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Effect of Dietary Supplementation of Tulsi (*Ocimum sanctum*) and Moringa (*Moringa oleifera*) Leaf Powder Along with Different Bedding Materials on Carcass Characteristics of Japanese Quail in Arid Region of Rajasthan

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ABSTRACT

Japanese quail is the wild species of poultry popularly known as "Bater" that has been domesticated in recent times.The present trial was planned with the objective to investigate the carcass characteristics of Japanese quail fed on dietary supplementation of Tulsi (*Ocimum sanctum*) and Moringa (*Moringa oleifera*) leaf powder alone as well as in combination, along with different bedding materials like sand, saw-dust and wheat straw. A sum total of 360 day-old commercial quail chicks were reared under brooder for a period of 7 days and uniformly distributed to three different bedding material groups as B_1, B_2 and B_3 with each group having four treatment groups, henceforth twelve treatment groups were made, each having two replicates and kept for duration of 42 days. The results indicated highly significant ($P<0.01$) effect of dietary supplementation of Tulsi alone or in combination with Moringa on dressing percentage as well as eviscerated percentage. For bedding materials used, results were non-significant both on dressing percentage and eviscerated percentage. Hence, it can be concluded from the investigation that there is significant effect of supplementation of Tulsi alone or in combination with Moringa however, no effect was seen due to bedding material on carcass characteristics.

HIGHLIGHTS

- Significant effect of Tulsi alone or in combination with Moringa on dressing percentage as well as eviscerated percentage.
- No effect was seen due to bedding material on carcass characteristics.

Keywords: Bedding material, carcass characteristics, Japanese quail, Moringa, Tulsi

Poultry rearing or farming, raising of birds domestically or commercially is primarily done for meat, eggs and for feathers. The main purpose of this endeavor was to meet the nutritional needs of the household family in terms of protein and fat. With the advent of new scientific techniques and surplus cash flow during the nineteenth century poultry farming has moved from a domestic activity to a structured commercial enterprise. New techniques have ensured high quality of product and at the same time has provided a well-balanced economic impetus to the farmers. In India too poultry farming has undergone a paradigm shift in its structure and operation. It has now evolved as a highly viable economic and commercial activity.

With the increased demand for animal protein and stringent safety standards in meat production it has become very pertinent that the meat provided to the consumer is antibiotic and chemical free. Efforts have been intensified

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to include herbal feed supplements which have improved functioning and fewer side effects. Many positive effects of dietary *Moringa oleifera* leaf supplementation on animal performance have been recorded in broilers and laying hens (Melesse *et al*., 2013; Lu *et al*., 2016) while some suggest that performance was depressed by addition of *Moringa oleifera* leaf meal in diet (Gadzirayi and Mupangwa, 2014).

Poultry birds are reared on floor and in cages however different bedding materials have been used for the comfort and welfare of the bird. Casey *et al*. (2005) defined litter material as a combination of bedding material, excreta, feathers, spilled feed and water it is generally regarded as litter material because it gets mixed with droppings and undergo a bacterial breakdown thereby synthesizing major b-complex vitamin and other dietary essentials thus preventing a smelly and unsanitary condition (Demirulus, 2006). Keeping in view the arid conditions and availability of resources, the present study was undertaken to evaluate carcass characteristics of Japanese quail fed on dietary supplementation of Tulsi and Moringa along with different bedding materials.

MATERIALS AND METHODS

Agro climatic condition of the region

The study was carried out at Poultry unit, Livestock Farm Complex, Department of Livestock Production and Management, College of Veterinary and Animal Science, Bikaner, Rajasthan. Geographically, the altitude of Bikaner city is 230 meter above mean sea level, latitude and longitude position being 28' 01' 00"N and 73" 18' 43", respectively in the state of Rajasthan. The city is situated in the middle of Thar Desert and has a hot semi-arid region with very little rainfall and extreme temperatures. In summer temperatures can exceed 48 °C, and during winter months it may fall down below freezing. Annual rainfall ranges from 260-440 millimeters. .

Experimental chicks

The study was carried out at Poultry unit, Livestock Farm Complex, Department of Livestock Production and Management, College of Veterinary and Animal Science, Bikaner, Rajasthan. The trial was carried out on 360 day old commercial quail chicks that were procured and transported from "Central Poultry Development Organization" (Northern Region), Chandigarh. Standard bio-security protocol was followed during the transportation.

Technical plan of work

Research trial was conducted to study the effects of dietary supplementation of Tulsi (*Ocimum sanctum*) and Moringa (*Moringa oleifera*) alone as well as in combination along with different bedding materials viz. sand, saw-dust and wheat straw on the carcass characteristics of Japanese Quail in arid region of Rajasthan.

Sum total of 360 birds were randomly and uniformly allocated to 12 treatment groups in total with each treatment comprising of 30 chicks each. Again treatment group was further subjected to division in two replicates with 15 birds each. Birds were reared on three different bedding materials with dietary supplementation according to the experimental design which is presented in table 1.

Table 1: Random distributions of Japanese quail chicks into experimental groups

Bedding material	Treatment group		Treatment details	No. of chicks
B_1 (Sand)	T_{10}	$T_{10}R_1$	Basal diet	15
		$T_{10}R_2$	Basal Diet	15
	T_{11}	$T_{11}R_1$	Basal diet + 0.5% Moringa leaf powder	15
		$T_{11}R_2$	Basal diet + 0.5% Moringa leaf powder	15
	T_{12}	$T_{12}R_1$	Basal diet + 0.5% Tulsi powder	15
		$T_{12}R_2$	Basal diet + 0.5% Tulsi powder	15
	T_{13}	$T_{13}R_1$	Basal diet + 0.5% Moringa leaf powder + 0.5% Tulsi powder	15
		$T_{13}R_2$	Basal Diet + 0.5% Moringa leaf powder+ 0.5% Tulsi powder	15
B_2 (Saw-dust)	T_{20}	$T_{20}R_1$	Basal diet	15
		$T_{20}R_2$	Basal diet	15
	T_{21}	$T_{21}R_1$	Basal diet + 0.5% Moringa leaf powder	15
		$T_{21}R_2$	Basal diet + 0.5% Moringa leaf powder	15
	T_{22}	$T_{22}R_1$	Basal diet + 0.5% Tulsi powder	15
		$T_{22}R_2$	Basal diet + 0.5% Tulsi powder	15
	T_{23}	$T_{23}R_1$	Basal diet + 0.5% Moringa leaf powder + 0.5% Tulsi powder	15
		$T_{23}R_2$	Basal diet + 0.5% Moringa leaf powder + 0.5% Tulsi powder	15

B_3 (wheat straw)	T_{30}	$T_{30}R_1$	Basal diet	15
		$T_{30}R_2$	Basal diet	15
	T_{31}	$T_{31}R_1$	Basal diet + 0.5% Moringa leaf powder	15
		$T_{31}R_2$	Basal diet + 0.5% Moringa leaf powder	15
	T_{32}	$T_{32}R_1$	Basal diet + 0.5% Tulsi powder	15
		$T_{32}R_2$	Basal diet + 0.5% Tulsi powder	15
	T_{33}	$T_{33}R_1$	Basal diet + 0.5% Moringa leaf powder + 0.5% Tulsi powder	15
		$T_{33}R_2$	Basal diet + 0.5% Moringa leaf powder + 0.5% Tulsi powder	15
TOTAL			**360**	

Managemental procedure

Birds were reared in deep litter system of housing. All the treatment groups were provided with fundamentally similar environment and managemental conditions throughout the experimental period. No vaccination had been done as per the instructions of CPDO, Chandigarh. Feed and water were offered *ad libitum* to the birds during entire study.

Experimental diet and supplements

All the birds were supplemented with commercially available readymade broiler starter and broiler finisher ration adequate in all nutrients as per BIS, 2007. Broiler starter ration was offered for first three weeks and thereafter broiler finisher ration was given for last 21 days of experiment. Feed and water was offered *ad libitum* to each group throughout the experimental trial. Supplements were added @ 0.5% alone as well as in combination and all were mixed with basal diet and were fed to the birds as per the experimental design. Group-wise feed consumption was recorded at weekly intervals.

Bedding material

For the purpose of investigation sand, saw-dust and wheat straw were chosen for bedding material as B_1, B_2 and B_3 respectively. Initially newspapers were used over bedding material for one week time after which they were reared on respective bedding material until the completion of the experimental study. During entire study period no litter material was added, removed or replaced, although regular stirring of litter material was followed as routine managemental procedure.

Carcass characteristics

On completion of trial, six birds were randomly selected from each treatment groups (three from each replicate) for studying the carcass characteristics. All the birds selected for carcass characteristics were offered *ad libitum* water and kept off fed for 12-15 hours before slaughter. Birds were slaughtered by halal method. Evisceration was done after scalding and defeathering and internal organs such as heart, liver and gizzard were collected and weighed. The dressed weight and eviscerated weight per cent was calculated.

Dressing weight (%) =

$$\frac{\text{Live wt} - \text{wt. of bold, feather, shank and head (g)}}{\text{Pre-slaughter live weight (g)}} \times 100$$

Eviscerated weight (%) =

$$\frac{\text{Dressed wt.} - \text{wt. of viscera except giblet (g)}}{\text{Live weight (g)}} \times 100$$

Remaining birds of experiment were sold off on live weight basis after the completion of experiment.

STATISTICAL ANALYSIS

The experimental data recorded during investigation trial have been statistically analyzed by factorial analysis of variance interaction design (Snedecor and Cochran, 1989) using statistical package SPSS software *Ver*. 20. Probabilities value of less than 0.05 ($P<0.05$) were considered significant and less than 0.01 ($P<0.01$) were considered highly significant. The means of different experimental groups were tested for statistical significance by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of dietary supplementation

The percent means of dressed weight and eviscerated weight for different treatment groups were recorded to be 78.79% and 66.15% in T_0, 80.82% and 71.18% in T_1, 84.90% and 76.30% in T_2 and 85.76% and 76.09% in group T_3 respectively. The data has been presented in table 2.

Table 2: Effect of dietary supplements on carcass traits in Japanese quail

Supplement effect	Dressing %	Eviscerated %
T_0	78.79[a]	66.15[a]
T_1	80.82[b]	71.18[b]
T_2	84.90[c]	76.30[c]
T_3	85.76[c]	76.09[c]
SEM	0.980	0.978

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

The statistical analysis of data shown in table 5 indicated highly significant (P<0.01) effect of supplementation of Moringa and Tulsi alone as well as in combination of both the herbs on dressed weight however, numerically higher values than dietary control group was observed. On analysis it was observed that highest dressed weight was recorded in T_3 group followed by T_2, T_1 and T_0 group.

Regarding Tulsi as dietary supplement, results were similar to Singh *et al*. (2014) who reported that 1% Tulsi (*Ocimum sanctum*) leaf powder supplementation had a beneficial impact on growth of muscle tissues. Shrivastava *et al*. (2013) observed improved dressing percentage of broilers when supplemented with indigenous herbal additives and concluded that it was due to better functionality of the vital organs.

The results obtained in present study regarding Moringa as feed supplement were in contrast to other reports (Melesse *et al*., 2013; Nkukwana *et al*., 2014a), who reported that on dietary supplement of Moringa leaf meal, there was improvement in carcass and meat quality in broilers.

Effect of bedding materials

The percent means of dressed weight and eviscerated weight for various bedding groups were recorded 81.86% and 71.74% in B_1, 83.05% and 72.93% in B_2, 82.78% and 72.63% in B_3 respectively and the data has been presented in Table 3.

The statistical analysis of data depicted in table 5 revealed non-significant effects among different bedding materials on dressing as well as eviscerated percentage.

Results obtained were similar to the study conducted by I. Al Homidan *et al*. (2017) who stated that carcass characteristics were non-significantly affected by different bedding material in broilers. In favour of the results obtained, Onu *et al*. (2011) also suggested that neither carcass characteristics nor internal organs were adversely affected by the type of bedding material.

Table 3: Effect of bedding material on carcass traits in Japanese quail

Bedding material	Dressing %	Eviscerated %
B_1	81.86	71.74
B_2	83.05	72.93
B_3	82.78	72.63
SEM	0.400	0.399

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

Interaction effect of dietary supplements × bedding materials

The mean values of per cent dressed weight and eviscerated weight of Japanese quail in different treatment groups based on interaction effect has been presented in Table 4.

Table 4: Effect of Dietary supplementation × bedding material on carcass traits in Japanese quail

Main effects	Dressing %	Eviscerated %
T_{10}	77.57[a]	64.87[a]
T_{11}	78.67[ab]	69.05[c]
T_{12}	86.25[f]	77.67[g]
T_{13}	84.99[def]	75.38[efg]
T_{20}	79.97[ab]	67.34[bc]
T_{21}	81[bc]	71.38[d]
T_{22}	85.28[ef]	76.64[fg]
T_{23}	85.99[f]	76.37[fg]
T_{30}	78.86[ab]	66.26[ab]
T_{31}	82.81[cd]	73.13[de]
T_{32}	83.18[cde]	74.62[ef]
T_{33}	86.3[f]	76.53[fg]
SEM	0.800	0.799

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

The statistical analysis of data presented in table 5 indicated highly significant effect of interaction between supplements and bedding materials on dressing per cent

and per cent eviscerated weight. Highest dressing per cent was observed for the group T_{33} followed by group T_{12} whereas group T_{10} recorded lowest dressing per cent weight. Highest eviscerated per cent was recorded in T_{12} followed by T_{22} group however; lowest value was recorded in T_{10} group.

Table 5: Mean sum of squares for carcass traits in Japanese quail

Source of variation	DF	Age in Weeks	
		MEAN SQUARES	
		Dressing %	Eviscerated %
Supplement	3	197.412**	416.480**
Bedding	2	9.318	9.243
Interaction (T×B)	6	14.256**	13.953**
Remainder	60	3.849	3.831

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

Table 6: Effect of dietary supplements on Organ weight (% live weight) at 42nd day in Japanese quail

Supplement effect	Liver	Heart	Gizzard	Giblet
T_0	4.09[a]	1.65	3.92[a]	9.67[a]
T_1	4.32[a]	1.77	4.15[ab]	10.25[a]
T_2	5.33[b]	1.79	4.28[bc]	11.41[b]
T_3	5.96[c]	2.00	4.56[c]	12.54[c]
SEM	0.190	0.198	0.217	0.473

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

Per cent organ weight

Effect of dietary supplementation

The data of mean per cent weight of liver, heart, gizzard and giblet were recorded 4.09%, 1.65%, 3.92% and 9.67% respectively in T_0, 4.32%, 1.77%, 4.15% and 10.25% respectively in group T_1, 5.33%, 1.79%, 4.28% and 11.41% respectively in T_2 group and 5.96%, 2%, 4.56% and 12.54% respectively in group T_3.

The statistical analysis of data given in table 9 show highly significant (P<0.01) effect of dietary supplementation of Moringa and Tulsi alone as well as in combination on liver, gizzard and giblet weight over control group and non-significant effect was seen on heart per cent weight.

Maximum liver, gizzard and giblet weight was reported in T_3 (combination of Moringa and Tulsi) group while minimum was noticed in T_0 group (dietary control group).

The results were similar to findings of Khatun *et al*. (2013) and Gupta and Charan (2007) who concluded that dietary supplementation of Tulsi alone did not significantly affect weight of heart.

Effect of bedding materials

The mean per cent weight of liver, heart, gizzard and giblet of Japanese quail for various bedding groups are present in table 7.

Table 7: Effect of bedding materials on Organ weight (% live weight) at 42nd day in Japanese quail

Bedding effect	Liver	Heart	Gizzard	Giblet
B_1	4.88	1.65[a]	4.20	10.73[a]
B_2	4.99	2.13[b]	4.29	11.42[b]
B_3	4.91	1.64[a]	4.20	10.75[a]
SEM	0.077	0.081	0.088	0.193

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

The mean per cent weight of liver, heart, gizzard and giblet were recorded 4.88%, 1.65%, 4.2% and 10.73% respectively in group B_1, 4.99%, 2.13%, 4.29% and 11.42% respectively in group B_2 and 4.91%, 1.64%, 4.2% and 10.75% respectively in group B_3.

The statistical analysis of data shown in table 9 depicts highly significant (P<0.01) effect of among different bedding material was found on mean weight per cent of heart whereas significant (P<0.05) effect was observed on per cent weight of giblet and non-significant effect was seen on per cent weight of liver and gizzard. The group reared on saw dust reported higher liver, heart, gizzard and giblet per cent weight. However, groups reared on wheat straw and sand revealed comparable results.

Findings of the trial were in agreement to the one observed by Mohammed *et al.* (2017) who found out that ingestive behaviour was significantly more frequent in saw dust than other litter materials used in the experiment.

Interaction effect of dietary supplements × bedding materials

The mean values of per cent weight of liver, heart, gizzard and giblets on the basis of interaction between dietary treatments and bedding materials are presented in table 8.

Table 8: Effect of Dietary supplement × Bedding material Interaction on Organ weight (% live weight) at 42nd day in Japanese quail

Interaction effect	Liver	Heart	Gizzard	Giblet
T_{10}	4.05	1.75^{bc}	3.83	9.63
T_{11}	4.30	1.68^{bc}	4.16	10.15
T_{12}	5.25	1.55^{ab}	4.33	11.13
T_{13}	5.93	1.62^{bc}	4.46	12.02
T_{20}	4.18	2.12^{c}	3.98	10.28
T_{21}	4.33	1.83^{bc}	4.13	10.30
T_{22}	5.43	1.83^{bc}	4.38	11.65
T_{23}	6.01	2.75^{d}	4.68	13.45
T_{30}	4.05	1.10^{a}	3.95	9.10
T_{31}	4.33	1.80^{bc}	4.16	10.30
T_{32}	5.33	2.00^{bc}	4.13	11.47
T_{33}	5.95	1.65^{bc}	4.55	12.15
SEM	0.155	0.162	0.177	0.386

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

The average per cent weight of liver, heart, gizzard and giblet were recorded to be 4.05%, 1.75%, 3.83% and 9.63% respectively in group T_{10}, 4.3%, 1.68%, 4.16% and 10.15% respectively in group T_{11}, 5.25%, 1.55%, 4.33% and 11.13% respectively in group T_{12}, 5.93%, 1.62%, 4.46% and 12.02% respectively in group T_{13}, 4.18%, 2.12%, 3.98% and 10.28% respectively in group T_{20}, 4.33%, 1.83%, 4..13%, 4.13% and 10.3% respectively in group $T_{21,}$ 5.43%, 1.83%, 4.13% and 11.65% respectively in group T_{22}, 6.01%, 2.75%, 4.68% and 13.45% respectively in group T_{30}, 4.33%, 1.8%, 4.16% and 10.3% respectively in group T_{31}, 5.33%, 2%, 4.13% and 11.47% respectively in group T_{32} and 5.95%, 1.65%, 4.55% and 12.15% respectively in group T_{33}.

The statistical analysis of data shown in table 9 revealed non-significant effect of interaction between supplementation and bedding material on per cent organ weight. However, group T_{23} in which birds were reared on saw dust as bedding material and were fed with combination of Moringa and Tulsi herbs recorded highest per cent organ weight from rest of the groups.

Table 9: Mean sum of squares for Organ weight (% live weight) in Japanese quail

Source of variation	DF	Mean square			
		Liver	Heart	Gizzard	Giblet
Supplement	3	13.856**	0.386	1.298**	29.215**
Bedding	2	0.073	1.918**	0.073	3.670*
Interaction (T×B)	6	0.008	0.839	0.047	0.885
Remainder	60	0.145	0.158**	0.188	0.895

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

CONCLUSION

The findings of the study concluded from the investigation that there is highly significant effect of supplementation of Tulsi alone or in combination with Moringa however, no effect was seen due to bedding material on carcass characteristics of Japanese quail.

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