RESEARCH ARTICLE

Effect of Dietary Supplementation of Giloy (*Tinospora cordifolia*) and Ascorbic Acid along with Different Bedding Materials on Egg Production of Japanese Quail

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Abstract

The study investigated the effects of giloy (*Tinospora cordifolia*) and ascorbic acid supplementation along with different bedding materials (sand B_1, saw dust B_2 and wheat straw B_3) on egg production status of Japanese quails. Total 432 chicks (7 day-old) of Japanese quails were divided into three equal groups (144 each) for different bedding material used and each group was further subdivided into four groups (each of 36 chicks) on the basis of dietary treatment (control T_0, giloy T_1, ascorbic acid T_2 and combination of both T_3). Thus birds were randomly and uniformly distributed in total 12 treatment groups comprising of 36 birds in each group and each group was further divided into two replicates comprising 18 birds in each. Quails were fed a basal diet (control, T_0) and the basal diet supplemented with giloy 5 g/kg of diet, ascorbic acid 240 mg/kg diet and a combination of giloy 5 g/kg and ascorbic acid 240 mg/kg diet in dietary treatment groups T_1, T_2 and T_3, respectively. Highly significant ($p<0.01$) effect of incorporation of supplements and different bedding material was found on mean total egg production and egg production per bird of Japanese quail. Total number of eggs produced and egg production per bird were found highest in group on wheat straw bedding material (B_3) and on giloy plus ascorbic acid diet combination (T_3). The interaction between dietary supplementation and different bedding materials was also highly significant ($p<0.01$) on total number of eggs produced per flock and per bird. The results showed that a combination of dietary supplements of giloy and ascorbic acid and bedding material wheat straw significantly increased egg production which is beneficial for economics.

Key words: Ascorbic acid, Giloy, Japanese quail, Total number of eggs produced per bird, Total number of eggs produced per flock.

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Introduction

Poultry is one of the fastest growing components of the agricultural sector in India. Poultry plays an important role as animal protein source in human diet in terms of egg and meat. India ranks fourth in total production of poultry meat in the world (Basic Animal Husbandry Statistics, 2019). Japanese quail (*Coturnix coturnix japonica*) is one of the most efficient biological machines for converting feed into animal protein of high biological value (Das *et al*., 2012). They have less feeding requirement (about 20-25 g per day) compared to chicken (120-130 g per day) (Ani *et al*., 2009).

Various types of feed additives, such as antibiotics, enzymes, hormones, prebiotics, probiotics, herbal products *etc*., are being used as growth stimulants in poultry production to improve efficiency and get maximum returns in shortest possible time. *Tinospora cordifolia*, which is known by the common names guduchi, giloy and heart-leaved moonseed, is a herbaceous vine of the family Menispermaceae indigenous to tropical regions of the Indian subcontinent (Sengupta *et al*., 2011). Giloy is a rich source of protein and micronutrients, such as iron, zinc, copper, calcium, phosphorus, and manganese (Saeed *et al*., 2020). The most clearly established functional role for vitamin C involves collagen biosynthesis. Beneficial effects result from ascorbic acid in the synthesis of "repair" collagen (Bera *et al*., 2010).

Wood sawdust is the most common used bedding material, however there are many alternative materials that may be used such as peanut hulls, rice and wheat straw, rice hull ash (Chamblee and Yeatman, 2003), and other dry, absorbent and low-cost organic materials. Moreover, sand is

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occasionally used as a bedding material (Shields *et al*., 2005). Birds spend their entire life in contact with the litter material. Therefore, its quality is considered a crucial factor of poultry welfare. Hence, the present experiment was planned to study the effect of bedding materials such as sand, wheat straw and saw-dust with dietary supplementation of giloy (*Tinospora cordifolia*) and ascorbic acid and their combination on production of total number of eggs and number of eggs per bird in Japanese quail.

Materials and Methods

The present study was conducted at Poultry unit, Livestock Farm Complex, College of Veterinary and Animal Science, Bikaner, Rajasthan University of Veterinary and Animal Sciences, Bikaner (India) following approval of Institutional Animal Ethics Committee of the College.

Experimental Design and Materials

The study was undertaken on four hundred thirty two (432) seven-day old Japanese quail chicks which were purchased from central poultry development organization, Chandigarh. Out of 432 birds 72 birds were slaughtered at the age of 8 weeks for evaluating carcass characteristics and remaining 360 birds were further used for remaining traits (growth traits and egg production traits) for the entire experimental trail of 24 weeks.

The factorial design (3x4) was adopted for the present study. The chicks were equally and randomly divided into four dietary treatment groups (n=108) and one-third of each (n=36) were reared on each of three bedding materials (sand, saw-dust and wheat-straw) using two replicates each of 18 birds (R1-R2) to make sure the uniformity in various treatment groups. The chicks were reared on sand, saw-dust and wheat straw as group B_1, B_2 and B_3, respectively (n=144 each), and each bedding group subdivided equally in one control and three dietary treatment groups (giloy @ 5 g/kg diet, ascorbic acid @ 240 mg/kg diet, and a combination of both at the said rates) denoted by T_0, T_1, T_2 and T_3, respectively (n=36 each) to study the effect of bedding material, dietary treatment and their interaction on egg production of birds.

Commercially available readymade starter and finisher and layer rations were procured as basal diets and feed additives such as giloy (*Tinospora cordifolia*) and ascorbic acid were supplemented in them. During first seven days, newspapers were spread on litter material and from 8th day onward till the completion of experiment chicks were reared on respective litter material of about 6 inches of depth.

Egg Production Traits

Eggs were collected twice a day. Total numbers of produced eggs were calculated in each group throughout the laying period (from 8 weeks to 24 weeks) at two weeks interval. Egg production per bird was calculated as follows.

$$\text{Egg production per bird} = \frac{\text{Number of egg lay per replicate}}{\text{Number of birds per replicate}}$$

Statistical Analysis

The data generated was analyzed for two way ANOVA using factorial RBD and means were compared using Duncan's post-hoc test at $p<0.05$ on SPSS software (Snedecor and Cochran, 1994).

Results and Discussion

Total Number of Eggs Produced per Flock

The mean total number of eggs of Japanese quail produced on the basis of dietary supplements, bedding materials and interaction groups are presented in Table 1. The statistical analysis revealed highly significant ($p<0.01$) effect of incorporation of supplements, different bedding material as well as their interaction on mean total number of eggs produced in Japanese quail throughout the experimental period.

The overall means of total number of eggs produced for various dietary treatment groups were recorded to be 832.16 in T_0, 958.66 in T_1, 899.33 in T_2 and 1060.83 in group T_3, respectively. Significantly ($p<0.05$) highest total number of eggs produced was found in combination of both supplements (T_3) followed by giloy alone (T_1) as compared to control (T_0) and ascorbic acid (T_2) groups. Lowest total number of eggs produced ($p<0.05$) was in control group (Table 1). This finding indicates that supplementation of giloy and ascorbic acid in the diet improves total number of eggs produced in the Japanese quails. The results observed in present study were in agreement with the findings of Dhaliwal (2004), who reported improved egg production in birds which were fed the combination of vitamin C and E. Similarly, Bardakcioglu *et al.* (2005) found increased egg production in group of Japanese quail fed vitamin C. Shit *et al.* (2012) and Sigolo *et al.* (2019) also found significant effect of ascorbic acid supplementation on total number of eggs produced.

The mean total numbers of eggs produced in Japanese quail for various bedding material groups were recorded to be 849.25 in B_1, 942.87 in B_2 and 1021.12 in group B_3, respectively. Further the comparison of means showed that highest total number of eggs produced was recorded in B_3 (wheat straw) followed by B_2 (sawdust) and B_1 (sand) group (Table 1). So the overall result indicates that there is beneficial effect of wheat straw on total number of eggs produced in Japanese quails, and agreed with the findings of Dhaliwal *et al*. (2018). The statistical analysis revealed significant effect of interaction between incorporation of dietary supplementation and different bedding materials on mean total number of eggs produced. Further the comparison of means showed that highest total number of eggs produced was recorded in $B_3 \times T_3$ group. Lowest total number of eggs produced was found in $B_1 \times T_0$ group (Table 1). The study

Table 1: Effect of dietary supplementation, bedding material and their interaction on total number of eggs produced at different weeks of age in Japanese quail

Dietary supplement/ Bedding material/Interaction effect	Age in weeks								
	8-10W	10-12W	12-14W	14-16W	16-18W	18-20W	20-22W	22-24W	Cumulative
T_0	76.33^{a}	93.16^{a}	96.5^{a}	102.83^{a}	111^{a}	114^{a}	119.16^{a}	119.16^{a}	832.16^{a}
T_1	90.66^{c}	108.33^{c}	114.83^{c}	121.5^{c}	125.33^{c}	129^{c}	132.83^{c}	136.16^{c}	958.66^{c}
T_2	85.33^{b}	100.16^{b}	105.5^{b}	113.83^{b}	118.83^{b}	122.16^{b}	125^{b}	128.5^{b}	899.33^{b}
T_3	105.83^{d}	122.66^{d}	128.16^{d}	137.16^{d}	138.83^{d}	140^{d}	142.83^{d}	145.33^{d}	1060.83^{d}
SEM	0.89	0.93	0.97	0.63	0.76	0.78	0.57	0.66	2.94
B_1	77.87^{a}	92.62^{a}	101.5^{a}	111.25^{a}	111.87^{a}	114.12^{a}	118.25^{a}	121.75^{a}	849.25^{a}
B_2	90.62^{b}	109.62^{b}	111^{b}	117.87^{b}	124.12^{b}	126.5^{b}	130.5^{b}	132.62^{b}	942.87^{b}
B_3	100.12^{c}	116^{c}	121.25^{c}	127.37^{c}	134.5^{c}	138.25^{c}	141.12^{c}	142.5^{c}	1021.12^{c}
SEM	0.77	0.81	0.84	0.54	0.66	0.68	0.49	0.57	2.54
B_1 X T_0	72^{a}	83^{a}	85.5	94.5^{a}	94^{a}	97^{a}	100^{a}	101.5^{a}	727.5^{a}
T_1	77.5^{b}	93^{b}	107.5	116.5^{d}	117^{c}	119.5^{c}	124.5^{d}	127.5^{c}	883^{d}
T_2	71.5^{a}	84^{a}	94	105.5^{b}	108.5^{b}	111^{b}	114.5^{b}	118^{b}	807^{b}
T_3	90.5^{de}	110.5^{d}	119	128.5^{f}	128^{d}	129^{d}	134^{ef}	140^{d}	979.5^{h}
B_2 X T_0	73^{ab}	94^{b}	97	103^{b}	110.5^{b}	112^{b}	120.5^{c}	117.5^{b}	827.5^{c}
T_1	92.5^{ef}	113.5^{de}	112.5	117^{d}	126^{d}	130^{d}	132.5^{e}	137^{d}	961^{g}
T_2	87.5^{cd}	102.5^{c}	105.5	113^{c}	118^{c}	120.5^{c}	123.5^{cd}	129.5^{c}	900^{e}
T_3	109.5^{h}	128.5^{f}	129	138.5^{g}	142^{f}	143.5^{g}	145.5^{h}	146.5^{ef}	1083^{j}
B_3 X T_0	84^{c}	102.5^{c}	107	111^{c}	128.5^{d}	133de	137^{f}	138.5^{d}	941.5^{f}
T_1	102^{g}	118.5^{e}	124.5	131^{f}	133^{e}	137.5^{f}	141.5^{g}	144^{e}	1032^{i}
T_2	97^{f}	114d^{e}	117	123^{e}	130de	135^{ef}	137^{f}	138^{d}	991^{h}
T_3	117.5^{i}	129^{f}	136.5	144.5^{h}	146.5^{g}	147.5^{g}	149^{i}	149.5^{f}	1120^{k}
SEM	1.54	1.62	1.69	1.09	1.32	1.36	0.98	1.14	5.09

Means having different superscripts in a column differ significantly (p≤0.05).

indicates that there is beneficial effect of wheat straw with supplementation of both giloy and ascorbic acid on total number of eggs produced in the Japanese quails.

Total Number of Eggs Production per Bird

The data of mean total number of eggs produced per bird of Japanese quail on the basis of dietary supplements, different bedding material and various interaction groups are presented in Table 2. The statistical analysis of data revealed highly significant ($p<0.01$) effect of all three factors on mean total number of eggs produced per bird.

The overall means of total number of eggs produced per bird for various dietary treatment groups were recorded to be 69.34 in T_0, 79.88 in T_1, 74.94 in T_2 and 88.40 in group T_3, respectively. Statistically highest total number of eggs produced per bird was found in combination of both supplements followed by giloy alone as compared to ascorbic acid and control groups. Total number of eggs produced per bird was the lowest in control group as compared to rest of all groups (Table 2). The results observed in present study were in agreement with the findings of Dhaliwal (2004), Bardakcioglu *et al.* (2005), Shit *et al.* (2012), and Sigolo *et al.* (2019) in Japanese quail.

The total numbers of eggs produced per bird of Japanese quail for various bedding material groups were recorded as 70.77 in B_1, 78.57 in B_2 and 85.09 in group B_3, respectively. The highest number was recorded in B_3 (wheat straw) followed by B_2 (sawdust) and B_1 (sand) groups (Table 2). It may be concluded that wheat straw as a bedding material improves total number of eggs produced per bird as compared to other bedding material. The results observed were in agreement with the findings of Dhaliwal *et al.* (2018).

The significant effects of interaction between dietary supplementation and different bedding materials on total numbers of eggs produced per bird of Japanese quail are shown in Table 2. The comparison of means showed that highest total number of eggs produced per bird was recorded in $B_3 \times T_3$ group, and the lowest in $B_1 \times T_0$ group. The overall result indicates that there is beneficial effect of wheat straw with supplementation of both giloy and ascorbic acid on total number of eggs produced per bird of the Japanese quails.

Table 2: Effect of dietary supplementation, bedding material and their interaction on total number of egg production per bird (Japanese quail) at different weeks of age

Dietary supplement/ Bedding material/Inter-action effect	Age in weeks								
	8-10W	10-12W	12-14W	14-16W	16-18W	18-20W	20-22W	22-24W	Cumulative
T_0	6.36^{a}	7.76^{a}	8.04^{a}	8.56^{a}	9.25^{a}	9.5^{a}	9.93^{a}	9.93^{a}	69.34^{a}
T_1	7.55^{c}	9.02^{c}	9.56^{c}	10.12^{c}	10.44^{c}	10.75^{c}	11.06^{c}	11.34^{c}	79.88^{c}
T_2	7.11^{b}	8.34^{b}	8.79^{b}	9.48^{b}	9.90^{b}	10.18^{b}	10.41^{b}	10.70^{b}	74.94^{b}
T_3	8.81^{d}	10.22^{d}	10.68^{d}	11.43^{d}	11.56^{d}	11.66^{d}	11.90^{d}	12.11^{d}	88.40^{d}
SEM	0.07	0.07	0.08	0.05	0.06	0.06	0.04	0.05	0.24
B_1	6.49^{a}	7.71^{a}	8.45^{a}	9.27^{a}	9.32^{a}	9.51^{a}	9.85^{a}	10.14^{a}	70.77^{a}
B_2	7.55^{b}	9.13^{b}	9.25^{b}	9.82^{b}	10.34^{b}	10.54^{b}	10.87^{b}	11.05^{b}	78.57^{b}
B_3	8.34^{c}	9.66^{c}	10.10^{c}	10.61^{c}	11.20^{c}	11.52^{c}	11.76^{c}	11.87^{c}	85.09^{c}
SEM	0.06	0.06	0.07	0.04	0.05	0.05	0.04	0.04	0.21
B_1 X T_0	6^{a}	6.91^{a}	7.12	7.87^{a}	7.83^{a}	8.08^{a}	8.33^{a}	8.45^{a}	60.62^{a}
T_1	6.45^{b}	7.75^{b}	8.95	9.70^{d}	9.75^{c}	9.95^{c}	10.37^{d}	10.62^{c}	73.58^{d}
T_2	5.95^{a}	7^{a}	7.83	8.79^{b}	9.04^{b}	9.25^{b}	9.54^{b}	9.83^{b}	67.25^{b}
T_3	7.54^{de}	9.20^{d}	9.91	10.70^{f}	10.66^{d}	10.75^{d}	11.16^{ef}	11.66^{d}	81.62^{h}
B_2 X T_0	6.08^{ab}	7.83^{b}	8.08	8.58^{b}	9.20^{b}	9.33^{b}	10.04^{c}	9.79^{b}	68.95^{c}
T_1	7.70^{ef}	9.45^{de}	9.37	9.75^{d}	10.5^{d}	10.83^{d}	11.04^{e}	11.41^{d}	80.08^{g}
T_2	7.29^{cd}	8.54^{c}	8.79	9.41^{c}	9.83^{c}	10.04^{c}	10.29^{cd}	10.79^{c}	75^{e}
T_3	9.12^{h}	10.70^{f}	10.75	11.54^{g}	11.83^{f}	11.95^{g}	12.12^{h}	12.20^{ef}	90.25^{j}
B_3 X T_0	7^{c}	8.54^{c}	8.91	9.25^{c}	10.70^{d}	11.08^{de}	11.41^{f}	11.54^{d}	78.45^{f}
T_1	8.5^{g}	9.87^{e}	10.37	10.91^{f}	11.08^{e}	11.45^{f}	11.79^{g}	12^{e}	86^{i}
T_2	8.08^{f}	9.5^{de}	9.75	10.25^{e}	10.83^{de}	11.25^{ef}	11.41^{f}	11.5^{d}	82.58^{h}
T_3	9.79^{i}	10.75^{f}	11.37	12.04^{h}	12.20^{g}	12.29^{g}	12.41^{i}	12.45^{f}	93.33^{k}
SEM	0.12	0.13	0.14	0.09	0.11	0.11	0.08	0.09	0.42

Means having different superscripts in a column differ significantly (p≤0.05).

Conclusion

The findings of the study indicate that supplementation of giloy and ascorbic acid in the diet improves total number of eggs produced per flock and per bird of the Japanese quails, and that there is beneficial effect of wheat straw as bedding material as well as wheat straw with supplementation of both giloy and ascorbic acid on total number of eggs produced per flock and per bird.

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