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Growth and Carcass Characteristics of Japanese Quails Fed Diets Containing Varying Levels of Moringa Leaf Meal

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ABSTRACT

The present experiment was conducted to evaluate the effect of incorporation of Moringa Leaf Meal (MLM) in the diet on growth and carcass characteristics of Japanese quails. One hundred and fifty day-old chicks were randomly allotted to five dietary treatment groups with three replicates of 10 birds each for 5 weeks. Moringa leaves were dried, ground and incorporated at 0 (T_1; Control), 1.5% (T_2), 3.0% (T_3), 4.5% (T_4) and 6.0% (T_5) per cent levels, respectively, in iso-caloric and iso-nitrogenous broiler quail diets to meet the requirements as per NRC (1994). Results indicated a significant increase ($P<0.01$) in body weight gain, overall feed intake and improved ($P<0.01$) FCR with incorporation of MLM at 3.0 % in the diet compared to other treatment groups. There was no significant difference in the carcass traits with respect to dressing percentage, meat: bone ratio and percentage of heart, liver, gizzard or giblet. However, incorporation of MLM at 3.0% level had increased carcass yield and ready to cook yield ($P<0.05$) compared to control group. The feed cost/kg gain decreased by ₹ 7.27 in T_3 as compared to the control (T_1). Thus, it is concluded that MLM can be incorporated at 3.0% level in the quail diets for economical production without any adverse effects.

Key words: Carcass characteristics, Growth, Moringa leaf meal, Quail

INTRODUCTION

Poultry production sectors in developing countries are facing magnitude of problems, one of which is an increase in the cost of feed due to high prices of protein and energy sources. Feeds and feeding are an integral part of broiler production that claims between 60-70% of total cost of production and at the same time, it dictates the production strength and quality. This also exerts impact on quail farming. Commercial quail farming is becoming popular in the recent years in most of the Asian countries. Quail farming is economically viable and technically feasible because quails are quite resistant to various diseases, early sexual maturity (6 weeks of age) and easily adapt to various rearing conditions (RSPCA, 2011). Quail meat and egg are known for their high-quality protein, high biological value and low caloric content. Quail eggs are rich in essential minerals, vitamins and the nutritional value is three to four times greater than chicken eggs. Quail meat is reported to be tastier than chicken and promotes body and brain development in children (Igado and Aina, 2010). The high and increasing prices, especially of protein and energy ingredients for animal feeds have compelled researchers to direct their attention to cheap, available and safe alternative sources. The possible alternative source to protein is the leaf meal of tropical legumes. Leaf meals serve as source of protein and also provide some necessary vitamins, minerals and oxycarotenoids (D'Mello *et al.,* 1987). One such leaf meal, which could be of value for poultry feeding, is the leaves of Moringa.

Moringa oleifera belonging to the family Moringaeceae is an effective remedy for malnutrition. Moringa has for long been consumed by humans and every part of the tree, from the roots to the leaves has beneficial properties, which are used as fodder, herbal medicine, spices, food, natural coagulants, nectar to bees, fuel and fertilizer. Moringa contains very high antioxidants and anti-inflammatory compounds. The tree has in recent times been advocated as an outstanding indigenous source of highly digestible protein, calcium, iron, vitamin C and carotenoids. Moringa leaves have a traditional application for its antimicrobial and pharmacological properties (Gakuya *et al.,* 2014). These excellent nutritional and medicinal characteristics would

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make it suitable forage for feeding animals (Nuhu, 2010). The leaves of moringa are potentially inexpensive protein for livestock feeding with a protein content ranging from 25.1 to 29.7 per cent (Makkar and Becker, 1996; Kakengi *et al.,* 2003). Moringa leaf meal is reported to improve the growth performance and carcass quality of broilers (Banjo, 2012; David *et al.,* 2012). Hence, the present study was undertaken to evaluate the effect of incorporation of moringa leaf meal in the diet on the growth and carcass characteristics in quails.

MATERIALS AND METHODS

The present experiment was carried out at the Poultry Experimental Station attached to the Livestock Farm Complex, NTR College of Veterinary Science, Gannavaram, Andhra Pradesh, India. Moringa leaves were collected form trees in the college campus, dried under shade and ground in a Wiley mill to prepare Moringa leaf meal.

One hundred and fifty day-old quail chicks were procured and randomly allotted into 5 groups, each with 3 replicates of 10 chicks. Chicks were wing banded and weight of the chick was recorded. The experiment was carried out for 5 weeks in a completely randomized design (CRD). During the experiment, MLM was included at 0 (T_1; Control), 1.5 (T_2), 3.0 (T_3), 4.5 (T_4) and 6.0 (T_5) per cent levels in iso-caloric and iso-nitrogenous quail diets (Table 1) formulated to meet nutrient requirements as per NRC (1994). All the chicks were housed in battery brooders throughout the experiment. All the cages were provided with uniform brooding facilities, feeders and waterers. Irrespective of the treatments, all the chicks were fed ad-libitum 2 times a day with respective broiler quail diets. Fresh and clean drinking water was made available at all the time. B-complex vitamins were offered in water for 3 days during first week. Except for feeding experimental diets, other managemental practices were uniform throughout the experimental period. The individual body weight of the quails was recorded at weekly interval up to 5 weeks of age. The feed offered and feed leftover was weighed daily to quantify the feed consumption. Weekly feed consumption was recorded replicate wise and feed efficiency was calculated accordingly.

At the end of study period (5th week), two birds per replicate and thus a total of 6 birds per experimental diet were randomly selected, weighed and slaughtered.

Table 1. Ingredient (%) and chemical composition (% DM basis) of quail diets

Parameter	T_1	T_2	T_3	T_4	T_5	Cost/kg (₹)
Maize	50.00	48.67	47.67	46.33	45.33	13.60
DORB	8.67	9.00	9.67	10.33	10.67	10.00
Soybean meal	34.00	33.33	32.67	32.00	31.33	38.00
Fish meal	5.00	5.00	5.00	5.00	5.00	60.00
Moringa leaf meal	0.00	1.50	3.00	4.50	6.00	5.00
DCP	0.20	0.20	0.20	0.20	0.20	26.0
Shell grit	1.25	1.25	1.25	1.25	1.25	2.00
Salt	0.25	0.25	0.25	0.25	0.25	3.50
Trace min mix	0.15	0.15	0.15	0.15	0.15	240
Feed additives	0.55	0.55	0.55	0.55	0.55	1116.00
Total	100	100	100	100	100	
ME* kcal/kg	2900.27	2900.51	2900.09	2900.17	2900.18	
Crude protein	23.99	24.02	24.00	23.99	24.01	
Feed cost/100 kg (₹)	25423	25119	24814	24506	24202	

*Calculated value

The data on dressing percentage, carcass yield, meat bone ratio, ready-to-cook yield and per cent weight of heart, liver, gizzard and giblet were recorded. All the data were analyzed statistically (SPSS, 17th Version) as per Snedecor and Cochran (1994) and comparison of means was done using Duncan's multiple range tests (Duncan, 1955).

RESULTS AND DISCUSSION

Moringa leaf meal used in the present study contained 93.86, 86.11, 24.61, 8.56, 14.53, 38.41, 13.89 and 0.35 DM, OM, CP, EE, CF, NFE, TA and AIA, respectively. The chemical composition of the experimental diets containing varying levels of MLM is presented in Table 1. Data pertaining to body weight gain, feed intake and feed conversion ratio (FCR) under different dietary treatments are presented in Table 2. The mean body weight gain (g) was significantly higher (P<0.01) in quails fed diets containing 3.0% MLM as compared to control and other dietary treatments. The improved weight gain observed in MLM fed groups can be attributed to higher protein quality of the diets which were efficiently metabolized for growth (Olugbemi *et al.,* 2010) and decreased weight gain at higher inclusion level may be attributed to higher crude fibre content which may impair nutrient digestion and absorption (Onu and Aniebo, 2011). The result of the present investigation was in agreement with earlier reports which indicate increased body weight gain in broilers (Hasan *et al.,* 2016; Khan *et al.,* 2017; Kumar *et al.,* 2018) and quails (Elkloub *et al.,* 2015; Mahmud *et al.,* 2016) as a result of incorporation of MLM in the diet. On the other hand, some researchers (Tesfaye *et al.,* 2013; Al-Bahouh *et al.,* 2017) reported decreased (P<0.05) body weight gain in broiler chicken fed MLM as compared to the control. However, Onunkwo and George (2015) and Elbashier and Ahmed (2016) reported no effect (P>0.05) on body weight gain in broilers fed Moringa leaf meal.

Feed intake increased linearly from T_1 to T_3 and decreased up to T_5 with increased level of inclusion of MLM in the diet and the differences between the treatments were significant (P<0.01). In line with the present findings, El-Tazi and Tibin (2014) reported increased feed intake at 5.0% level, while decreased at 7.0% level. Decreased feed intake with increased level of MLM may be due to the increased bulk and lower metabolizable concentration (Olugbemi *et al.,* 2010) and decreased palatability at higher levels (Kakengi *et al.,* 2003). In contradiction to the present findings, several authors reported significantly (P<0.05) increased (Hassan *et al.,* 2016; Mousa *et al.,* 2017; Kumar *et al.,* 2018) and decreased (Makanjuola *et al.,* 2014; Agashe *et al.,* 2017) feed intakes in broilers fed varying levels of MLM in the diet. On the other hand, Onunkwo and George (2015) and Mahmud *et al.* (2016) reported no effect (P>0.05) on feed intake in broilers fed MLM in the diet.

Inclusion of MLM at varying levels from 0 to 6.0% in the diet had significant effect (P<0.01) on feed conversion ratio in quails with better FCR reported at 3.0% level. The improvement in FCR at 3.0% level may be attributed to rich content of nutrients in Moringa leaf meal (Kakengi *et al.,* 2003), antimicrobial properties of Moringa (Fahey *et al.,* 2001) and adequate utilization of diets by the birds. In line with the present findings, Kumar *et al.* (2018) reported better FCR at 5% level of moringa leaf compared to 10, 15, 20% and control. Similarly, improved FCR was reported by Nkukwana *et*

Table 2. Effect of inclusion of MLM at varying levels on body weight gain, feed intake, FCR and feed cost/kg gain in quails

Parameter	T_1	T_2	T_3	T_4	T_5	SEM	P Value
Body weight gain (g)	170.61^{ab}±1.22	179.49^{cd}±0.76	185.53^{d}±2.86	176.16^{bc}±1.64	166.80^{a}±4.17	1.91	P<0.01
Overall feed intake (g)	555.93^{ab}±1.50	562.93^{bc}±1.14	564.88^{c}±3.05	561.76^{bc}±2.99	551.49^{a}±1.81	1.66	P<0.01
Feed conversion ratio	3.26^{c}±0.03	3.14^{ab}±0.02	3.05^{a}±0.04	3.19^{bc}±0.04	3.31^{c}±0.04	0.03	P<0.01
Feed cost/kg gain (₹)	82.84^{c}±0.82	78.79^{b}±0.47	75.57^{a}±1.04	78.18^{b}±1.02	80.05^{bc}±1.74	0.72	P<0.01

Table 3. Effect of inclusion of MLM at varying levels in the diet on carcass characteristics of quails

Parameter	T_1	T_2	T_3	T_4	T_5	SEM	P Value
Carcass yield (g)	116.17$^{ab\pm}$4.25	120.00$^{ab\pm}$3.10	125.67$^{b\pm}$4.11	121.00$^{ab\pm}$2.25	114.67$^{a\pm}$2.80	1.58	P<0.05
Dressing (%)	64.16±2.52	63.98±0.97	64.38±0.81	61.66±0.91	61.04±1.53	0.67	NS
Ready to cook yield (g)	124.33$^{ab\pm}$4.34	128.63$^{ab\pm}$3.16	134.58^{b}±3.91	129.45^{ab}±2.23	122.58$^{a\pm}$2.77	1.60	P<0.05
Meat: bone ratio	3.67±0.32	3.74±0.11	4.15±0.26	4.15±0.26	3.38±0.08	0.12	NS
Heart (%)	1.50±0.22	1.58±0.27	1.67±0.21	1.53±0.21	1.45±0.26	0.10	NS
Liver (%)	2.33±0.21	2.55±0.22	2.67±0.21	2.50±0.22	2.30±0.19	0.09	NS
Gizzard (%)	4.33±0.21	4.50±0.22	4.58±0.20	4.42±0.27	4.17±0.31	0.11	NS
Giblet (%)	8.17±0.31	8.63±0.19	8.92±0.33	8.45±0.43	7.92±0.59	0.18	NS

al. (2014) and Hassan *et al.* (2016), in broiler chicks and Elkloub *et al.* (2015) in Japanese quails. However, no effect (P>0.05) on feed conversion ratio was reported by several authors (Makanjuola *et al.,* 2014; Mousa *et al.,* 2017) in broiler chicks.

Data pertaining to carcass characteristics are presented in Table 3. Incorporation of MLM at 3.0% level in the diet of quails resulted in increased (P<0.05) carcass yield (g) and ready to cook yield (g) as compared to control and other treatments. These results corroborated with the findings of Kumar *et al.* (2018) who reported that carcass weight (g) was significantly (P<0.05) higher in broilers fed 15% MLM in the diet. On the other hand, Ayssiwede *et al.* (2011) reported no effect (P>0.05) on relative weight of carcass fed MLM up to 24.0% level in the diet of broilers. Incorporation of MLM up to 6.0% level in the diet of quails had no effect (P>0.05) on dressing percentage and meat: bone ratio in the current study. Zanu *et al*. (2012) and Liaqat *et al*. (2016) also reported that feeding broilers with diets containing MLM at varying levels had no effect (P>0.05) on dressing percentage as compared to control. In contradiction, Mousa *et al*. (2017) reported increased (P<0.05) dressing percentage in broilers fed 1.5% MLM in the diet as compared to control. Incorporation of MLM up to 6.0% level in the diet of quails had no effect (P>0.05) on per cent weight of heart, liver, gizzard and giblets which was in agreement with the findings of earlier researchers (Aderinola *et al.,* 2013; Ayo-Ajasa *et al.,* 2016; Liaqat *et al.,* 2016).

The current study indicated that the feed cost/kg gain (₹) decreased by 4.05 in T_2, 7.27 in T_3, 4.66 in T_4 and 2.79 in T_5 group of quails fed diets containing MLM at varying levels as compared to the control (Table 2). The decreased (P<0.01) feed cost/kg gain in T_3 group of quails might be attributed to the better feed efficiency and increased weight gains in quails fed MLM at 3.0% level as compared to the other treatments. Similarly, El-Tazi and Tibin (2014) reported highest profitability ratio (P<0.05) in broiler chicks fed 5.0% MLM in the diet followed by 3.0 and 7.0% as compared to the control.

CONCLUSION

The present study indicated that incorporation of MLM at 3.0% in the diet resulted in increased body weight gain, carcass yield and improved FCR with a concomitant decrease in cost of production. Hence, it would be beneficial to incorporate MLM at 3.0% level in the diet of broiler quails without any adverse effects.

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