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Effect of Feeding Moringa leaf powder (*Moringa oleifera*) on Egg production performance of Japanese Quail (*Coturnix japonica*)

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Abstract
The study was conducted to investigate the "Effect of Feeding Moringa Leaf Powder (*Moringa oleifera*) on Performance of Japanese Quail (*Coturnix japonica*)". One hundred eighty unsexed Quail chicks (day-old) were used in a completely randomized design in 4 treatments with 3 replications, each consisting of 15 chicks. The treatments included the (T_1) control, (T_2) T_1+5% Moringa Leaf Powder (MOLP), (T_3) T_1+10% Moringa Leaf Powder (MOLP), (T_4) T_1+15% Moringa Leaf Powder (MOLP). In this experiment body weight, body weight gain, feed intake, FCR, egg production performance and nutrient utilization parameters were measured to assess the effect of different treatments in Japanese quail. Lowest age at first egg and highest body weight at first egg was found in 5% Moringa Leaf Powder (MOLP) fed group as compared to control group. The HDEP% was significantly highest in group of birds fed 5% Moringa Leaf Powder (MOLP) (T_2) and lowest in control group (T_1). The HDEP% increases when the Moringa Leaf Powder (MOLP) was included in the diet up to 5% level but further increases in the level of Moringa Leaf Powder (MOLP) in diet reduces the hen day egg production of Japanese quails.

Keywords: Feeding moringa leaf powder, Japanese quail

Introduction
Japanese quail (*Coturnix japonica*) are used as a laboratory animal model for multiple areas of scientific research, but not limited to developmental biology, endocrinology, aging, immunology, behavior studies and a variety of human genetic disorders. The quail embryo is an amniote with early developmental patterns remarkably as humans; as such they present significant experimental advantages for the study of amniotes e.g., rapid reproductive maturation, modest size of breeding adults, ease of breeding in laboratory animal facilities, resilience to research manipulations, availability of transgenic lines, a fully sequenced genome, and tools for molecular manipulations (Janet *et al*., 2015) [5].
Feeding has a great effect in poultry growth, egg production and meat quality. Feeds and feeding are integral parts of poultry production which accounts for 60-70% of total cost of production. Poultry feed cost in developing country are continuing challenge improving feed efficiency and reduce feed cost, make poultry production a remunerative one.
Being a herbal plant, *Moringa oleifera* is considered as the most efficient because leaves contain higher amount of protein besides its several therapeutic and medicinal uses. Moringa is the sole genus in the flowering plant family Moringaceae. It is locally known as Munga or Sahjan. One such plant is *Moringa oleifera*, commonly known as the drumstick tree (Makkar and Becker, 1997) [7]. There are about 13 species of Moringa tree in the family Moringaceae. They are native to India, the Red Sea area or parts of Africa. The trees also grow in tropical and subtropical climates. . The purpose of this study was to evaluate the effect of *Moringa oleifera* leaf meal (MOLM) in the Japanese quail diet on their productive performance.

Materials and Methods
The experiment was conducted at poultry farm, Department of Animal production, Rajasthan College of Agriculture, MPUAT, Udaipur, location in humid region at latitude 24.57 North and longitude of 73.70 East The research work carried out with 180 day-old age chicks of Japanese quail procured from the poultry farm, Department of Animal production, Rajasthan College of Agriculture, Udaipur.

Observations to be recorded

Feed intake and feed conversion ratio Egg production performance

A. Age at first egg (days): Age at first lay was determined by the total number of days from the date of hatching to laying first egg in a group.

B. Body weight at first egg (g): Body weight of quail at the age of first egg laid was recorded.

C. Weight of first egg (g): Average weight of first egg was recorded by weighing balance.

D. Hen day egg production: Egg production was recorded 7th to 14th week of age, it was calculated as hen day egg production (HDEP) formula:

$$\text{HDEP (\%)} = \frac{\text{Total no. of egg production during the period}}{\text{No. of birds during the period}} \times 100$$

E. Hen housed day egg production: Hen housed day egg production was calculated by the following formula:

$$\text{Hen housed day egg production (\%)} = \frac{\text{Total no. of eggs laid on a day}}{\text{Total no. of female birds housed at the beginning of laying period}} \times 100$$

Results and Discussion

The egg production performance

The age at first egg (Table 1) was earlier (42.33 days) in birds supplemented with 5% Moring Leaf Powder as compared to others. The body weight at first egg was significantly highest 216.00 g in 5% Moring Leaf Powder diet. The weight of first egg ranged from 8.07 to 8.23 g among different treatments and non-significant difference among the treatments was observed. Differences in egg number (HDEP %) (Table 2) was significant among treatments from 8th week to 14th week of age. The data revealed that HDEP% was significantly highest in group of birds fed 5% MOLP (T_2) and lowest in control group (T_1). The HDEP% increases when the MOLP included in the diet up to 5% level but further increases in the level of MOLP in diet reduces the hen day egg production.

The results of the present study are in close agreement with Wei Lu *et al*. (2016) [10] who also reported that dietary supplementation of 5% MOLM increased the egg production. Ebenebe *et al*. (2013) [4] also reported that supplementation of *Moringa oleifera* leaf meal at 5% level, resulted in significantly better egg production. Mousa *et al.* (2017) [8] reported that the diet supplemented with 0.4% followed by 0.2% MOLM recorded higher egg production values but 0.4, 0.6% recorded higher average egg weight during different periods. In conclusion, MOLM up to 0.6% supplementation in the diet had better positive effects on egg production of Japanese quail. Voemesse *et al*. (2019) [9] observed that feeding of *Moringa oleifera* leave meal (MOLM) showed a positive influence on egg production in laying hen. From the point of view of egg production, the use of 1% *Moringa oleifera* leaves in the diet of laying hens should be encouraging. Bidura *et al.* (2020) [3] observed that the supplementation of 4-6% *Moringa oleifera* feeding (MOL) in diet, increased egg mass, yolk colour, shell thickness, Ca and Mg in the yolk. Abou-Elezz *et al.* (2012) [1] reported that *Moringa oleifera* fresh leaves had higher egg laying rate and daily egg mass production. Improving laying parameters may be due to the effects of higher protein availability of *Moringa oleifera* (Kaijage *et al*., 2015) [6] and could relieve the harmful effects of tannins on egg production performance where it contains essential nutrients with anti-nutritional factors (Alikwe and Omotosho, 2003) [2].

Table 1: Effect of feeding Moringa leaf powder on age at first egg (days), body weight at first egg (g) and weight of first egg (g)

Treatment	Age at first egg (days)	Body weight at first egg (g)	Weight of first egg (g)
T_1	$45.33^{a\pm}0.33$	$178.33^{c\pm}3.28$	8.07±0.08
T_2	$42.33^{c\pm}0.66$	$216.00^{a\pm}2.64$	8.23±0.05
T_3	$43.67^{bc\pm}0.33$	$194.33^{b\pm}5.60$	8.12±0.10
T_4	$45^{ab\pm}0.57$	$184^{bc\pm}3.46$	8.17±0.12
CD 5%	1.63	12.80	NS

Table 2: Effect of feeding Moringa leaf powder (*Moringa oleifera*) on egg production (HDEP %)

Treatment/ week	7	8	9	10	11	12	13	14
T_1	46.53±0.49	$45.66^{c\pm}0.03$	$48.86^{c\pm}1.17$	$51.83^{c\pm}0.34$	$56.52^{c\pm}0.73$	$60.56^{c\pm}0.17$	$67.93^{c\pm}0.28$	$68.92^{c\pm}1.79$
T_2	51.56±0.40	$53.78^{a\pm}0.43$	$57.51^{a\pm}1.09$	$60.13^{a\pm}0.73$	$62.86^{a\pm}0.31$	$66.21^{a\pm}0.28$	$73.43^{a\pm}0.17$	$77.06^{a\pm}0.25$
T_3	48.63±1.55	$49.11^{b\pm}0.79$	$53.41^{b}\pm0.34$	$55.86^{b\pm}0.98$	$59.16^{b\pm}0.81$	$60.56^{c}\pm0.31$	$70.33^{b\pm}0.28$	$73.11^{b\pm}1.79$
T_4	47.93±1.84	$47.87^{b\pm}0.53$	$51.65^{b\pm}0.37$	$54.16^{b\pm}0.80$	$60.32^{b\pm}0.37$	$63.35^{b\pm}0.43$	$69.86^{bc\pm}1.36$	$71.89^{b\pm}1.01$
CD 5%	NS	1.74	2.78	2.49	1.97	1.07	2.35	2.89

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