{a}

$^{a, b, c}$ Mean values having different letters in a column differ significantly (P<0.05)

Table 5: The effect of dietary enzyme supplementation on meat chemical composition of of Japanese quail (means ±SE)

Parameters (%)	T1	T2	T3	T4
Moisture	74.03±0.38^{a}	74.80±0.23^{a}	74.36±0.24^{a}	74.56±0.26^{a}
Dry Matter	25.97±0.38^{a}	25.20± 0.23^{a}	25.64± 0.24^{a}	25.44± 0.26^{a}
Crude protein	18.66±0.26^{b}	20.10±0.32^{a}	19.53± 0.34^{ab}	20.00± 0.20^{a}
Ether extract	2.03±0.26^{a}	1.33± 0.23 ^{a}	1.53± 0.20^{a}	1.46±0.27^{a}
Ash	2.66±0.26^{a}	1.73±0.18^{b}	1.96±0.20^{ab}	1.83±0.26^{b}

$^{a, b, c}$ Mean values having different letters in a column differ significantly (P<0.05)

Hana *et al.* (2010) who stated that ash percent for thigh meat significantly (P<0.05) decreased. A significant reduction in ash concentration in the carcass of Japanese quails receiving Kemzyme plus dry and Kemzyme plus phytase is consistent with work reported by Olukosi *et al*. (2008).

Conclusion

As shown in the present findings that adding enzyme to corn-soybean diet had no significant effect on carcass characteristics, dry matter and moisture of meat of Japanese quails. Enzyme can be added to quail diet lead to increase crude protein of meat and slightly decrease in fat of meat.

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