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Effect of supplementation of tulsi (*Ocimum sanctum*) and ginger (*Zingiber officinale*) powder as feed additives on nutrient utilization of Japanese quail (*Coturnix japonica*)

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Abstract
The study was conducted to evaluate the "Effect of supplementation of Tulsi (*Ocimum sanctum)* and Ginger (*Zingiber officinale*) powder as feed additives on nutrient utilization of Japanese quail *(Coturnix japonica*)". Two hundred ten, Japanese quail chicks (day-old) were used in a completely randomized design in 7 treatments with 3 replicates (10 birds in each replication). Seven different experimental diets were used for feeding of Japanese quails. The dietary treatment consists of basal diet T_1 (Control) feeding without additives, T_2 (T_1 + Tulsi powder @ 0.5%), T_3 (T_1 + Ginger powder @ 0.5%), T_4 (T_1 + Tulsi powder @ 0.25% + Ginger powder @ 0.25%), T_5 (T1 + Tulsi powder @ 1%), T6 (T_1+ Ginger powder @ 1%) and T_7 (T_1 + Tulsi powder @ 0.5% + Ginger powder @ 0.5%). According to findings of results, Tulsi and Ginger powder supplemented groups utilized more nutrients as compared to control group in term of per cent DM, CP, EE, CF and NFE. From the results, it may be concluded that supplementation of 0.5% Tulsi + 0.5% Ginger powder in diet is beneficial in improving nutrient utilization of Japanese quail.

Keywords: Japanese quail, nutrient utilization, randomized, replicates, supplementation

Introduction

The poultry industry has emerged as the most dynamic and rapidly expanding segment among livestock economy as evident from the production level touching about 851.8 million numbers in 2019 and the total poultry population in the country has increased by 16.81 per cent over the previous census (20th Livestock census, 2019). The poultry sector has undergone a paradigm shift in structure and operation during the last four decades. It has transformed itself from a mere backyard activity into a major commercial activity with participation by big players as a successful implementation of contract poultry farming on a large scale. India has rank 6th in broiler production and 3rd in egg production in the world.

Japanese quail is raised for egg and meat production. It is one of the best sources of non-vegetarian diet and a good converter of agro-byproducts or cereals to animal protein. The quality of quail meat is very high due to low calorific values, nutrient contents is more, very tender, juicy and delicious meat.

The productivity of poultry mainly depends on quality of feed. Beside the quality of feeds, genotype of poultry and several environmental factors also affect the overall productivity. The feed additive should be added in the poultry ration when improves the feed quality and promote the growth of poultry. Currently natural feed additives like probiotics, plant extracts and essential oils are gaining popularity as alternative supplements.

Tulsi also called "Queen of herbs" due to its greater medicinal values in Ayurveda. The major chemical constitutes of leaves is eugenol, that are associated with its treatment potential. Tulsi are mainly known for its anti-oxidant, anti-microbial and anti-fungal as well as immunomodulatory and anticoccidial qualities. The major chemical compounds such as eugenol, ascorbic acid, palmic acid, tannins etc. improve health of birds as well as growth. Ginger is a perennial plant which is widely used as a food condiment and as a medicinal plant.

The important chemical compounds in ginger are gingerol, gingerdiol and gingerdione which have positive effects on digestive system, microbial activities and antioxidative activity of birds. The main objective of this study is to gain more information about effect of Tulsi *(Ocimum sanctum)* and Ginger *(Zingiber officinale)* on nutrient utilization of Japanese quail (*Coturnix japonica*).

Materials and Methods

Experimental birds and design

To evaluate the effect of supplementation of tulsi and ginger powder as feed additives on nutrient utilization of Japanese quail, a feeding trail of eight week was carried out at Poultry Farm, Department of Animal Production, Rajasthan College of Agriculture, and Udaipur. 210, Japanese quail chicks (day-old) were randomly divided into 7 treatment groups with 3 replications (10 chicks in each replication). All the birds were reared under cage system for eight weeks with identical standard management practices. Birds were provided free access to feed and water during the entire experimental period.

Digestibility of nutrients

The metabolism trial was conducted after 8th week of age of birds. 6 birds from each treatment (2 birds from each replication) were randomly selected. The birds were individually fed with experimental treatment diet. During the metabolism trial, quantity of feed offered, left over and excreta voided were recorded and taken for determination of nutrient utilization. For the digestibility percentage, nutrient analysis was carried out using standard method and the results were calculated by using following formula.

Statistical Analysis

Data collected during the present investigation were subjected to statistical analysis by adopting appropriate methods of analysis of variance as described by Snedecor and Cochran (1994) [7]. Probabilities values of less than 0.05 (p<0.05) were considered significant.

Results and Discussion

The information on nutrient utilization is shown in table no. 1. The dry matter intake (DMI) in Japanese quail was 19.72±0.06, 19.43±0.06, 19.45±0.06, 19.23±0.06, 19.41±0.06, 19.43± 0.06 and 19.20±0.06 in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 groups, respectively. The crude protein intake (CPI) was 4.76±0.01, 4.67± 0.01, 4.69±0.01, 4.63±0.01, 4.64±0.01, 4.64± 0.01 and 4.60±0.01 in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 groups, respectively. The crude fiber intake (CFI) was 0.79±0.001, 0.81±0.003, 0.78±0.001, 0.78±0.001, 0.83± 0.003, 0.78±0.003 and 0.81±0.003 in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 groups, respectively. The ether extract intake (EEI) was 0.58±0.001, 0.58±0.003, 0.57±0.001, 0.57±0.001, 0.58±0.001, 0.57±0.001 and 0.57±0.001 in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 groups, respectively. The nitrogen free extract intake (NFEI) was 11.78±0.03, 11.53±0.03, 11.48±0.03, 11.38±0.03, 11.58±0.03, 11.53±0.03 and 11.36±0.03 in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 groups, respectively. The digestibility coefficient of dry matter (DM) was 66.19±0.85, 67.79±0.57, 67.92±0.56, 70.12± 0.65, 67.74±0.23, 67.63±0.10 and 72.40±0.62 in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 groups, respectively. The digestibility coefficient of crude protein (CP) was 67.40±0.63, 69.35±0.62, 69.41±0.43, 71.78±0.55, 69.37±0.15, 69.39±0.24 and 72.34± 0.54 in T_1, T_2, T_3, T4, T_5, T_6 and T_7 groups, respectively. The digestibility coefficient of crude fibre (CF) was 25.26±0.63, 26.67± 0.62, 26.61±0.43, 28.10±0.55, 26.75±0.15, 26.77±0.24 and 28.51±0.55 in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 groups, respectively. The digestibility coefficient of ether extract (EE) was 73.96±0.54, 75.14±0.57, 75.04±0.45, 75.99±0.50, 75.37± 0.37, 75.18±0.69 and 77.28±0.64 in T_1, T_2, T_3, T_4, T_5, T_6 and T7 groups, respectively. The digestibility coefficient of nitrogen free extract (NEE) was 68.6±0.44, 71.29±1.00, 71.37±0.65, 75.26±0.06, 72.18±0.69, 72.22±0.30 and 75.49± 0.67 in T_1, T_3, T_4, T_5, T_6 and T7 groups, respectively.

Table 1: Effect of supplementation of tulsi and ginger powder on nutrient digestibility

	T_1	T_2	T_3	T_4	T_5	T_6	T_7	SEm±	CD at 5%
Dry Matter Intake (g/bird/day)	19.72^{a}±0.06	19.43^{b} ±0.06	19.45^{b} ±0.06	19.23^{c}±0.06	19.41^{b} ±0.06	19.43^{b} ±0.05	19.20^{c}±0.06	0.06	0.17
Digestible DMI (g/bird/day)	13.03^{c}±0.20	13.17^{bc}±0.08	13.21^{bc}±0.10	13.48^{b} ±0.09	13.15^{bc}±0.04	13.14^{bc}±0.04	13.90^{a}±0.08	0.10	0.32
DM Digestible Coefficient	66.19^{c}±0.85	67.79^{c} ±0.57	67.92^{c} ±0.56	70.12^{b} ±0.65	67.74^{c} ±0.23	67.63^{c} ±0.10	72.40^{a}±0.62	0.56	1.73
Crude Protein Intake (g/bird/day)	4.76^{a} ±0.01	4.67^{b} ±0.01	4.69^{b} ±0.01	4.63^{bc} ±0.01	4.64^{bc} ±0.01	4.64^{bc} ±0.01	4.60^{c} ±0.01	0.01	0.04
Digestible CPI (g/bird/day)	3.21^{b} ±0.02	3.24^{b} ±0.01	3.25^{b} ±0.01	3.33^{a} ±0.03	3.22^{b} ±0.02	3.22^{b} ±0.01	3.33^{a} ±0.02	0.02	0.06
CP Digestible Coefficient	67.40^{c}±0.63	69.35^{b} ±0.62	69.41^{b} ±0.43	71.78^{a} ±0.55	69.37^{b} ±0.15	69.39^{b} ±0.24	72.34^{a}±0.54	0.48	1.47
Crude Fibre Intake (g/bird/day)	0.79±0.00	0.81±0.00	0.78±0.00	0.78±0.00	0.83±0.00	0.78±0.00	0.81±0.00	0.00	NS
Digestible CFI (g/bird/day)	0.20±0.00	0.22±0.00	0.21±0.00	0.22±0.00	0.22 ±0.00	0.21±0.00	0.23±0.01	0.00	NS
CF Digestible Coefficient	25.26^{c}±0.63	26.67^{bc}±0.62	26.61^{bc} ±0.43	28.10^{ab}±0.55	26.75^{bc}±0.15	26.77^{bc}±0.24	28.51^{a}±0.55	0.48	1.49
Ether Extract Intake (g/bird/day)	0.58 ±0.00	0.58 ±0.00	0.57 ±0.00	0.57 ±0.00	0.58 ±0.00	0.57±0.00	0.57±0.00	0.00	NS
Digestible EEI (g/bird/day)	0.43±0.00	0.43±0.01	0.43±0.01	0.43±0.00	0.44±0.00	0.43±0.01	0.44± 0.01	0.00	NS
EE Digestible Coefficient	73.96^{c}±0.54	75.14^{bc}±0.57	75.04^{bc}±0.45	75.99^{ab}±0.50	75.37^{bc}±0.37	75.18^{bc}±0.69	77.28^{a}±0.64	0.55	1.68
Nitrogen Free Extract Intake (g/bird/day)	11.78^{a}±0.03	11.53^{b} ±0.03	11.48^{b} ±0.03	11.38^{c} ±0.03	11.58^{b} ±0.03	11.53^{b} ±0.03	11.36^{c}±0.03	0.03	0.10
Digestible NFEI (g/bird/day)	8.08^{c} ±0.07	8.22^{bc} ±0.11	8.19^{bc} ±0.06	8.57^{a} ±0.02	8.36^{b} ±0.07	8.33^{b} ±0.02	8.58^{a} ±0.07	0.07	0.20
NFE Digestible Coefficient	68.60^{c}±0.44	71.29^{b} ±1.00	71.37^{b} ±0.65	75.26^{a} ±0.06	72.18^{b} ±0.69	72.22^{b} ±0.30	75.49^{a}±0.67	0.61	1.88

Figures bearing different superscript in a row differ significantly (p<0.05) from each other

It can be visualized from the data that DMI and CPI was lowest in T_7 but digestibility coefficient of DM and CP was higher in T_7 group as compared to other groups. CFI was highest in T_5 but digestibility coefficient was higher in T_7 group. EEI was similar in all groups but digestibility coefficient was highest in T_7 group as compared to rest of groups. Similarly, NFE intake was lowest in T_7 group but digestibility of NFE was highest in T_7 group and lowest in control (T_1) group. It can be interpreted from the data obtained in the present study that digestibility coefficient of nutrients increased when the Tulsi and Ginger were included in the diet in alone and in combination.

Similarly, the results of present study are in close agreement with the findings of Shende *et al.* (2019) [6] who reported that the supplementation of Tulsi and ginger powder alone and in combination had significant effect on the digestibility of DM, CP and EE. Authors concluded that the supplementation of Tulsi leaf and ginger powder as feed additives improved nutrient utilization of broiler chicks. Minh *et al.* (2010) [5] also reported that significantly higher retention of DM in broilers fed ginger diet as compared to control group. Similarly, Kumar (2016) [4] reported that the DM digestibility was highest in the treatment group supplemented with garlic and holy basil leaf powder. On other hand, EL-Matty *et al.* (2014) [2] observed non-significant effect of ginger powder on dry matter retention. EL-Matty *et al.* (2014) [2] observed significantly higher utilization of crude protein and ether extract in broilers supplemented with ginger powder as compared to control group. Jadhav (2016) [3] also reported significant effect on digestibility of CP and EE with supplementation of ginger powder as compared to control group.

Conclusion

By comparing the results of the current experiment to the control group, it may be concluded that supplementation of 0.5% Tulsi + 0.5% Ginger powder in diet is beneficial in improving nutrient utilization of Japanese quail.

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