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Effect of feeding neem, ginger and garlic powder on growth performance in Giriraja birds

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Abstract
An experiment was conducted to study the supplementation of neem, ginger and garlic powder on growth performance in Giriraja birds. A total of one hundred and fifty day- old chicks were distributed into five treatment groups with three replicates in each group and ten birds in each replicate. Basal diet (T_1) and the experimental diets were prepared by incorporating garlic powder at 0.50 per cent (T_2), neem powder at 0.50 per cent (T_3), ginger powder at 1.0 per cent (T_4) and garlic powder 0.5 per cent + neem powder 0.5 per cent + ginger powder 1 per cent (T_5). The duration of the experiment was 8 weeks. The results revealed that feeding neem, ginger and garlic powder individually and also in combination resulted in significant improvement in body weight, feed intake and feed efficiency among different treatment groups compared to control.

Keywords: body weight, feed intake, feed efficiency

1. Introduction

Poultry farming has emerged as one of the fastest growing agribusiness industries in the world. The term feed additive is applied in a broad sense, to all products other than those commonly called feedstuffs, which could be added to the ration with the purpose of obtaining some special effects. The main objective of adding feed additives is to boost animal performance by increasing their growth rate, better-feed conversion efficiency, greater livability and lowered mortality in poultry birds.

These feed additives are termed as “growth promoters” and often called as non-nutrient feed additives. Antibiotic growth promoters (AGP) have been used as a feed additive to enhance gut health and control sub-clinical diseases. Sub-therapeutic levels of antibiotics given to poultry as growth enhancer may result to the development of antibiotic-resistant of bacteria, which are hazardous to animal and human health (Sarica *et al*., 2005) [12]. The term "antibiotic growth promoter" is used to describe any medicine that destroys or inhibits bacteria which is administered at a low sub-therapeutic dose. The use of various plant materials as dietary supplements may positively affect poultry health and productivity. The large number of active compounds in these supplements may therefore present a more acceptable defense against bacterial attack than synthetic antimicrobials.

Azadirachta indica (neem) is one of the most common wild growing tree in India. Studies have been shown significant non specific immune stimulating properties. Neem has attracted worldwide prominence due to its vast range of medicinal properties like antibacterial, antiviral, antifungal, antiprotozoal, hepato protective and various other properties.

Zingiber officinalis, commonly known as ginger belongs to family Zingiberoside’s. Ginger powder and extracts are known for their antioxidant and antimicrobial properties both in dietary supplementation and in food preservation (Zowrawi *et al*., 2012) .Ginger used as a substitute for antibiotic growth promoters is desirable for greater productivity in poultry, increased palatability of feed, nutrient utilization, appetite stimulation, increased gastric juice flow (Owen and Amakiri, 2012) [11].

Garlic (*Allum sativum*) is widely distributed all over the world. In past two decades attention has been focused on its cholesterol lowering activity. Garlic contains active principles like allin, allylic sulphide which aid in respiration and digestion, most importantly diarrhoea and worm infestation.

Chakravarty (1991) [2] observed that highest body weight gain compared to control when offered neem leaf and ginger extracts to broilers from 1 to 6 weeks.

Omage *et al*. (2007) [10] observed the effect of ginger waste meal on growth performance, carcass characteristics and serum lipid profile of rabbits by supplementing the ginger waste

meal at the rate of 10, 20, 30 and 40% replacing the maize. They observed no significant difference (P>0.05) in the body weight among all the treatment groups compared to the control

Dieumou *et al*. (2009) [3] evaluated the effect of ginger and garlic essential oils on growth performance and gut microbial population of broilers by supplementing ginger and garlic oil at the rate of 10, 20 and 30 mg/kg/day. They observed no significant difference (P>0.05) in the body weight among all the groups fed with essential oil compared to control group.

Lim *et al*. (2006) [8] concluded that there was no significant difference (P>0.05) in the feed intake in the groups fed with garlic powder and copper compared to control group.

Wankar *et al*. (2009) [15] supplemented neem leaf powder to the broilers at the rate of 1, 2 and 3 g/kg. They observed no significant difference (P>0.05) in the feed intake in the groups fed with neem leaf powder compared to the control group.

Zowrawi *et al*. (2014) [16] concluded that supplementation of ginger root powder at the rate of 0.5%, 1.0% and 1.5% had no significant effect (P>0.05) on the feed intake compared to the control group but there was increased in the feed consumption among the groups which are fed with the ginger root powder. Ginger increases palatability of feed, nutrient utilization, appetite stimulation, increased gastric juice flow in turn it helps increased feed consumption and improved growth performance.

Nemade *et al.* (1993) [9] reported increase in feed efficiency in neem leaf and ginger extracts fed groups in comparison with control diet.

Khan *et al*. (2008) [6] found no significant difference (P>0.05) in the feed efficiency of the native desi laying hens which are supplemented with the garlic powder at the dose rate of 2%, 4% and 6% for the period of 6 weeks.

Tekeli (2011) [14] found that improved feed conversion efficiency in garlic and neem fed group compared to control, which may be due to the active ingredients like allicin, nimbidin in garlic and neem helps in the formation of more stable intestinal flora which result into improved feed conversion efficiency in consequence of a better digestion.

Shraddha *et al*. (2017) [13] studied the toxicological effect of hydro alcoholic extract of *Azadirachta indica* leaf (neem) in broiler birds and observed significant difference (P<0.05) in the survivability in the birds compared to the control group.

Anwarul *et al.* (2018) [1] observed no significant difference in survivability among control and other treatment groups fed with different level of neem leaf powder in broilers.

2. Materials and Methods

The experiment was conducted at the Department of Poultry Science, Veterinary College, Hebbal, Bengaluru. A total of 150 one day old Giriraja birds were distributed into five treatment groups with three replicates in each group and ten birds in each replicate. Chicks were reared under deep litter system with supply of *ad libitum* feed and water. The trial duration was for 8 weeks (56 days). A standard broiler starter and finisher rations were formulated as per ICAR (2013) recommendation. Basal diet (T_1) and the experimental diets were prepared by incorporating garlic powder at 0.50 per cent (T_2), neem powder at 0.50 per cent (T_3), ginger powder at 1.0 per cent (T_4) and garlic powder 0.5 per cent + neem powder 0.5 per cent + ginger powder 1 per cent (T_5). Body weights of individual birds, average weekly cumulative feed consumption, feed conversion ratio (FCR) and mortality in respective group were recorded at weekly intervals.

3. Results and Discussion

3.1 Body weight

The results of the effect of feeding neem, ginger and garlic powder on weekly cumulative body weight (g/bird/week) in commercial broilers is presented in Table 1.

At the end of first week, the cumulative average body weight of Giriraja birds (g/bird/week) under different treatment groups T_1, T_2, T_3, T_4, T_5 were 109.32, 109.10, 110.47, 113.18 and 117.26, respectively. The statistical analysis revealed non-significant (P>0.05) difference in body weight of birds among different treatment groups and also compared to control.

The cumulative average body weight of Giriraja birds (g/bird/week) at the end of second week under different treatment groups were 216.81 (T_1), 242.05 (T_2), 251.40 (T_3), 237.31 (T_4) and 253.72 (T_5). The ANOVA revealed significant (P≤0.05) difference in body weight among different treatments. The significantly higher body weights were observed in T_2, T_3 and T_5 compared to in T_1 (control) and T_4 groups. There was no significant difference in body weight among T_2, T_3 and T_5 and also there was no significant (P>0.05) difference in body weight among T_1 and T_4 and also between T_2 and T_4.

The cumulative average body weight of Giriraja birds (g/bird/week) under different treatment groups *viz*., T_1, T_2, T_3, T_4 and T_5 at the end of third week were 439.16, 462.36, 467.81, 457.50 and 472.76, respectively. The ANOVA revealed significant (P≤0.05) difference in body weight among different treatments at the end of third week. The treatment groups *viz*., T_2, T_3 and T_5 showed significantly (P≤0.05) higher body weight than the groups T_1 and T_4. There was no significant difference in body weight among T_2, T_3 and T_5 and also there was no significant (P>0.05) difference in body weight among T_1 and T_4 and also between T_2 and T_4.

At the end of fourth week (28th day), the cumulative average body weight of Giriraja birds (g/bird/week) under different treatment groups T_1, T_2, T_3, T_4 and T_5 were 702.84, 777.97, 785.51, 757.88 and 795.12 respectively. The ANOVA indicated significant (P≤0.05) difference in body weight among different treatments groups. The treatment groups T_2, T_3 and T_5 showed significantly higher body weight than T_1 and T_4. There was no significant difference (P>0.05) in treatment groups between T_2, T_3 and T_5 and also among T_1 and T_4 and also among T_2 and T_4.

The cumulative mean body weight of birds (g/bird/week) under different treatment groups T_1, T_2, T_3, T_4 and T_5 were 964.25, 1023.47, 1128.28, 997.97 and 1155.13, respectively. At the end of fifth week (35th day), the statistical analysis revealed significant (P≤0.05) difference in body weight of birds among different treatment groups. The treatment groups T_3 and T_5 showed significantly (P≤0.05) higher body weight than the groups T_1, T_2 and T_4. There was no significant (P>0.05) difference in body weight among T_3 and T_5, also between T_2 and T_4 and also between T_1 and T_4. The group T_1 showed significantly lower body weight compared to other treatment group.

At the end of sixth week (42nd day), the cumulative average body weight of Giriraja birds (g/bird/week) under different treatment groups were 1170.78 (T_1), 1222.93 (T_2), 1363.27 (T_3), 1214.50 (T_4) and 1387.31 (T_5). The ANOVA revealed significant (P≤0.05) difference in body weight among different treatments. The body weights were significantly

($P \leq 0.05$) higher in groups T_3 and T_5 compared to T_1, T_2 and T_4 groups. There was no significant ($P>0.05$) difference in body weight among T_1, T2 and T_4 and also among the treatments T_3 and T_5.

The cumulative average body weight of Giriraja birds (g/bird/week) under different treatment groups *viz*., T_1, T_2, T_3, T_4 and T_5 at the end of seventh week were 1389.46, 1452.07, 1591.46, 1437.42 and 1607.32, respectively. The ANOVA revealed significant ($P \leq 0.05$) difference in body weight among different treatments. The body weights were significantly ($P \leq 0.05$) higher in groups T_3 and T_5 compared to T_1, T_2 and T_4 groups. There was no significant ($P>0.05$) difference in body weight among T_3 and T_5 and also among the treatments T_1, T_2 and T_4.

The cumulative average body weight of Giriraja birds (g/bird/week) under different treatment groups *viz*., T_1, T_2, T_3, T_4 and T_5 at the end of eighth week were 1689.46, 1707.94, 1885.34, 1715.46 and 1899.15 respectively. The ANOVA revealed significant ($P \leq 0.05$) difference in body weight among different treatments. The body weights were significantly ($P \leq 0.05$) higher in groups T_3 and T_5 compared to T_1, T_2 and T_4 groups. There was no significant ($P>0.05$) difference in body weight among T_3 and T_5 and also among the treatments T_1, T_2 and T_4.

There was a significant difference ($P \leq 0.05$) in the body weight of the Giriraja birds fed with neem, ginger and garlic powder compared to the control group from second week till the end of the experiment (56th day).

The present study results are also in agreement with results of Kharde and Soujanya (2014) [7] who conducted experiment by feeding neem at 1 and 2 g/kg and garlic at 0.5 and 1 g/kg of feed, respectively and observed significant ($P \leq 0.05$) improvement in body weight in the groups fed with 2 g/kg neem and 0.5 g/mg garlic compared to control in all the 6 weeks in broiler.

Throughout the experimental period the body weight of Giriraja birds fed with neem, ginger and garlic powder was significantly higher than all other groups. The increase in body weight and weight gain of chicks might be due to the fact that ginger used as a substitute for antibiotic growth promoters is desirable for greater productivity in poultry, increased palatability of feed, nutrient utilization, appetite stimulation, increased gastric juice flow (Owen and Amakiri, 2012).

In disagreement with the present study Dieumou *et al*. (2009) evaluated the effect of ginger and garlic essential oils on growth performance and gut microbial population of broilers by supplementing ginger and garlic oil at the rate of 10, 20 and 30 mg/kg/day. They observed no significant difference ($P>0.05$) in the body weight among all the groups fed with essential oil compared to control group.

3.2 Feed intake

The results of the influence of feeding neem, ginger and garlic powder on average weekly cumulative feed intake (g/bird/week) in Giriraja birds are presented in Table 2.

At the end of first week, the average feed intake (g/bird/week) under different treatment groups T_1, T_2, T_3, T_4 and T_5 were 81.27, 78.23, 79.64, 78.46 and 78.89, respectively. The statistical analysis revealed non-significant ($P>0.05$) difference in feed intake of birds among different treatment groups.

The cumulative average feed intake (g/bird/week) at the end of second week was 317.63, 314.23, 316.43, 311.43 and 315.73 in groups T_1, T_2, T_3, T_4 and T_5, respectively. The ANOVA revealed non-significant ($P>0.05$) difference in feed intake among different treatments.

At the end of third week, the cumulative average feed intake of Giriraja birds (g/bird/week) under different treatment groups T_1, T_2, T_3, T_4 and T_5 were 615.17, 618.89, 613.34, 617.41 and 610.61, respectively. The statistical analysis revealed non-significant ($P>0.05$) difference in feed intake of birds among different treatment groups.

After completion of fourth week (28th day), the cumulative average feed intake of Giriraja birds (g/bird/week) under different treatment groups from T_1 through T_5 were correspondingly 1118.31, 1109.89, 1113.61, 1100.44 and 1107.49. The ANOVA revealed non-significant ($P>0.05$) difference in feed intake among different treatments.

At the end of fifth week (35th day), the cumulative average feed intake of Giriraja birds (g/bird/week) under different treatment groups T_1, T_2, T_3, T_4 and T_5 were 1748.31, 1726.52, 1712.64, 1714.49 and 1718.22 respectively. The statistical analysis revealed non-significant ($P>0.05$) difference in feed intake among different treatment groups.

At the end of sixth week (42nd day), the cumulative average feed intake of Giriraja birds (g/bird/week) under different treatment groups were 2692.62 (T_1), 2684.49 (T_2), 2517.16 (T_3), 2528.73 (T_4) and 2515.09 (T_5). The ANOVA revealed significant ($P \leq 0.05$) difference in feed intake among different treatment groups. The treatment groups T_1 and T_2 showed significantly ($P \leq 0.05$) higher feed intake compared to the groups T_3, T_4 and T_5. There was no significant ($P>0.05$) difference among groups T_1 and T_2 and also among the groups T_3, T_4 and T_5.

The cumulative average feed intake (g/bird/week) at the end of seventh week 3611.92, 3594.36, 3582.16, 3361.27 and 3357.43 in groups T_1, T_2, T_3, T_4 and T_5, respectively. The ANOVA indicated significant ($P \leq 0.05$) difference in feed intake among different treatment groups. The treatment group T_1, T_2 and T_3 showed significantly ($P \leq 0.05$) higher feed intake compared to treatment groups T_4 and T_5. The treatment groups T_1, T_2 and T_3 showed non-significant difference among themselves and also no significant ($P>0.05$) difference was observed among the groups T_4 and T_5.

At the end of trial highest feed intake was observed in T_2 (4494.53) followed by T_1 (4487.26), T_3 (4463.42), T_5 (4237.31) and least in T_4 (4211.07). The ANOVA revealed significant ($P \leq 0.05$) difference in feed intake among different treatments at the end of eighth week. The treatment group T_1, T_2 and T_3 showed significantly ($P \leq 0.05$) higher feed intake compared to other treatment groups. Among the groups T_1, T_2 and T_3 showed non-significant difference among themselves and also no significant ($P>0.05$) difference was observed among the groups T_4 and T_5.

There was a significant difference ($P \leq 0.05$) in the feed intake of the Giriraja birds fed with neem, ginger and garlic powder compared to the control group from sixth week till the end of the experiment (56th day).

The present results are in agreement with results of Kale *et al*. (2003) [5] who assumed that the body weight gain of broilers supplemented with neem leaf and ginger may be due to antimicrobial and anti-protozoal properties of neem leaf and ginger extracts, which help to reduce the microbial load of birds, thus improve the feed consumption and feed efficiency of the birds.

The present study is disagreement with the study of Zowrawi *et al*. (2014) concluded that supplementation of ginger root

powder at the rate of 0.5%, 1.0% and 1.5% had no significant effect ($P>0.05$) on the feed intake compared to the control group but there was increased in the feed consumption among the groups which are fed with the ginger root powder.

3.3 Feed conversion ratio

The results of the influence of feeding neem, ginger and garlic powder on weekly cumulative feed conversion ratio (FCR) in Giriraja birds are presented in Table 3.

The mean feed conversion ratio values among different treatments T_1, T_2, T_3, T_4 and T_5 were 0.646, 0.602, 0.600, 0.603 and 0.573, respectively at the end of first week. The statistical analysis revealed non-significant ($P>0.05$) difference in FCR among different treatment groups.

The cumulative average FCR values at the end of second week were 1.479, 1.413, 1.284, 1.253 and 1.251 in T_1, T_2, T_3, T_4 and T_5 groups, respectively. The ANOVA revealed significant ($P\leq0.05$) difference in cumulative FCR values among different treatments. The significantly better FCR was recorded in group T5 when compared to T1 and T2. There was no significant ($P>0.05$) difference observed among groups T_1, T_2, T_3 and T_4 and also within the groups T_3, T_4 and T_5.

The cumulative average FCR values at the end of third week were 1.489, 1.370, 1.327, 1.311 and 1.303 in T_1, T_2, T_3, T_4 and T_5 groups, respectively. The ANOVA revealed significant ($P\leq0.05$) difference in cumulative FCR among different treatments at the end of third week. The significantly better FCR values were observed in groups T_5 when compared to the T_1 (control group) and T_2 and also between T_2, T_3 and T_4 compared to the T_1 (control group) . There was no significant ($P>0.05$) difference between the groups T_2, T_3, T_4 and also among the groups T_3, T_4 and T_5.

At the end of fourth week, the cumulative average FCR values were 1.692, 1.563, 1.433, 1.410 and 1.404 in T_1, T_2, T_3, T_4 and T_5 groups, respectively. The ANOVA revealed significant ($P\leq0.05$) difference in cumulative FCR among different treatments at the end of fourth week. The significantly better FCR values were observed in groups T_5 when compared to the T_1 (control group) and T_2 and also between T_2, T_3 and T_4 compared to the T_1 (control group). There was no significant ($P>0.05$) difference between the groups T_2, T_3, T_4 and also among the groups T_3, T_4 and T_5.

The cumulative average FCR values at the end of fifth week were 1.851, 1.706, 1.615, 1.628 and 1.566 in T_1, T_2, T_3, T_4 and T_5 groups, respectively. The significantly better FCR values were observed in groups T_5 when compared to the T_1 (control group) and T_2 and also between T_2, T_3 and T_4 compared to the T_1 (control group) . There was no significant ($P>0.05$) difference between the groups T_2, T_3, T_4 and also among the groups T_3, T_4 and T_5.

At the end of the sixth week trial (42nd day), the cumulative average FCR value 2.291, 2.117, 2.063, 1.851 and 1.816 in T_1, T_2, T_3, T_4 and T_5 groups, respectively. The ANOVA revealed significant ($P\leq0.05$) difference in FCR among different treatments. The treatment groups T_4 and T_5 showed significantly better FCR compared to other groups T_1, T_2 and T_3 and also significant difference was observed among T_2, T_3 compared to T_1(control). There was no significant ($P>0.05$) difference among the groups T_4 and T_5 and also among T_2 and T_3.

The cumulative average FCR values at the end of seventh week were 2.651, 2.513, 2.511, 2.112 and 2.103 in T_1, T_2, T_3, T_4 and T_5 groups, respectively. The ANOVA revealed significant ($P\leq0.05$) difference in FCR among different treatments. The treatment groups T_4 and T_5 showed significantly better FCR compared to other groups T_1, T_2 and T_3 and also significant difference was observed among T_2, T_3 compared to T_1(control). There was no significant ($P>0.05$) difference among the groups T_4 and T_5 and also among T_2 and T_3.

At the termination of eighth week trial (56th day), the cumulative average FCR values were 2.777, 2.624, 2.615, 2.240 and 2.233 in T_1, T_2, T_3, T_4 and T_5 groups, respectively. The ANOVA revealed significant ($P\leq0.05$) difference in FCR among different treatments. The treatment groups T_4 and T_5 showed significantly better FCR compared to other groups T_1, T_2 and T_3 and also significant difference was observed among T_2, T_3 compared to T_1(control). There was no significant ($P>0.05$) difference among the groups T_4 and T_5 and also among T_2 and T_3.

There was significant difference ($P\leq0.05$) in the feed conversion ratio of the Giriraja birds fed with neem, ginger and garlic powder compared to the control group from second week to end of the experiment (eighth week).

The present study is in agreement with the study of Kale *et al.* (2003) [5] who assumed that the body weight gain of broilers supplemented with neem leaf and ginger may be due to antimicrobial and anti-protozoal properties of neem leaf and ginger extracts, which help to reduce the microbial load of birds, thus improve the feed consumption and feed efficiency of the birds.

The present study was in disagreement with Khan *et al.* (2008) found no significant difference ($P>0.05$) in the feed efficiency of the native desi laying hens which are supplemented with the garlic powder at the dose rate of 2%, 4% and 6% for the period of 6 weeks.

The findings of the present study are in disagreement with Zowrawi *et al.* (2014) concluded that supplementation of ginger root powder at the rate of 0.5%, 1.0% and 1.5% had no significant effect ($P>0.05$) on the feed efficiency compared to the control group.

3.4 Survivability

The results of influence of feeding neem, ginger and garlic powder on per cent survivability in Giriraja birds are presented in Table 4.

The survivability or liveability (%) values were 96.09 in T1, 95.75 in T2, 95.69 in T3, 96.45 in T4 and 98.88 in T5. The statistical analysis revealed non-significant ($P>0.05$) difference in survivability (%) of birds among control and other treatment groups.

There was no significant difference ($P>0.05$) in survivability of Giriraja birds in the groups fed with neem, ginger and garlic powder compared to the control group.

The present study is in agreement with Anwarul *et al.* (2018) who observed no significant difference in survivability among control and other treatment groups fed with different level of neem leaf powder in broilers.

The present study is in disagreement with Durrani *et al.* (2008) [4] who conducted experiment on broilers by supplementing neem leaf infusion along with drinking water and observed significant improvement ($P<0.05$) in the survivability of the broiler chicks in all the groups supplemented with neem leaf infusion compared to the control group.

Table 1: Effect of supplementation of Neem, Ginger and Garlic powder at different age intervals on weekly cumulative body weight (g/bird/week) (Mean ± SE) in Giriraja birds.

Experimental group	Description of the treatment	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th Week
T_1	Basal diet	109.32 ±1.97	216.81 ± 5.37^{c}	439.16 ± 8.84^{c}	702.84 ± 13.53^{c}	964.25 ± 14.82^{c}	1170.78 ± 11.12^{b}	1389.46 ± 09.07^{b}	1689.46 ± 11.84^{b}
T_2	Basal diet + 0.5% Garlic powder	109.10 ± 2.62	242.05 ± 6.34^{ab}	462.36 ± 10.14^{ab}	777.97 ± 16.44^{ab}	1023.47 ± 19.98^{b}	1222.93 ± 63.46^{b}	1452.07 ± 63.65^{b}	1707.94 ± 22.83^{b}
T_3	Basal diet + 0.5% Neem powder	110.47 ± 1.79	251.40 ± 3.63^{a}	467.81 ± 11.31^{a}	785.51 ± 14.32^{a}	1128.28 ± 17.94^{a}	1363.27 ± 22.84^{a}	1591.46 ± 47.36^{a}	1885.34 ± 22.82^{a}
T_4	Basal diet + 1.0% Ginger powder	113.18 ± 2.51	237.31 ± 4.55^{bc}	457.50 ± 9.47^{bc}	757.88 ± 14.74^{bc}	997.97 ± 16.69^{bc}	1214.50 ± 24.16^{b}	1437.42 ± 19.84^{b}	1715.46 ± 27.17^{b}
T_5	Basal diet + 0.5% Garlic powder + 0.5% Neem powder + 1.0% Ginger powder	117.26 ± 2.43	253.72 ± 4.42^{a}	472.76 ± 8.43^{a}	795.12 ± 15.84^{a}	1155.13 ± 15.25^{a}	1387.31 ± 32.24^{a}	1607.32 ± 27.49^{a}	1899.15 ± 22.43^{a}

^{abc} Means in the same column with no common superscript differ significantly ($P \leq 0.05$)

Table 2: Effect of supplementation of Neem, Ginger and Garlic powder at different age intervals on weekly cumulative feed intake (g/bird/week) (Mean ± SE) in Giriraja birds.

Experimental group	Description of the treatment	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th Week
T_1	Basal diet	81.27 ± 6.74	317.63 ± 5.46	615.17 ± 10.45	1118.31 ± 4.46	1748.31 ± 9.01	2692.62 ± 11.09^{b}	3611.92 ± 17.90^{b}	4487.26 ± 13.90^{b}
T_2	Basal diet + 0.5% Garlic powder	78.23 ± 2.54	314.23 ± 18.45	618.89 ± 29.44	1109.89 ± 28.64	1726.52 ± 23.16	2684.49 ± 13.46^{b}	3594.36 ± 27.02^{b}	4494.53± 21.26^{b}
T_3	Basal diet + 0.5% Neem powder	79.64 ± 2.57	316.43 ± 3.56	613.34 ± 33.21	1113.61 ± 23.61	1712.64 ± 16.19	2517.16 ± 16.71^{a}	3582.16 ± 25.21^{b}	4463.42 ± 27.78^{b}
T_4	Basal diet + 1% Ginger powder	78.46 ± 1.51	311.43± 19.21	617.41 ± 13.48	1100.44 ± 11.22	1714.49 ± 09.02	2528.73 ± 31.83^{a}	3361.27 ± 26.09^{a}	4211.07 ± 34.79^{a}
T_5	Basal diet + 0.5% Garlic powder + 0.5% Neem powder + 1% Ginger powder	78.89 ± 2.72	315.73 ± 13.64	610.61 ± 29.67	1107.49 ± 13.01	1718.22 ± 37.64	2515.09 ± 29.04^{a}	3357.43 ± 37.48^{a}	4237.31 ± 03.56^{a}

^{abc} Means in the same column with no common superscript differ significantly ($P \leq 0.05$)

Table 3: Effect of supplementation of Neem, Ginger and Garlic powder at different age intervals on weekly cumulative feed conversion ratio (Mean ± SE) in Giriraja birds.

Experimental group	Description of the treatment	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th Week
T_1	Basal diet	0.646 ± 0.019	1.479 ± 0.019^{b}	1.489 ± 0.031^{c}	1.692 ± 0.046^{c}	1.851 ± 0.016^{c}	2.291 ± 0.09^{c}	2.651 ± 0.043^{c}	2.777 ± 0.081^{c}
T_2	Basal diet + 0.5% Garlic powder	0.602 ± 0 .024	1.413 ± 0.031^{b}	1.370 ± 0.043^{b}	1.563 ± 0.019^{b}	1.706 ± 0.076^{b}	2.117 ± 0.037^{b}	2.513 ± 0.049^{b}	2.624 ± 0.035^{b}
T_3	Basal diet + 0.5% Neem powder	0.600 ± 0 .037	1.284 ± 0.021^{ab}	1.327 ± 0.036^{ab}	1.433 ± 0.034^{ab}	1.615 ± 0.019^{ab}	2.063 ± 0.012^{b}	2.511 ± 0.034^{b}	2.615 ± 0.054^{b}
T_4	Basal diet + 1% Ginger powder	0.603 ± 0 .009	1.253 ± .074^{ab}	1.311 ± 0.022^{ab}	1.410 ± 0.079^{ab}	1.628 ± 0.038^{ab}	1.851 ± 0.081^{a}	2.112 ± 0.061^{a}	2.240 ± 0.015^{a}
T_5	Basal diet + 0.5% Garlic powder + 0.5% Neem powder + 1% Ginger powder	0.573 ± 0 .011	1.251 ± .032^{a}	1.303 ± 0.039^{a}	1.404 ± 0.043^{a}	1.566 ± 0.011^{a}	1.816 ± 0.043^{a}	2.103 ± 0.008^{a}	2.233 ± 0.063^{a}

^{abc} Means in the same column with no common superscript differ significantly ($P \leq 0.05$)

Table 4: Effect of supplementation of Neem, Ginger and Garlic powder on survivability in Giriraja birds.

Experimental group	Description of the treatment	Survivability percentage (%)
T_1	Basal diet	96.09
T_2	Basal diet + 0.5% Garlic powder	95.75
T_3	Basal diet + 0.5% Neem powder	95.69
T_4	Basal diet + 1% Ginger powder	96.45
T_5	Basal diet + 0.5% Garlic powder + 0.5% Neem powder + 1% Ginger powder	98.88

^{abc} Means in the same column with no common superscript differ significantly ($P \leq 0.05$)

4.Conclusion

The body weight (g) of the birds revealed significant difference ($P \leq 0.05$) in the Giriraja birds fed with 0.5% garlic, 0.5% neem, 1% ginger and combination of 0.5% garlic powder + 0.5% neem powder + 1% ginger powder when compared to control from second week till the end of the experiment (56th day).

Feed intake (grams) revealed significant difference ($P \leq 0.05$) in the Giriraja birds fed with 1% ginger and combination of 0.5% garlic powder + 0.5% neem powder + 1% ginger

powder respectively, compared to the control group and other treatment (0.5% garlic, 0.5% neem) groups from 6th week till the end of the experiment (eighth week).

The feed conversion ratio was significantly better ($P \leq 0.05$) among treatment groups fed with 0.5% garlic, 0.5% neem, 1% ginger powder and combination of 0.5% garlic, 0.5% neem, 1% ginger powder compared to the control group from second week to end of the experiment (eighth week).

The survivability (per cent) of birds were non significant ($P > 0.05$) among Giriraja birds in the groups fed with 0.5% garlic, 0.5% neem, 1% ginger powder and combination of 0.5% garlic, 0.5% neem, 1% ginger powder compared to the control group till the end of the experiment (56th day).

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