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Effect of Phytogenic Feed Additives on Growth Performance of Japanese Quail

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ABSTRACT: Use of Antibiotic growth promoters (AGP) in poultry feed has been reduced in many countries due to antibiotic resistance. As an alternative to antibiotics locally available herbal mixtures are added in poultry feed to enhance the performance of chicken. Hence, the present study was designed to analyse the effect of phytogenic feed additives (*Allium sativum, Emblica officinalis, Ocimum sanctum, Cuminum cyminum, Curcuma longa, Foeniculum vulgare, Jatropha curcas, Murraya koenigii, Piper nigrum, Trigonella foenum graecum and Zingiber officinale*) on growth performance of Japanese quails. A total of 360-day old Japanese quail chicks were randomly divided into four treatment groups with three replicates of 30 Japanese quail chicks in each. Graded level of phytogenic feed additives (0, 0.5, 0.75 and 1 %) added to the basal feed. There was a significant difference (P < 0.01) in body weight and weight gain at 4 and 5 weeks of age between treatment groups. Japanese quail received 1 % phytogenic feed additives had significantly (P<0.01) higher feed consumption and better feed conversion ratio. No significant difference in livability among treatment groups. Ready-to-cook yield showed significant (P<0.05) difference among treatment and control group. Supplementation of phytogenic feed additives had non-significant effect on sensory attributes. The inclusion of 1 % phytogenic feed additives improved the growth performance of Japanese quail.

Keywords: Phytogenic feed additives, Growth performance, Japanese quail.

INTRODUCTION

Among the avian species, Japanese quail was chosen for unique research in the National Aeronautics and Space Administration (NASA) programme. Japanese quail was introduced in India by ICAR-Central Avian Research Institute (CARI), Uttar Pradesh during 1974. Japanese quail brought from California, USA and subsequently from West Germany and Korea. Japanese quail is considered as a diversified poultry species for meat and egg production (Alkan *et al.,* 2010). Japanese quail eggs and meat are low in cholesterol, good amount of unsaturated fatty acids, essential amino acids and vitamins (Tarhyel *et al*., 2012). The intensive poultry production poses a risk of exposure of poultry to adverse conditions, which leads to potential production losses. So, poultry farmers intermittently uses antibiotic growth promoters, which results in antibiotic utilization increases the chance of their accumulation in poultry products as residues and increases the resistance of pathogens to antibiotics (Saraiva *et al*., 2022).

The poultry farmers uses locally available plant sources that are known as phytogenic feed additives. These phytogenic feed additives has got anti-bacterial, anti-viral, anti-fungal, anti-protozoal, anti-cancer, anti-oxidant, immunomodulatory and anti-inflammatory effect (Khan *et al*., 2022). The phytogenic feed additives improve the gut health there by stimulate the growth, which results in improve the production performance (Mapatac, 2017). Hence, the present experiment was aimed to investigate the effect of phytogenic feed additives on growth performance of Japanese quails.

MATERIALS AND METHODS

The Japanese quail biological experiment was started using 360 day- old Japanese quail chicks of single hatch obtained and reared upto 5 weeks of age under cage system of management. Day-old Japanese quail chicks were randomly divided into four treatment groups with three replicates of 30 Japanese quail chicks in each. Known quantities of different herbal mixtures were incorporated into Japanese quail pre-starter and starter Japanese quail diet at graded levels of 0, 0.5, 0.75 and 1 %. All the diets were made *iso-nitrogenous* and *iso-caloric* by adjusting the other ingredients. The Japanese quail were fed with experimental diet *ad libitum* throughout the experiment.

Hatch weights of the Japanese quail chicks were recorded by using electronic weighing balance of

0.1 g accuracy and individually weighed every week upto 5 weeks. Feed was weighed daily and fed to Japanese quails. Every day feed was measured and fed to Japanese quail, at the end of each week, net feed consumption was recorded and feed conversion ratio was calculated.

A total of six Japanese quails (3 males and 3 females) were randomly selected per treatment and slaughtered was carried out as per the method described by Arumugam and Panda (1970). Eviscerated carcass and giblets weight, the cut- up- parts yields were recorded. The organoleptic assessment of Japanese quail meat was carried out as per Panda *et al.* (1982). The organoleptic assessment were recorded on a nine point hedonic scale with ascending ratings for the desired attributes of appearance, flavour, juiciness, tenderness and overall acceptability. Angular transformation was applied to percentages before statistical analysis. All the statistical analysis was performed by using SPSS software (version 20.0) as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The effect of supplementation of phytogenic feed additives on mean body weight (g) and body weight gain (g) of Japanese quails are presented in Table 1 and 2. The result revealed that there was highly significant (P<0.01) difference between treatment groups was observed on 4th and 5th week of the study period. Dietary supplementation of 1 % of phytogenic feed additives (T_4) significantly (P<0.01) increased body weight (252.28 ± 2.35 g) when compared to control group (217.82 ± 2.22 g) at 5th week of age.

The highly significant (P<0.01) difference in body weight gain of Japanese quail was recorded on 4th and 5th week of biological experiment. Dietary supplementation of 1 % of phytogenic feed additives (T_4) shown highly significant (P<0.01) higher body weight gain (242.77± 2.34) followed by T_3 (228.32± 2.24), T_2 (225.21 ± 2.45) and control (208.31 ± 2.17) group at 5th week of age.

Table 1: Effect of supplementation of phytogenic feed additives on body weight (g) (Mean ± SE) of Japanese quails upto 5 weeks of age.

Treatment groups	Hatch weight	1st week	2nd week	3rd week	4th week	5th week
T_1 (Control)	9.51± 0.14	36.11± 0.75	86.04± 1.02	137.4± 1.26	194.9^{b}± 3.51	217.82^{c}± 2.22
T_2 (0.5 %)	9.52± 0.12	36.79± 0.81	86.11± 1.07	140.75± 1.24	201.09^{ab}± 2.28	234.73^{b}± 2.45
T_3 (0.75 %)	9.54± 0.11	36.93± 0.84	86.44± 1.04	140.43± 1.24	202.8^{a}± 1.74	237.86^{b}± 2.2
T_4 (1 %)	9.51± 0.16	36.95± 0.82	87.04± 1.15	142.73± 1.27	207.67^{a}± 1.47	252.28^{a}± 2.35
F value	0.01^{NS}	0.24^{NS}	0.18^{NS}	2.1^{NS}	4.89**	37.57**

Means bearing different superscripts within a column differ significantly (P<0.05)
NS- Not significant; ** Highly Significant (P<0.01)

Table 2: Effect of supplementation of phytogenic feed additives on body weight gain (g) (Mean ± SE) of Japanese quails upto 5 weeks of age.

Treatment groups	1st week	2nd week	3rd week	4th week	5th week
T_1 (Control)	26.6 ± 0.77	76.52 ± 1.06	128.89 ± 1.26	185.38^{b} ± 3.52	208.31^{c} ± 2.17
T_2 (0.5 %)	27.27 ± 0.8	76.59 ± 1.11	131.23 ± 1.27	191.57^{ab} ± 2.28	225.21^{b} ± 2.45
T_3 (0.75 %)	27.38 ± 0.84	76.9 ± 1.07	131.89 ± 1.25	193.25^{a} ± 1.74	228.32^{b} ± 2.24
T_4 (1 %)	27.44 ± 0.82	77.53 ± 1.12	133.22 ± 1.25	198.15^{a} ± 1.43	242.77^{a} ± 2.34
F value	0.23^{NS}	0.18^{NS}	2.07^{NS}	4.91**	37.83**

Means bearing different superscripts within a column differ significantly
NS- Not significant; ** Highly Significant (P<0.01)

The present findings are in agreement with Sumanth (2021), who observed that supplementation of amla fruit powder, tulsi leaf powder and their combinations had significantly improved body weight and gain. This might be due to increased beneficial gram positive *Lactobacilli*, which could have resulted in increased absorption of nutrients present in gut and thus improved the utilization of feed leading to better body weight in Japanese quails. Similarly, Canogullari *et al.* (2010) observed that incorporation of 0, 1, 2, 4 % garlic powder significantly (P<0.05) improved feed consumption in Japanese quails. The results of the present study are in accordance with the earlier reports of Ampode (2019), who supplemented papaya leaf meal at graded levels (0, 5, 10 and 15 %) showed highly significant (p<0.01) differences, where 5 per cent papaya leaf meal fed group had heavier body (142.33 g) weight than control (91.33 g) group in Japanese quails. The increase of the body weight could be due to the papain, cysteine protease in papaya leaf meal improves the protein digestion (Ebenebe *et al.*, 2011). According to Valiollahi *et al.* (2014), significant (P<0.05) improvement in higher body weight and weight gain was observed in broiler fed with 0.02 % ginger powder, 0.02 % black pepper powder, 0.0 1% ginger + 0.01 % black pepper powder.

Table 3: Effect of supplementation of phytogenic feed additives on feed consumption (g) (Mean ± SE) of Japanese quails from 1st to 5th week of age.

Treatment groups	1st week	2nd week	3rd week	4th week	5th week
T_1 (Control)	35.25 ± 0.85	110.69 ± 1.27	209.74 ± 1.75	235.3^{c} ± 1.99	583.74^{d} ± 3.2
T_2 (0.5 %)	36.45 ± 0.69	113.24 ± 0.91	209.99 ± 1.34	240.24^{ab} ± 1.62	594.79^{c} ± 2.29
T_3 (0.75 %)	36.78 ± 0.62	114.36 ± 1.04	212.45 ± 1.32	242.9^{ab} ± 1.64	602.95^{b} ± 2.39
T_4 (1 %)	36.91 ± 0.44	113.9 ± 1.00	212.09 ± 1.46	248.93^{a} ± 1.62	617.25^{a} ± 3.13
F value	1.30^{NS}	1.30^{NS}	2.42^{NS}	4.49**	9.32**

Means bearing different superscripts within a column differ significantly
NS- Not significant; ** Highly Significant (P<0.01)

Table 4: Effect of supplementation of phytogenic feed additives on feed conversion ratio (Mean ± SE) of Japanese quails from 1st to 5th week of age.

Treatment groups	1st week	2nd week	3rd week	4th week	5th week
T_1 (Control)	1.36 ± 0.05	1.46 ± 0.03	1.63 ± 0.02	1.97^{a} ± 0.07	2.86^{a} ± 0.04
T_2 (0.5 %)	1.38 ± 0.06	1.49 ± 0.03	1.61 ± 0.02	1.84^{ab} ± 0.02	2.64^{b} ± 0.03
T_3 (0.75 %)	1.38 ± 0.05	1.50 ± 0.02	1.62 ± 0.02	1.88^{ab} ± 0.02	2.66^{b} ± 0.04
T_4 (1 %)	1.37 ± 0.04	1.48 ± 0.22	1.59 ± 0.01	1.81^{b} ± 0.02	2.51^{c} ± 0.03
F value	0.06^{NS}	0.47^{NS}	0.74^{NS}	2.63*	9.34**

Means bearing different superscripts within a column differ significantly
NS- Not significant; *Significant (P<0.05); ** Highly Significant (P<0.01)

Effect of supplementation of phytogenic feed additives on mean feed consumption (g/bird/week) and feed conversion ratio are presented in Table 3 and 4 respectively. Statistical analysis revealed that significant difference was observed in feed consumption and feed conversion ratio between treatment groups on 4th and 5th week of age in Japanese quails fed with phytogenic feed additives. The present findings are corroborate with earlier report of Sumanth (2021), who supplemented amla fruit powder, tulsi leaf powder and their combinations showed significant (p<0.05) improvement in feed consumption and feed conversion ratio in Japanese quail. Previous studies indicated that the inclusion of hot red pepper powder into broiler diets improved their feed intake and feed conversion ratio (El-Deek *et al*., 2012). The beneficial effects of capsicum in birds may be related to capsaicin, which has a bactericidal effect against intestinal pathogens, such as *Escherichia coli*, *Salmonella* spp., and *Clostridium* spp. (Omolo *et al.,* 2014; Agarwal *et al*., 2017; Salem *et al*., 2021). On the contrary, Salazar *et al.* (2021) fed with dietary supplementation of 0.5 and 1.0 % of *Jatropha curcas* leaf powder did not show significant differences in feed intake among treatment groups in Japanese quails. Similarly, Anvar *et al.* (2012); Malahubban *et al.* (2013); Eltazi *et al.* (2014), who had stated that there was no significant difference in feed consumption due to garlic and nilavembu supplementation in broilers.

The present study suggested that supplementation of phytogenic feed additives in Japanese quails feed had no deleterious effect on health of the Japanese quails and the livability was uniformly superior in all the treatment groups. These results coincide with those reported by Khalifa and Noseer (2019); Suwarta and Suryani (2019); Zeweil *et al.* (2019), who found no morbidity and mortality in quails, when they used ginger (*Zingiber officinale*), cinnamon (*Cinnamomum verum*), turmeric (*Curcuma longa*) and licorice (*Glycyrrhiz glabra*) as phytochemical additives, respectively.

The effect of supplementation of phytogenic feed additives on carcass characteristics and breast and thigh yield (%) of Japanese quail is presented in Table 5. Dietary supplementation of phytogenic feed additives recorded significant (P<0.05) increase in ready-to-cook yield at 5 weeks of age in Japanese quails. The present findings are in agreement with Sumanth (2021), who observed that supplementation of amla fruit powder, tulsi leaf powder and their combinations had significantly (P<0.05) improved Ready-to-cook yield percentage in Japanese quails. On the contrary, Shahverdi *et al.* (2013) reported that dietary supplementation of 0.02 % hot red pepper powder alone or in combination with black and red pepper (0.01% + 0.01%) had significantly (P < 0.05) increased the weights of the liver, drumstick, breast meat, gizzard, heart and spleen.

Table 5: Effect of supplementation of phytogenic feed additives on carcass characteristics, breast and thigh yield (%) of Japanese quails at 5 weeks of age (Mean ± SE).

Treatment groups	Eviscerated yield	Giblets yield	Ready- to –cook yield	Breast	Thigh
T_1 (Control)	50.75 ± 3.46	4.75 ± 0.22	55.39^{b} ± 1.57	42.82 ± 1.32	14.17 ± 0.39
T_2 (0.5 %)	52.26 ± 1.53	4.62 ± 0.17	57.04^{ab} ± 1.73	43.14 ± 1.34	14.32 ± 0.34
T_3 (0.75 %)	56.24 ± 1.15	4.73 ± 0.19	60.97^{a} ± 1.28	44.92 ± 2.12	14.34 ± 0.45
T_4 (1 %)	56.24 ± 2.31	5.10 ± 0.23	61.73^{a} ± 1.50	42.82 ± 2.57	14.88 ± 0.52
F value	1.50^{NS}	0.72^{NS}	4.8*	0.92^{NS}	1.72^{NS}

Means bearing different superscripts within a column differ significantly
NS- Not significant; *Significant (P<0.05)

The results of the present study are not in agreement with the earlier reports of Puvaca *et al.* (2016) observed that supplementation of hot red pepper powder at 0.5 g and 1 g or mixed with garlic and black pepper (1:1:1) at 0.5 g/100 g of feed resulted in significant ($P < 0.05$) improvement in carcass quality of broiler. According to Rahimian *et al.* (2018), improved the carcass and breast weight percentage of Japanese quail, when supplemented with 2 % ginger, 2 % red pepper 2 % black pepper powder. The effect of supplementation of phytogenic feed additives on organoleptic evaluation of Japanese quail meat at 5 weeks of age is presented in Table 7. The results of the present study indicate that the sensory attributes were not statistically different among the treatment groups.

Table 6: Effect of supplementation of phytogenic feed additives on organoleptic evaluation of Japanese quail meat at 5 weeks of age (Mean ± SE).

Treatment groups	Appearance	Juiciness	Flavour	Tenderness	Overall acceptability
T_1 (Control)	5.83 ± 0.31	5.67 ± 0.33	6.17 ± 0.65	5.50 ± 0.62	5.33 ± 0.42
T_2 (0.5 %)	6.50 ± 0.43	6.33 ± 0.42	6.83 ± 0.48	5.83 ± 0.48	6.33 ± 0.33
T_3 (0.75 %)	5.67 ± 0.21	4.17 ± 0.31	4.83 ± 0.48	4.67 ± 0.76	4.83 ± 0.48
T_4 (1 %)	4.83 ± 0.48	4.50 ± 0.40	5.50 ± 0.76	4.67 ± 0.42	5.17 ± 0.48
F value	0.01	0.91	0.10	0.89	0.92

CONCLUSIONS

It is concluded that the supplementation of phytogenic feed additives at graded levels enhanced growth performance in Japanese quails. Further, it could be explained that this improvement on growth may be due to enhanced digestibility, anti-oxidant and anti-microbial activities of phytogenic feed additives fed to Japanese quails.

FUTURE SCOPE

The similar biological experiment can be conducted by using locally available herbs and spices in Japanese quail feed.

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Conflict of Interest. None.

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