Original Research Article

Effect of Dietary Supplementation of Giloy (*Tinospora Cordifolia*) Herb and Ascorbic acid along with Different Bedding Materials on Age at Sexual Maturity and Weight at Sexual Maturity of Japanese Quail During Laying Period

ABSTRACT

The present study investigates the effects of giloy and ascorbic acid supplementation along with different bedding materials (sand, saw dust and wheat straw) on age at sexual maturity and weight at sexual maturity of Japanese quails (Coturnix coturnix japonica). Four hundred thirty two laying Japanese quails (7 day old) were divided into three of different bedding material and each bedding material group further subdivided into four groups on the basis of supplementation (control, giloy, ascorbic acid and combination of both). Thus birds were randomly and uniformly distributed in total 12 treatment groups comprising of 36 birds in each group and each group further divided into two replicates comprising 18 birds in each replicate. Quails were fed a basal diet and the basal diet supplemented with 5 g/kg giloy supplement of diet, 240 mg of ascorbic acid/kg supplement of diet and a combination of 5 g/kg giloy and 240 mg of ascorbic acid/kg supplement of diet. Highly significant ($P<0.01$) effect of incorporation of supplements and different bedding material was found on age at sexual maturity and weight at sexual maturity of Japanese quail. But interaction effect of bedding material and supplementation was non-significant on age at sexual maturity and weight at sexual maturity during experiment. Numerically minimum age at sexual maturity was found in sawdust as compared to other bedding material. Weight at sexual maturity was found highest in sand bedding material. The present study show that a combination of dietary supplements of giloy and ascorbic acid significantly decreases the age at sexual maturity while increases weight at sexual maturity.

Keywords: Age at sexual maturity, ascorbic acid, giloy, japanese quail, weight at sexual maturity.

1. INTRODUCTION

Poultry is one of the fastest growing components of the agricultural sector in India. India ranks fourth in total production of poultry meat in the world (Basic Animal Husbandry Statistics, 2019). The total poultry population in the country has increased by 16.80% over the previous census and the total poultry in the country is 851.81 million numbers in 2019 (All India Report on 20th Livestock census, 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). Japanese quails have less feeding requirement (about 20-25 g per day) compared to chicken (120-130 g per day) (Ani *et al*., 2009).

Recent trend in broiler production is to provide feed containing the feed additives to improve efficiency and get maximum returns in shortest possible time. Various types of feed additives such as antibiotics, enzymes, hormones, prebiotics, probiotics, herbal products *etc.*, are being used as growth stimulants in poultry production. *Tinospora cordifolia*, which is known by the common names heart-leaved moonseed, guduchi, and giloy, is an 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). Under normal conditions, poultry can synthesize vitamin C within their body but endogenous synthesis may not be enough to provide the full need of poultry at all times, especially the need of this vitamin may increase during heat stress (Lin *et al.,* 2006).

Wood sawdust is the most common used bedding material, however there were many alternative materials that may be used such as peanut hulls (Lien *et al*., 1998), rice and wheat straw (Benabdeljelil and Ayachi, 1996), leaves (Willis *et al*., 1997), rice hull ash (Chamblee and Yeatman, 2003) and other dry, absorbent, low-cost organic materials. Moreover, sand is occasionally used as a bedding material (Shields *et al*., 2005).

Hence, the present experimental design was planned to carry out study of effect of bedding materials such as sand, wheat straw and saw dust with dietary supplementation of giloy herb (*Tinospora cordifolia*) and ascorbic acid and their combination on age at sexual maturity and weight at sexual maturity in Japanese quail.

Comment [A1]: Explain the effect of adding herbs to the parameters measured

Comment [A2]: Explain the effect of the bedding material used in this study on the parameters measured

2. MATERIALS AND METHODS

2.1 Location of study area

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, Rajasthan.

2.2 Experimental design of study

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) entire the end of experimental trail. The study was conducted for a period of 24 weeks.

The factorial design (3x4) was adopted for the present study. The 432 seven day old Japanese quail chicks were equally and randomly divided into twelve treatments groups according to feed supplements and different bedding materials and each treatment group was further replicated into two sub-groups (R1-R2) to make sure uniformity in various treatment groups. The chicks were reared on sand, saw-dust and wheat straw in group B_1, B_2 and B_3 respectively, to study effect of bedding material on various traits. Further, each bedding material were subdivided in one control and three dietary treatment groups (giloy, ascorbic acid and combination of both) equally and denoted by T_0, T_1, T_2 and T_3, respectively to study dietary effect on traits. Thus total number of interaction groups was 12 in present study.

Table 1: Random distributions of birds (Japanese quail) and experimental feeds offered in different treatment groups

S.N.	Type of bedding materials	Treatments Groups		Treatment details	Number of birds (Japanese quail)
1.	B_1 (sand)	T_{10}	$T_{10}R_1$	Basal diet	18
			$T_{10}R_2$	Basal diet	18
		T_{11}	$T_{11}R_1$	Basal diet + 5 g/kg giloy**	18
			$T_{11}R_2$	Basal diet + 5 g/kg giloy**	18
		T_{12}	$T_{12}R_1$	Basal diet + 240 mg/kg ascorbic acid**	18
			$T_{12}R_2$	Basal diet + 240 mg/kg ascorbic acid**	18
		T_{13}	$T_{13}R_1$	Basal diet + mixture of	18

				5 g/kg giloy and 240 mg/kg ascorbic acid**	
			$T_{13}R_2$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
2.	B_2 (saw-dust)	T_{20}	$T_{20}R_1$	Basal diet	18
			$T_{20}R_2$	Basal diet	18
		T_{21}	$T_{21}R_1$	Basal diet + 5 g/kg giloy**	18
			$T_{21}R_2$	Basal diet + 5 g/kg giloy**	18
		T_{22}	$T_{22}R_1$	Basal diet + 240 mg/kg ascorbic acid**	18
			$T_{22}R_2$	Basal diet + 240 mg/kg ascorbic acid**	18
		T_{23}	$T_{23}R_1$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
			$T_{23}R_2$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
3.	B_3 (wheat straw)	T_{30}	$T_{30}R_1$	Basal diet	18
			$T_{30}R_2$	Basal diet	18
		T_{31}	$T_{31}R_1$	Basal diet + 5 g/kg giloy**	18
			$T_{31}R_2$	Basal diet + 5 g/kg giloy**	18
		T_{32}	$T_{32}R_1$	Basal diet + 240 mg/kg ascorbic acid**	18
			$T_{32}R_2$	Basal diet + 240 mg/kg ascorbic acid**	18
		T_{33}	$T_{33}R_1$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
			$T_{33}R_2$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
	Total birds				432

** Prepared at farm by manual mixing of giloy and ascorbic acid in basal diet.

2.3 Composition of experimental ration and feeding:

Commercially available readymade starter and finisher and layer rations were procured and feed additives such as giloy (*Tinospora cordifolia*) and ascorbic acid were supplemented. The giloy and ascorbic acid were supplemented at 5 g/kg and 240 mg/kg in alone and combination, respectively.

Comment [A3]: according to whom this herbal addition?

2.4 Litter materials

Different litter materials such as sand, saw dust and wheat straw were used as per the experimental design. 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.

2.5 Parameters studied

2.5.1 Age at sexual maturity (day)

The age at sexual maturity, which is a determinant of egg production in quails, were evaluated as the age when the first egg was laid. Age at first egg is of importance since it indicates the sexual maturity age.

2.5.2 Sexual maturity weight (g)

Sexual maturity weight was determined when the quails laid their first eggs in each pen.

2.6 STATISTICAL ANALYSIS

The data obtained in the experiment were analysed statistically for main effect of Geloi or ascorbic acid alone as well as interaction (Geloi × Ascorbic acid) and effect of different bedding material as well as interaction with feed supplementation in factoral design (3×4) by factorial analysis of variance interaction design technique (Snedecor and Cochran, 1989) using statistical package SPSS software (Ver. 26.0, 2005). The means of different experimental groups were tested for statistical significance by Duncan's New Multiple Range Test (DNMRT) as modified by Kramer (1956).

3. RESULTS AND DISCUSSION

3.1 Age at sexual maturity (days)

The age at sexual maturity (age at 5% lay) was determined when the Japanese quails laid their first eggs in each pen. The age at 5% lay, which is a determinant of egg production in quails, was evaluated as the age when the first egg was laid. Age at first egg is of importance since it indicates the sexual maturity age.

3.1.1 Effect of dietary supplementation, bedding material and their interaction on age at sexual maturity

The statistical analysis of variance of data revealed highly significant ($P<0.01$) effect of incorporation of supplements, different bedding material on age at sexual maturity of Japanese quail during experiment (Table 2). But interaction of dietary supplements and bedding materials did not exhibit any significant effect on age at sexual maturity in present study. The age at

sexual maturity (age at 5% lay) of Japanese quail on the basis of dietary supplements, bedding material and interaction groups were presented in Table 2.a,2.b and 2.c respectively.

Table 2: Mean sum of squares for Age at sexual maturity

Source of variation	DF	MEAN SQUARES
Supplement	3	4.81**
Bedding	2	12.32**
Interaction (TxB)	6	0.12
Error	12	0.40

*= significant (P≤0.05), **= highly significant (P≤0.01)

3.1.1.1 Effect of dietary supplementation on Age at sexual maturity

The minimum age at sexual maturity was recorded in T_3 group (39.75 days) followed by T_2 (40.58 days), T_1 (41.25days) and then control group T_0 (41.83 days). There was no significant difference between age at sexual maturity in T_0 (control) and T_1 (giloy supplemented) group in present study. The findings of the above experiment was in close agreement with results of Ipek (2006), Nazlıgul et al., (2001) and Testik et al., (1993) in Japanese quail.

Comment [A4]: why? please give your reasons

Table 2.a: Effect of dietary supplements on Age at sexual maturity

Supplement effect	Age in days
T_0	41.83^{c}
T_1	41.25^{bc}
T_2	40.58^{b}
T_3	39.75^{a}
SEM	0.26

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

3.1.1.2 Effect of bedding materials on Age at sexual maturity

The age at sexual maturity was found to be 41.93, 39.5 and 41.12 days in B_1, B_2, and B_3 group respectively. Statistically significant difference of age at sexual maturity in different bedding material was observed and numerically minimum age at sexual maturity was found in sawdust as compared to the sand. Maximum age at sexual maturity was found in sand then rest of the other bedding materials.

Comment [A5]: why? please give your reasons

Table 2.b: Effect of bedding materials on Age at sexual maturity

Bedding effect	Age in days
B_1	41.93^{c}
B_2	39.5^{a}
B_3	41.12^{b}
SEM	0.22

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

3.1.1.3 Interaction Effect of dietary supplements × bedding materials on Age at sexual maturity

The age at sexual maturity (days) in different interaction groups was shown in Table 2.c. Further the comparison of means showed that minimum age at sexual maturity was recorded in T_{23} group. Maximum age at sexual maturity was found in T_{10} group. So the overall study indicates that there is beneficial effect of sawdust with supplementation of both giloy and ascorbic acid on age at sexual maturity of the Japanese quails.

Comment [A6]: why? please give your reasons

Table 2.c Effect of dietary supplement × bedding material Interaction on Age at sexual maturity

Interaction Effect	Age in days
T_{10}	43
T_{11}	42.25
T_{12}	41.75
T_{13}	40.75
T_{20}	40.25
T_{21}	40.25
T_{22}	39.25
T_{23}	38.25
T_{30}	42.25
T_{31}	41.25
T_{32}	40.75
T_{33}	40.25

SEM	0.45

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

3.2 Weight at sexual maturity (g)

The weight at sexual maturity (g) was determined when the Japanese quails laid their first eggs in each pen. Weight at first egg is of importance since it indicates the sexual maturity weight.

3.2.1 Effect of dietary supplementation, bedding material and their interaction on weight at sexual maturity

The statistical analysis of variance of data revealed highly significant (P<0.01) effect of incorporation of supplements, different bedding material on age at sexual maturity of Japanese quail during experiment (Table 3). But interaction effect of dietary and bedding materials was found non-significant on weight at sexual maturity in present study. The weight at sexual maturity (age at 5% lay) of Japanese quail on the basis of dietary supplements, bedding material and interaction groups were presented in Table 3.a,3.b and 3.c respectively.

Table 3: Mean sum of squares for Weight at sexual maturity.

Source of variation	DF	MEAN SQUARES
Supplement	3	704.29**
Bedding	2	63.61**
Interaction (TxB)	6	0.82
Error	12	0.42

*= significant (P≤0.05), **= highly significant (P≤0.01)

3.2.1.1 Effect of dietary supplementation on Weight at sexual maturity

The weight at sexual maturity was found to be 178.11, 182.57, 189.76 and 202.91 gm in T_1, T_2, T_3 and T_4 group respectively, which were also statistically, differ in numerical values. Further the comparison of means showed that maximum weight at sexual maturity was recorded in T_3 group followed by T_2, T_1 and then control group T_0. So the overall study indicates that there is beneficial effect of incorporation of giloy and ascorbic acid in the diet on weight at sexual maturity of the Japanese quails.

Comment [A7]: why? please give your reasons

The findings of the above experiment was in close agreement with Ipek (2006) who also found maximum weight at sexual maturity in the group on a combination of 240 mg of vitamin E and 240 mg of vitamin C in quail.

Table 3.a: Effect of dietary supplements on Weight at sexual maturity

Supplement effect	Weight in gm
T_0	178.11^a
T_1	182.57^b
T_2	189.76^c
T_3	202.91^d
SEM	0.26

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

3.2.1.2 Effect of bedding materials on Weight at sexual maturity

The weight at sexual maturity was found to be 191.36, 187.36 and 185.78 gm in B_1, B_2, and B_3 group respectively. Statistically significant effect of bedding material was observed and numerically maximum weight at sexual maturity was found in sand as compared to the wheat straw. Minimum weight at sexual maturity was found in wheat straw then rest of the other bedding materials. So the overall study indicates that there is beneficial effect of sand on weight at sexual maturity of the Japanese quails.

Comment [A8]: why? please give your reasons

Table 3.b: Effect of bedding materials on Weight at sexual maturity

Bedding effect	Weight in gm
B_1	191.36^c
B_2	187.87^b
B_3	185.78^a
SEM	0.22

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

3.2.1.3 Interaction Effect of dietary supplement × bedding material on Weight at sexual maturity

The weight at sexual maturity was found to be 181.63 in group T_{10}, 185.93 in group T_{11}, 192.06 in group T_{12}, 205.82 in group T_{13}, 176.83 in group T_{20}, 181.86 in group T_{21}, 189.86 in group T_{22}, 202.95 in group T_{23}, 175.87 in group T_{30}, 179.92 in group T_{31}, 187.36 in group T_{32} and 199.96 in group T_{33}.Further the comparison of means showed that maximum weight at sexual maturity was recorded in T_{13} group. Minimum weight at sexual maturity was found in T_{30} group. So the overall study indicates that there is beneficial effect of sand with supplementation of both giloy and ascorbic acid on weight at sexual maturity of the Japanese quails.

Comment [A9]: why? please give your reasons

Table 3.c: Effect of dietary supplement × bedding material Interaction on Weight at sexual maturity.

Interaction Effect	Weight in gm
T_{10}	181.63
T_{11}	185.93
T_{12}	192.06
T_{13}	205.82
T_{20}	176.83
T_{21}	181.86
T_{22}	189.86
T_{23}	202.95
T_{30}	175.87
T_{31}	179.92
T_{32}	187.36
T_{33}	199.96
SEM	0.45

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

4. CONCLUSION

Reduced age at sexual maturity was obtained in birds which fed combination of giloy and ascorbic acid both and kept at saw dust bedding material. For weight at sexual maturity sand with combination supplementation show best result. In present experiment sand bedding material was found beneficial for weight at sexual maturity. The interaction effect of dietary supplementation with bedding material on age at sexual maturity and weight at sexual maturity were found non-significant.

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