PRODUCTION PERFORMANCE OF JAPANESE QUAILS ON DIETS SUPPLEMENTED WITH DRIED FRUIT GRANULES OF *MORINDA CITRIFOLIA*

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ABSTRACT

Morinda citrifolia (Noni), also known as Indian mulberry, grows widely in Andaman & Nicobar group of Islands, and is used as a traditional food by the tribal populace. There is lack of empirical literature on the use of dried fruit granules as a food complement in birds. The present study depicts the effect of supplementation of Sun-dried ripened fruit granules of *Morinda citrifolia* on the production performance of Japanese quails and its economic significance. Fifty quails (day-old) procured for this study, were divided into two groups, with 25 birds in each group. Group A birds were given Sun-dried ripe fruit granules of *Morinda citrifolia* (20%, w / w) as replacement of the concentrate mixture in the ration, while group B birds were given concentrate mixture in the ration, and was used as the control. The study was conducted for 18 weeks. The dried fruit granules of ripened morinda, contained protein (5.8%), fat (2.3%), crude fibre (7.7%), ash (13.5%), moisture (8%), Zn (26 ppm), Mn (14.5 ppm), Fe (33.21 ppm), Cu (18.65 ppm), Ca (49.12 ppm), Mg (173.77 ppm), Na (336.12 ppm), and K (1158.2 ppm). It was found that the birds in morinda supplemented group achieved higher ($P \geq 0.05$) market body weight (g) at 5 weeks (109.4±7.22) and better ($P \geq 0.05$) feed conversion ratio (FCR, g) per week between 1-5 weeks (7.57±0.91) than the market body weight (106.8±6.65) and FCR (9.01±0.97) in the control. The average hen housed egg production per week in 13 weeks (59.34±12.31) was higher ($P \geq 0.05$) in morinda supplemented group than the control (56.80±10.71). The feed cost per gram gain in body weight in quails was ₹ 0.13 in morinda supplemented group compared to ₹ 0.18 in the control. The cost of an egg was ₹ 0.45 in morinda supplemented group, while it was ₹ 0.78 in the control group. Thus, morinda supplementation accrued a dividend of ₹ 0.05 per gram gain in body weight and ₹ 0.33 per egg over the control. It is concluded that substitution of conventional concentrate mixture with *Morinda citrifolia* dried fruit granules (20%, w / w) in ration was cost-efficient in quails.

KEY WORDS

Cost-efficiency, Egg production, Growth, Japanese quail, Morinda

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INTRODUCTION

Morinda citrifolia (Noni), also known as Indian mulberry of the family *Rubiaceae*, has been in use since long, as a herbal remedy against infection, inflammation, parasitism, cancer, hypertension, and trauma in humans (Wang *et al*., 2002). Morinda plant grows widely in Andaman & Nicobar group of Islands, and is commonly known as *Lorang*, *Burmaphal*, *Pongee phal*, and *Surangi* by the tribal. Its fruit is very rich in a variety of nutrients (Rosalizan *et al*., 2010).

Morinda fruit and leaves have been in use as traditional foods in Southeast Asia and in the Pacific islands (West *et al*., 2006). The use of its plant extract as feed-supplement in goats (Aregheore *et al*., 2005) and Japanese quail (Sunder *et. al*., 2011a), and fruit extract in poultry (Sunder *et. al*., 2011b) have been reported. There is no literature available on the use of *Morinda citrifolia* fruits as a feed supplement in quails or in poultry. This paper presents the use of dried ripe fruit of *Morinda citrifolia* as a feed supplement in Japanese quail. This is the first report on the use the *Morinda citrifolia* fruit as a feed supplement in Japanese quail ration.

MATERIALS AND METHODS

Morinda citrifolia ripe fruits were collected from Horticulture Farm of Central Agricultural Research Institute, Port Blair, cut into small pieces and sun dried (Figures-1a, 1b, 1c)). The dried *Morinda citrifolia* fruits were grounded to make it in the form of small granules. The proximate analysis of the fruits was done by spectra analyzer and the quantitative estimation of minerals was carried out by using atomic absorption spectrophotometer. The dry ashing method was followed for estimation of macro- and micro- minerals (Jones *et al*., 1969). The mineral content was studied by atomic absorption spectrophotometer.

The quails (day-old) were divided in two groups of 25 birds in each group. Group A birds were given the experimental concentrate mixture in the ration containing *Morinda citrifolia* sun-dried ripened fruit granules (20%, w / w), while Group B birds received the normal concentrate mixture in the ration that served as the control. The ration was composed of maize: 48.0, Rice bran: 5.0, Soya bean oil cake: 33.6, Fish meal: 6.0, Shell grit: 6.7, Salt: 0.4, and Minerals & Vitamins: 0.3 parts.

The birds were kept under deep litter system of rearing and were provided with *ad-lib* water for drinking. The observations, *viz*., body weight, feed intake, and hen housed egg production were recorded. The birds were not given medication, and mineral and vitamin supplements during the experiment. The experiment was conducted in the year 2011, and continued for 18 weeks.

RESULTS AND DISCUSSION

Proximate composition: The proximate analysis of dried fruit granules of morinda revealed that it contained protein: 5.8%, fat: 2.3%, crude fibre: 7.7%, ash: 13.5%, moisture: 8%, Zn: 26 ppm, Mn: 14.5 ppm, Fe: 33.21, Cu: 18.65, Ca: 49.12 ppm, Mg: 173.77 ppm, Na: 336.12 ppm, and K- 1158.2 ppm. The fruit granules were rich in protein and minerals. The morinda dried fruit granules used in our study contained more amount of protein, Zn, Fe, and Na, and less amount of Ca and K than the report of Rosalizan *et al*. (2010), based on the analysis of mature fruits in Malaysia, indicating possible geographical variation.

Growth: The body weights (g) of pullets from 1-5 weeks in control and morinda supplemented groups (Table-1, Figure-2) revealed that morinda treated group

Figure-1a. Morinda fruit.

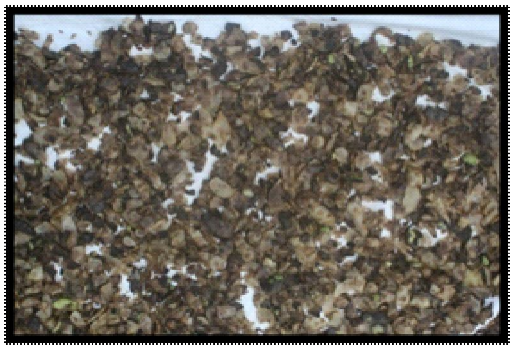

Figure-1b. Cut pieces of Morinda fruit.

Figure-1c. Morinda fruit granules.

achieved higher market body weight at 5 weeks (109.4±7.22 g) than the control (106.8±6.65), but the difference was non-significant (P≥0.05). Earlier studies on the supplementation of morinda fruit juice had indicated higher body weight in quails (Sunder *et al.,* 2011a).

Feed conversion ratio: The feed conversion ratio (g) of the pullets in control and morinda administered groups in different weeks (Table-2, Figure-3) revealed that morinda supplemented group showed better conversion ratio (7.57±0.91) than the control, but the difference was non-significant (P≥0.05). Earlier studies on the supplementation of morinda fruit juice had indicated better feed conversion ratio in quails (Sunder *et al.,* 2011a).

Hen housed egg production: The hen housed egg production of the quails from 6-18 weeks (Table-3, Figure-4) revealed that the average hen housed egg production per week was higher in morinda supplemented group (59.34±12.31), compared to the control (56.80±10.71), but the difference was non-significant (P≥0.05). In control group, the egg production was at peak at 11th week and declined there after, while in morinda fed group, the egg production reached peak at 12th week, and declined there after. By and large, egg production was better in morinda fed group, compared to the control, but the differences were non-significant (P≤0.05). Earlier studies on the supplementation of morinda fruit juice had indicated higher hen housed egg production (30.9), compared to the control group (20.9) during 8-14 weeks of age in quails (Sunder *et al.,* 2011a).

Cost efficiency: The cost efficiency of morinda supplementation (Table-4) indicated that feed cost per gm gain in body weight was ₹ 0.13 in morinda supplemented group, compared to ₹ 0.18 in control. Supplementation of morinda in feed brought a dividend of ₹ 0.05 per gm gain in body weight. The cost of an egg was ₹ 0.45 in morinda supplemented group, while it was ₹ 0.78 in the control group. Morinda feeding brought a dividend of ₹ 0.33 per egg.

Table-1. Body weight (g) of quails/ week from 1 to 5 weeks.

Week	Control	Morinda
1	19.16±2.03	19.87±2.68
2	31.33±3.85	38.16±4.51
3	48.4±4.79	57.2±6.76
4	76.8±6.46	80.8±10.16
5	106.8±6.65	109.4±7.22

Note: (1) The figures are presented as Mean±SEM.

Table-2. Feed Conversion ratio (g) of quails/ week between 1-5 weeks.

Week	Control	Treatment
1*	9.65±0.99	5.89±0.90
2	7.80±0.90	7.35±0.89
3	7.14±0.95	6.87±0.93
4	11.44±0.94	10.17±0.88
Mean	9.01±0.97	7.57±0.91

Note: (1) The figures are presented as Mean±SEM.
(2) *The difference was significant at P≤0.05.

Table-3. Hen housed egg production of layers from 6-18 weeks.

Week	Control	Morinda
6	28.57±10.86	14.29±12.01
7	59.26±10.60	57.14±11.94
8	80.95±9.94	61.90±11.83
9	76.19±11.02	85.71±12.25
10	90.48±10.09	80.95±11.87
11	95.24±11.19	90.48±11.81
12	71.43±11.01	95.24±12.61
13	41.94±10.71	71.43±10.98
14*	41.94±10.31	80.95±11.36
15	52.38±10.75	19.05±12.93
16	33.33±10.99	42.86±11.14
17	23.81±10.48	38.10±12.49
18	42.86±11.26	33.33±11.99
Av./ wk	56.80±10.71	59.34±12.31

Note: (1) The figures are presented as Mean± SEM.

(2) *The difference was significant at P≤0.05.

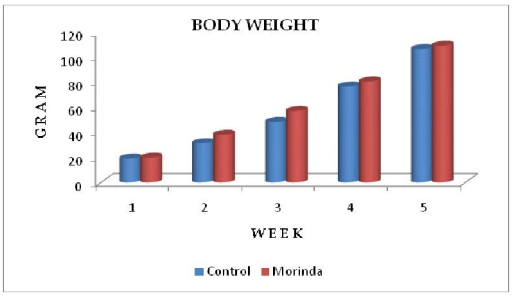

Figure-2. Body weight in different weeks.

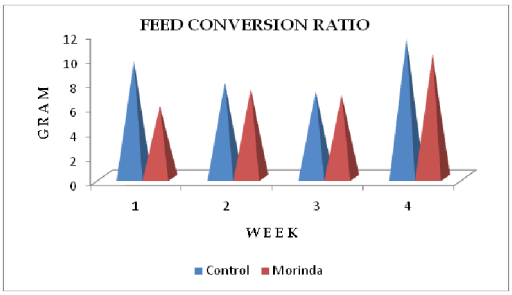

Figure-3. Feed conversion ratio in different weeks.

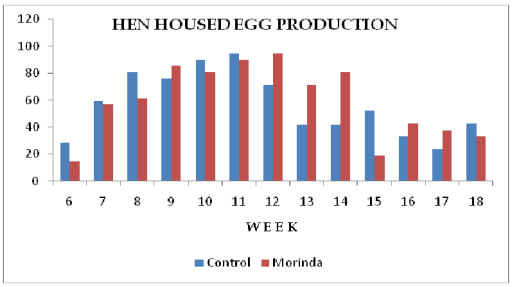

Figure-4. Hen housed egg production in different weeks.

Table-4. Cost efficiency of quail production under different dietary regimen.

Factor	Control	Morinda
Feed consumption (g)/ Quail till market age (5wk)	879.6	821.7
Total Body weight gain (g)/ Quail (1-5 weeks)	87.64	89.53
Feed consumption (g)/ gm gain in body weight	10.03	9.17
Feed cost (₹)/ kg	18.00	14.40
Feed cost (₹)/ gm of gain in body weight	0.18	0.13
Cost efficiency (₹)/ gm gain in body wt. over control	—-	0.05
Number of eggs produced/ Quail/ day in 6-18 weeks	0.57	0.62
Feed consumed (g)/ Quail per day in 6-18 weeks	25	20
Feed cost (₹)/ Quail	0.45	0.28
Cost of production of One egg (₹)	0.78	0.45
Cost efficiency (₹)/ egg over control	—-	0.33

CONCLUSION

The supplementation of *Morinda citrifolia* dried fruit granules in quail feed (20%, w/w) as replacement to concentrate mixture in the diet could accrue more dividends in broilers and layers, and had no side effects.

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