

## Effect of garlic and neem leaf powder supplementation on growth performance and carcass traits in broilers

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### Abstract

**Aim:** Present experiment was designed to study the effect of supplementation of garlic and neem leaf powder (NLP) on growth performance and carcass yields in broilers.

**Materials and Methods:** A total of 210-day-old commercial male broiler chicks (Ven Cobb) were procured and randomly distributed in to seven treatments, each treatment had six replicates with five chicks per each replicate. Growth trial was conducted in a randomized block design comprising seven dietary treatments. T1 was served as control. T2 and T3 were fed with garlic powder (GP) 0.5, 1 g/kg feed respectively. T4 and T5 were given with NLP 1, 2 g/kg feed respectively. T6 was fed with 0.5 g/kg GP and 1.0 g/kg NLP. T7 was treated with 1.0 g/kg GP and 2.0 g/kg NLP. The body weight, feed consumption of individual bird was recorded at weekly interval and the body weight gain, feed conversion ratio (FCR) were calculated. At the end of 42 day, six birds from each dietary group were sacrificed to estimate the dressing yield and relative weights of gible (liver, heart and gizzard).

**Results:** Supplementation of garlic and NLP alone and their combination significantly ( $p < 0.05$ ) improved the body weight gain and FCR whereas no significant ( $p > 0.05$ ) influence was observed in carcass parameters like dressing yield and gible yield (heart, gizzard and liver) in all treatment groups.

**Conclusions:** Supplementation of GP alone showed poor performance, but when it was supplemented in combination with NLP there was improvement in performance parameters. These results indicated that the combination of GP and NLP can be used as alternates to coccidiostats for improving the performance. Such meat can be used as a designer meat as fetch higher price if marketed as branded item.

**Keywords:** body weight gain, carcass yield, feed conversion ratio, garlic, neem.

### Introduction

Garlic contains at least 33 sulfur compounds, several enzymes, 17 amino acids and minerals such as selenium [1]. The sulphur compounds are responsible both for garlic's pungent odor and many of its medicinal effects like lowering cholesterol level [2]. There are also studies showing immunostimulatory function of garlic extracts [3]. Injury to the garlic bulb activates the enzyme alliinase, which metabolizes alliin to allicin. Allicin has antimicrobial effects against many viruses, bacteria, fungi and parasites [4].

Neem contains several active ingredient like, nimbidin, sodium nimbolide, gedunin, azadirachtin, mahmoodin, gallic acid, epicatechin and catechin, margalone, margolonone and isomargolonone, cyclic trisulphides, polysaccharides GIa, GIIa, GIIIa, GIb, NB-II peptidoglycon which all contribute to its beneficial medicinal properties [5]. Neem leaves and its constituents have been demonstrated to exhibit immunomodulatory, anti-inflammatory, antihyperglycemic, antiulcer, antimalarial, antifungal, antiviral, antioxidant, antimutagenic, anticarcinogenic properties [6].

When neem as an herbal drug is incorporated in feed mixture, it promotes growth and improves feed efficiency and live body weight due to its antibacterial and hepatoprotective properties [7].

In the present study, the effect of supplementation of neem leaf powder (NLP) alone and in combination with garlic on body weight gain, feed conversion ratio (FCR) and carcass yield were evaluated in broiler birds.

### Materials and Methods

#### Ethical approval

CPCSEA guidelines indicate that birds weighing up to 0.5 kg should be provided with a floor space of 929.03 cm<sup>2</sup>/bird and the present experiment was conducted as per CPCSEA guidelines.

#### Birds

210-day-old commercial male broiler chicks (Ven Cobb) were procured and randomly distributed into seven treatments; each treatment had six replicates with five chicks per each replicate. The chicks were reared in battery brooders up to 6 weeks of age under standard management and vaccination schedule. The experiment was conducted at poultry experimental station, Department of Poultry Science, College of Veterinary Science, Rajendranagar, Hyderabad.

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### Housing and management

Battery brooders, feed hoppers, waterer, nipple system pipes, nipples were cleaned thoroughly, disinfected and sterilized with a blow lamp prior to stocking chicks. Chicks were housed in battery brooder providing floor space of 929.03 cm<sup>2</sup>/bird. During the experiment, light was provided continuously (24 h). Feed and water were offered *ad libitum* throughout the experimental period. Birds were immunized against Newcastle disease on 7<sup>th</sup> (primary) and 28<sup>th</sup> (booster) day of age with lasato vaccine and for infectious bursal disease (IBD) on 14<sup>th</sup> day of age with IBD (intermediate-Georgia strain) vaccine.

The body weights of individual birds were recorded at weekly interval, and average body weight gain was calculated. Feed consumption of each replicate was recorded at weekly intervals, on the cumulative basis and feed consumption per bird per week was arrived at. The FCR was calculated as feed intake per unit body weight gain from 0 to 6 weeks of age at weekly intervals. At the end of experimental period (42 day) six birds from each dietary group (one bird from each replicate) were sacrificed to estimate dressing yield and relative weights of giblet (liver, heart and gizzard).

### Statistical analysis

The data were analyzed using general linear model procedure of statistical package for social sciences 15<sup>th</sup> version (Minitab Inc.) and comparison of means tested using Duncan's multiple range test (1955) and significance was considered at  $p < 0.05$  [8].

### Results

#### Body weight gain

Supplementation of garlic powder (GP) and NLP in broiler diets have significant ( $p < 0.05$ ) influence on body weight gains from 1<sup>st</sup> to 6<sup>th</sup> weeks of age. The highest mean body weight gain was observed in T5 (2.0 g/kg NLP) group which is statistically compared with T4 (1.0g/kg NLP). While T1 (control) group recorded lowest mean weight gain and statistically comparable with T3 (1.0 g/kg GP). There was no significant ( $p < 0.05$ ) difference in weight gain between treatment T7 (1.0 g/kg GP+2.0 g/kg NLP) and

T2 (0.5 g/kg GP). Among GP supplemented groups, 0.5 g/kg GP (T3) gained more weight compared to 1.0 g/kg GP (T4) group. The supplementation of 0.5 g/kg GP+1.0 g/kg NLP (T<sub>6</sub>) showed improved body weight gains in comparison to T7 (1.0 g/kg GP+2.0 g/kg NLP) (Table-1).

#### FCR (Feed intake/body weight gain)

Significant ( $p < 0.05$ ) difference were revealed for FCR in all the treatments from 1<sup>st</sup> to 6<sup>th</sup> weeks of age. Poor FCR was observed in T1 and better FCR was observed in group T7. The results indicate that birds fed with higher doses of GP (1.0 g/kg) and NLP (2.0 g/kg) and their combinations (1.0 g/kg+2.0g/kg) showed better FCR (Table-2).

#### Carcass yield

Dietary supplementation of GP and NLP alone and their combination did not significantly ( $p < 0.05$ ) influenced the dressing yield and giblet yield (liver, heart and gizzard) in broilers (Table-3).

### Discussion

In the present study, supplementation of GP and NLP alone and their combination significantly ( $p < 0.05$ ) improved the body weight gain. Similar findings with respect to improvement in body weight gain was observed by earlier researchers [9-11]. The improvement in weight gain might be due to anti-protozoal and immunostimulatory properties of neem leaves that help to reduce the microbial load and improved the performance [12]. In the contrary to our findings, there is also some reports in which birds exhibited poor performance and lower body weights in all treatment groups [13]. While some earlier reports showed no significant variations in weight gain of broilers [14-16].

Among GP supplemented groups, 0.5 g/kg GP (T3) gained more weight compared to 1.0 g/kg GP (T4) group. The reduction in body weight gain at higher doses might be due to increasing in repulsive odour and taste of garlic [17]. Improvement in weight gain 0.5 g/kg might be due the fact that allicin (an antibiotic substance found in garlic), inhibits growth of intestinal bacteria and inhibit aflatoxins producing fungi resulting in lowering the load of these organisms

**Table-1:** Effect of supplementing garlic and NLPs and their combinations on weight gain of broilers.

Treatments	Weeks							Cumulative gain
	Day old	1	2	3	4	5	6	
T1	47.23	80.00 <sup>e</sup>	174.67 <sup>e</sup>	283.17 <sup>d</sup>	384.22 <sup>e</sup>	425.33 <sup>d</sup>	371.00 <sup>d</sup>	1718.38 <sup>d</sup>
T2	47.23	83.33 <sup>cde</sup>	179.00 <sup>de</sup>	290.00 <sup>c</sup>	387.18 <sup>cde</sup>	455.00 <sup>c</sup>	385.00 <sup>c</sup>	1779.52 <sup>c</sup>
T3	47.43	82.00 <sup>de</sup>	177.00 <sup>de</sup>	288.00 <sup>c</sup>	385.17 <sup>de</sup>	429.17 <sup>d</sup>	375.17 <sup>d</sup>	1736.50 <sup>d</sup>
T4	47.50	89.00 <sup>ab</sup>	187.00 <sup>ab</sup>	298.00 <sup>ab</sup>	394.00 <sup>ab</sup>	478.22 <sup>a</sup>	401.22 <sup>a</sup>	1847.43 <sup>a</sup>
T5	47.37	91.00 <sup>a</sup>	191.00 <sup>a</sup>	300.00 <sup>a</sup>	396.00 <sup>a</sup>	482.00 <sup>a</sup>	403.17 <sup>a</sup>	1863.17 <sup>a</sup>
T6	47.67	87.00 <sup>abc</sup>	185.00 <sup>bc</sup>	295.17 <sup>b</sup>	391.20 <sup>bc</sup>	461.17 <sup>b</sup>	395.00 <sup>b</sup>	1814.53 <sup>b</sup>
T7	47.64	85.00 <sup>bcd</sup>	181.33 <sup>cd</sup>	289.17 <sup>c</sup>	389.17 <sup>cd</sup>	456.17 <sup>c</sup>	387.00 <sup>c</sup>	1787.83 <sup>c</sup>
SEM	0.16	0.77	0.98	1.01	0.83	3.19	1.86	8.35
p-value	0.98 <sup>NS</sup>	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Values bearing different superscripts within a column are significantly ( $p < 0.05$ ) different. SEM=Standard error of the mean, NS=Non-significant, NLP=Neem leaf powder

**Table-2:** Effect of supplementing garlic and NLPs in experimental diets on FCR of broiler chicken.

Treatments	Weeks						Cumulative FCR
	1	2	3	4	5	6	
T1	1.41 <sup>c</sup>	1.61 <sup>e</sup>	1.65 <sup>d</sup>	1.84 <sup>d</sup>	1.91 <sup>g</sup>	2.05 <sup>e</sup>	1.83 <sup>e</sup>
T2	1.39 <sup>c</sup>	1.58 <sup>d</sup>	1.63 <sup>c</sup>	1.84 <sup>d</sup>	1.80 <sup>e</sup>	1.98 <sup>d</sup>	1.78 <sup>d</sup>
T3	1.32 <sup>b</sup>	1.52 <sup>b</sup>	1.57 <sup>a</sup>	1.80 <sup>b</sup>	1.83 <sup>f</sup>	1.97 <sup>c</sup>	1.75 <sup>c</sup>
T4	1.32 <sup>b</sup>	1.55 <sup>c</sup>	1.63 <sup>c</sup>	1.83 <sup>d</sup>	1.73 <sup>bc</sup>	1.97 <sup>c</sup>	1.75 <sup>c</sup>
T5	1.27 <sup>a</sup>	1.49 <sup>a</sup>	1.59 <sup>b</sup>	1.81 <sup>c</sup>	1.71 <sup>a</sup>	1.94 <sup>b</sup>	1.72 <sup>b</sup>
T6	1.28 <sup>a</sup>	1.52 <sup>b</sup>	1.59 <sup>b</sup>	1.82 <sup>c</sup>	1.75 <sup>d</sup>	1.91 <sup>a</sup>	1.73 <sup>b</sup>
T7	1.27 <sup>a</sup>	1.48 <sup>a</sup>	1.56 <sup>a</sup>	1.78 <sup>a</sup>	1.72 <sup>ab</sup>	1.91 <sup>a</sup>	1.70 <sup>a</sup>
SEM	0.01	0.01	0.02	0.02	0.01	0.02	0.01
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Values bearing different superscripts within a column are significantly ( $p < 0.05$ ) different, SEM=Standard error of the mean, FCR=Feed conversion ratio, NLP=Neem leaf powder

**Table-3:** Effect of supplementing garlic and NLPs and their combinations on carcass yields of broiler at 42 day of age.

Treatments	Carcass parameters (%)			
	Dressing yield	Heart weight	Gizzard weight	Liver weight
T1	71.60	0.43	1.82	2.31
T2	70.75	0.52	2.09	1.97
T3	71.44	0.35	2.00	2.04
T4	71.27	0.40	1.91	2.15
T5	71.12	0.47	2.03	2.39
T6	70.60	0.36	1.72	2.21
T7	71.66	0.41	1.93	2.22
SEM	1.57 <sup>NS</sup>	0.01 <sup>NS</sup>	0.04 <sup>NS</sup>	0.13 <sup>NS</sup>
p-value	0.712	0.066	0.165	0.439

NS=Non-significant, SEM=Standard error of the mean, NLP=Neem leaf powder

in the intestine and birds may absorb more nutrients leading to the improvement in weight gain of the birds using rations supplemented with garlic. These findings were in agreement with [17,18].

The supplementation of combination of 0.5 g/kg GP+1.0 g/kg NLP (T<sub>6</sub>) showed improved body weight gains in comparison to T7 (1.0 g/kg GP+2.0 g/kg NLP). In an experiment, supplementation of diet with 1% neem leaf meal and pawpaw leaf meal improved performance, as neem leaf might have suppressed the growth of harmful organisms, thereby creating a conducive environment for the active substances in the pawpaw leaf to aid digestion and give better performance [11]. Similar mechanism of action would have occurred while supplementing GP and NLP in combination at lower dose.

In the present study, supplementation of GP and NLP alone and their combination significantly ( $p < 0.05$ ) improved the FCR. The higher body weight gains might be due to growth promoting and antimicrobial property of garlic and neem leaves that helped to reduce the microbial load of birds and improved feed efficiency [12,19]. Similar findings with respect to increased FCR were reported by earlier researchers [9,10,12,18,20,21]. In contrary to findings of this study, some authors observed that the supplementation

of garlic and neem leaves had no significant ( $p > 0.05$ ) effect FCR [14,16,22-26].

In the present study, there was no significant ( $p > 0.05$ ) influence on carcass parameters like dressing yield and giblet yield (heart, gizzard and liver) in all dietary groups. These results are in agreement with earlier researchers [15,17,23,25,27-30]. In the contrary with these findings, a significant increase in average dressing percentage with supplementation of garlic [18] and neem [9,11] was also reported by earlier workers in broilers.

### Conclusion

Supplementation of GP and NLP alone or in combination significantly ( $p < 0.05$ ) influenced the growth performance of broilers in comparison to control. Supplementation of 1.0 g/kg GP+2.0 g/kg NLP proved most efficient as it showed best FCR. Carcass yield was not affected by feeding of GP and NLP in all the treatment groups. Thus combine supplementation of GP and NLP can be used as feed additives in broilers for improving the performance.

### Authors' Contributions

KRK planned, designed the study and analysed the data. SS assisted in literature collection. Manuscript was drafted and revised by SS under the guidance of KRK. Both authors read and approved the final manuscript.

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### Competing Interests

The authors declare that they have no competing interests.

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