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Effect of Garlic (*Allium sativum*) on Production Performances and Carcass Traits of Nandanam Broiler-2

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A B S T R A C T

A study was conducted to the effect of garlic with two different levels on the growth performances and carcass characteristics of NandanamBroiler-2. A total of 84 day old NandanamBroiler-2 chicks were randomly allotted into three treatments with two replicates which contained 14 chicks in each replicate for 8 weeks experimental period. The dietary treatments were formulated as a control (T1), 0.25 % (T2), 0.50% (T3) garlic paste with basal diet. The data on production parameters like weekly body weight, feed consumption and mortality were recorded. At the end of the 8 weeks of age, six birds (3male and 3 female) were randomly selected and subjected to slaughter studies to determine the carcass characteristics. The birds supplemented with 0.25 % garlic paste (T2) had significantly higher body weight, better feed efficiency and livability compared to control (T1). However, no significant difference was observed in terms of carcass traits in this experiment. The dietary supplementation of 0.5% garlic (T3) resulted in significant ($P<0.01$) improvement in terms of thigh yield as compared to T1 and T2. On the other hand, significant ($P<0.01$) improvement in wing yield was noticed with dietary supplementation of 0.25% garlic (T2) as compared to T1 and T3. It can be concluded that garlic paste supplementation at the level of 0.25% in the diet of coloured broilers can result in substantial improvements in production performances.

Introduction

Feed additives are a group of nutrient and non-nutrient compounds which helps in improving the efficiency of feed utilization and thus reducing the cost of feed. In the past, antibiotics were the most routinely used feed additives. However, now -a-days use of antibiotics is not only limited but their use in livestock and poultry industry also have been banned in many countries due to the reasons like alteration of natural gut microbes and drug resistance in bacteria and humans. As, a result, to replace them without adversely affecting the performance of birds, natural growth promotes such as prebiotics, symbiotic, enzymes, plant extracts etc. can be used to feed the broilers (Borazjanizadeh *et*

*al.,*2011).Garlic (*Allium sativum*) has been used as a spice and native medicine for many years. It possess antibacterial, antiparasitic, antiviral, antioxidant, anticholesteremic, anti-cancerous and vasodilator characteristics (Hanieh *et al*., 2010). Garlic powder as a natural growth promoter can be potential alternative for common artificial growth promoters like antibiotics and in this respect, it can improve growth rate, feed conversion ratio (FCR), and carcass characteristics (Makwana *et al.,* 2015; Demir *et al.,* 2003; Lewis *et al.,* 2003; Tollba and Haesan, 2003). The active ingredient in garlic is the plant chemical allicin, which rapidly decompose to several volatile organosulphur compounds with bioactivity (Chang and Cheong, 2008). Thus the present study was designed to observe the potential of incorporating different levels of garlic as a phytogenic growth promoter in NandanamBroiler-2 chicken.

Materials and Methods

The study was carried out at Poultry Research Station, Madavaram Milk Colony, Tamil Nadu Veterinary and Animal Sciences University, Chennai, located between 13^{o}-9' and 13^{o}-15'N and longitudes 80^{o}-14' and 80^{o}-24' E with an altitude of 22 meters above mean sea level. Chennai has a hot and humid climate, classified as "Tropical Maritime Monsoon" type. The average annual rainfall is 130mm and pends mostly on the North East monsoon. Average temperature was 28.4^{o}C during the study period (December to February). The relative humidity was high throughout the year in range of 65- 85 percent.

Experimental design

The standard recommended commercial broiler diet was prepared as per BIS 2007 broiler standard with similar nutrient composition for all the treatments. The design of experiment is presented in Table 1. The control diet was formulated without supplementation of any antibiotics, growth promoters or yeast, prebiotics (T1). The experimental diets were prepared by supplementing the control diet with two different levels of garlic. The required amount of garlic paste were prepared and weighed and initially mixed with small quantity of feed and then mixed with bulk quantity of feed to get the final concentration of 0.25 and 0.50 percent in (T2) and (T3) respectively. All the diets were isocaloric and is on itrogenous.

Management of experimental birds

The chicks were reared upto three weeks of age in a brooder cage and later transferred to large size cage and maintained upto the experimental period of 8 weeks of age. All the chicks were provided with uniform floor, feeder and water space and were reared under standard management condition throughout the experimental period. Brooding was done in cages having dimensions of 75x 50x 30cm in size from 1-21 days of age.

All brooding managements were made well before the arrival of chicks. All the chicks were provided with uniform facilities using 40 watt incandescent bulb in each cage. From 4–6weeks of age the bird were reared in cages having dimensions of 90 x50 x 30cm and from 7-8 weeks of age was done in cages having dimensions of 120x 50x 30cm in size.

The feed and water were provided *ad libitum* during the experimental periods. Standard management practices were adopted in all the experimental groups. Chicks were provided with 24 hours light during the first 3 days of brooding period followed by 23 hours of light till 2 weeks of age. The vaccination schedule followed is presented in Table 2.

Statistical analysis

The statistical analysis was done using Sigmaplot version 11.0 (Systat Software Inc., USA). Data sets were first tested for normality by Shapiro-Wilk's normality test and analysed by RC2analysis of variance (ANOVA) with general linear model (GLM). All pair wise differences in mean were compared by Tukey post hoc test.

Results and Discussion

The effect of supplementation of garlic paste on body weight, feed efficiency, livability, carcass traits and cut-up-parts were presented in Tables 3-6.

Body weight

Mean second week body weight of Nandanam Broiler - 2 were ($P<0.05$) significantly higher in0.25% garlic supplemented groups (T2) than control (T1). There was no significant difference in the body weight during 4 and 6 weeks of age. However, birds fed with garlic paste at the level of 0.25 % (T2) and0.50 % (T3) had body weights heavier ($P<0.05$) than those in control group (T1).The groups supplemented with garlic paste of 0.25% (T2) and 0.50% (T3) had significantly ($P<0.05$) higher body weights than control (T1) at 8 weeks of age (Table 3). The present findings at 2 weeks of age on body weight is in agreement with the findings of Aji *et al.,* (2011), who also reported that administration of 100 mg of garlic resulted in improved body weight gain at 14 days of age in broiler chicks. Similar findings were also reported by Suriya *et al.,* (2012) broilers fed with 0.25% and 0.5% garlic at 21 days of age. Patel *et al.,* (2017) reported that basal diet supplemented with 0.5% garlic bulb powder significantly ($P<0.05$) improved body weight compared to control groups upto 42 days in broilers. Similar, findings were observed Makwana *et al.,* (2015), who conducted research on garlic powder supplementation at 0.1 and 0.5% of in basal diet and reported that body weight of the broiler birds was significantly higher in 0.1% as compared to 0.5% and control. The total body weight of cobb- 400 broilers upto 6 weeks of age fed with a diet containng1.0 % garlic showed significantly ($P<0.05$) higher values as compared to control (Karangiya *et al*., 2016). Pourali *et al.,* (2010) suggested that allicin in garlic promotes the performance of the intestinal flora thereby improving digestion and enhancing the utilization of energy, leading to improved growth. On the other hand, a contradictory report of no significant effect on body weight was observed by Rahimi *et al.,* (2011) with garlic supplementation of broiler diet. Onibi *et al.,* (2009) and Fadlalla *et al.,* (2010) also reported that garlic powder had no significant effect on the body weight gain of birds.

Feed efficiency

Experimental birds in (T2) group showed significantly ($P<0.01$) better feed conversion ratio as compared to T1and T3 groups as presented in Table 3. The birds fed with basal diet (T1) and basal diet supplemented with 0.50% garlic (T3) had similar FCR. This present findings are agreement with those of Onu (2010), who showed that ginger and garlic supplementation at 0.25% level in broiler finisher diets enhanced the feed conversion ratio. Makwana *et al.,* (2015)stated that better feed conversion ratio ($P<0.01$) was observed in birds receiving 0.1% garlic as compared to those receiving either 0.5% garlic or control. Patel *et al,* (2017) reported that broilers supplemented with 0.5% garlic had better FCR than 0.5% garlic and fenugreek seed powder supplemented group. Suriya *et al*., (2012) reported that overall performance of 0.5% and 0.1% garlic supplementation improved feed conversion ratio when compared to control. The feed conversion ratio of garlic powder mixed in the feed at 14g/kg of basal diet had a

significant (P<0.05) increase than other treatments (Oleforuh-Okoleh *et al.,* (2014). On the other hand, Aji *et al*., (2011) reported non-significant effect of dietary garlic on feed conversion ratio. Although, contrary results were obtained by Onibi *et al.,* (2009) and Fadlalla *et al*., (2010), who reported that garlic powder had no significant effect on the feed conversion ratio of birds.

Livability

The mean percent cumulative livability upto 8 weeks of experiment is shown in Table 4. Experimental birds in (T3) and (T1) had significantly (P<0.05) better livability at 2 week of age compared to (T2). Whereas remaining periods of experiment at 4, 6 and 8 week of age were significantly (P<0.01) better livability on 0.25% garlic (T2) group compared with 0.5% garlic (T3) and control (T1) group. The present findings were closely agreed with Patel *et al.,* (2017) who have reported that the mean percent livability was 95 % with inclusion of 0.5%garlic in broiler diet. The present finding concurred with previous report of Makwana *et al.,* (2015) who have reported that the livability of 98.33% at 0.5% garlic included in broiler diets. The results of the present study were supported by the earlier findings of Fadlalla *et al.,* (2010). In present study, lower mortality in garlic fed birds might be due to antimicrobial action of garlic (Ankri and Mirelman, 1999).

Carcass traits

The carcass parameters studied in this experiment are shown in Table 5. The present findings revealed non- significant (P>0.05) differences among different dietary treatment groups in terms of blood loss, feather loss, weights of liver, heart and gizzard, and eviscerated and ready-to-cook Aji *et al*., (2011) also reported non-significant effect of garlic supplementation on dressing percentage in broilers. Similarly, Abbas (2010) and Awadein *et al.,* (2010) reported that weights of liver, gizzard, heart and spleen had non-significant (P>0.05) differences in garlic and fenugreek supplemented broilers. Makwana *et al*., (2015) reported non-significant effect due to 0.1% and 0.5% garlic supplementation on shrinkage loss, blood loss, feather loss, eviscerated yield, relative weights of heart, liver, gizzard and giblets. In contrast to the present findings, Ashayerizadeh *et al.,* (2009) and Makwana *et al.,* (2015) reported significant (P<0.05) increase in dressing percentage on garlic supplementation in broilers.

Cut-up-parts

The cut-up-parts of Nandanam Broiler - 2 of different treatment groups were presented in Table 6. The present findings revealed significantly (P<0.05) higher thigh percentage were observed in (T3) as compared (T1) and (T2). In contrast to present findings, Ashagerizadeh *et al.,* (2009) and Javed *et al.,* (2009) demonstrate that garlic powder added into broiler feed and water did not change thigh weight. The percent wing yield was significantly (P<0.05) lower in (T3) as compared to T1 and T2.The similar finding of improved leg weight was observed by Javed *et al.,* (2009) in a 35days experimental trail. In this study, broilers were supplemented with aqueous extract of medicinal plants containing garlic at the rate of 10ml/litter of drinking water.

The other weights and cut-up-parts were not affected in Nandanam Broiler –2due to supplementation of different levels of dietary garlic. On the other hand, Raeesi *et al.,* (2010) reported a significant effect on the carcass parts of broilers fed with garlic. Pourali *et al.,* (2010) reported that the carcass parts were not affected by garlic supplementation and the finding is in agreement with the present findings.

Table.1 Experimental design

Group	Treatment	Replicates	No. of birds
T1	Basal diet (control)	2	28
T2	Basal diet with 0.25% garlic paste	2	28
T3	Basal diet with 0.50% garlic paste	2	28

Table.2 Vaccination schedule

Age	Type of Vaccine	Route of administration	Dose
5-7 days	RD or Newcastle- RDVF	Intra ocular/ Intra nasal	1 drop
18th day	IBD Vaccine (Intermediate Georgia)	Intra ocular/ Intra nasal	1 drop
28th day	RDV-LaSota strain	Drinking water	-
56th day	RDVK or R2B	S/C	0.5ml

Table.3 Effect of supplementation of garlic on production performance of Nandanam broiler 2 (Mean ± S.E)

Production performance	T1 (Control)	T2(Feed plus 0.25%garlic)	T3(Feed plus 0.50% garlic)
Hatch weight (g)^{NS}	40.05 ±0.58	41.06 ±0.68	41.88 ±0.71
2nd week weight (g)**	131.79^{b} ± 6.25	172.37^{a} ± 3.48	110.89^{c} ± 5.82
4th week weight (g)^{NS}	327.60 ±14.94	336.44 ±17.07	311.00 ±12.72
6th week weight (g)^{NS}	608.04 ± 23.87	645.33 ± 13.87	613.11 ±12.39
8th week weight (g)*	993.08^{b} ±38.27	1089.00^{a} ±22.92	1016.46^{a} ± 21.29
Feed efficiency**	2.54^{b}± 0.10	2.16^{a}± 0.04	2.45^{b} ± 0.05

** - Significant(P<0.01); *Significant (P<0.05); NS-Not Significant
Mean value within each row bearing common superscripts do not differ significantly (P >0.05)

Table.4 Effect of supplementation of garlic on liveability of NandanamBroiler- 2 (Mean ± S.E)

Age	T1 (Control)	T2(Feed plus 0.25%garlic)	T3(Feed plus 0.50%garlic)
First Week*	100.00^{a}±0.00	98.47^{b}±0.72	100.00^{a}±0.00
Fourth Week**	90.30^{c}±0.66	96.43^{a}±0.00	92.86^{b}±0.00
Sixth Week**	87.76^{c}±0.72	96.43^{a}±0.00	92.86^{b}±0.00
Eighth Week**	85.71^{c}±0.00	96.43^{a}±0.00	92.86^{b}±0.00

** Significant (P<0.01) *- Significant (P<0.05)
Mean value within each row bearing common superscripts do not differ significantly (P >0.05)

Table.5 Effect of garlic on carcass traits of NandanamBroiler-2(Mean ± S.E)

Carcass Traits	T1 (Control)	T2(Feed plus 0.25%garlic)	T3(Feed plus 0.50% garlic)
Live weight (g)^{NS}	1176.33 ± 58.90	1329.33 ±106.70	1355.50 ± 48.30
Blood loss (%)^{NS}	4.35 ± 0.17	4.73 ± 0.17	4.68 ± 0.37
Feather loss (%)^{NS}	7.31±0.42	6.54±0.40	6.26±0.16
Liver weight (%)^{NS}	2.96± 0.28	2.98± 0.22	2.71± 0.09
Heart weight (%)^{NS}	0.59±0.10	0.57±0.03	0.55±0.04
Gizzard weight (%)^{NS}	2.85±0.19	2.53±0.07	2.39±0.13
Eviscerated weight (%) ^{NS}	61.70±0.70	62.70±1.25	61.66±1.66
Giblet weight (%)^{NS}	6.40±0.41	6.08±0.30	5.65±0.20
R-to-C- weight (%)^{NS}	68.10±0.69	68.78±1.10	67.31±1.75
Small intestine length (cm)^{NS}	168.50 ± 4.88	170.75 ± 5.87	173.33 ± 4.39

NS-Not Significant (P>0.05)

Table.6 Effect of garlic on cut-up-parts of NandanamBroiler-2(Mean ± S.E)

Cut-up-Parts	T1 (Control)	T2(Feed plus 0.25%garlic)	T3(Feed plus 0.50%garlic)
Breast weight (%)^{NS}	28.62±1.21	28.62±1.21	28.62±1.21
Back weight (%)^{NS}	18.09±1.10	17.18±0.45	16.23±0.46
Thigh weight (%)**	18.72^{a}±0.51	16.07^{b}±0.40	18.92^{a}±0.46
Drumstick weight %)^{NS}	16.73±0.68	15.59±0.38	17.22±0.47
Neck weight (%)^{NS}	8.29±0.51	9.59±0.54	8.20±0.48
Wing weight (%)**	14.59^{a}±0.29	15.13^{a}±0.64	12.64^{b}±0.34

** - (P<0.01) Highly Significant NS-Not Significant (P>0.05)
Mean values sharing any one common superscript in a row or column do not differ significantly (P>0.05)

Small intestine length

The small intestine length (cm) at 8th week of age showed statistically non-significant (P>0.05) differences among garlic (0.25% and 0.50%) fed groups and control group (Table 6). Similarly, (Patel *et al.*, 2017) also reported that the length of intestine and caecum had

non-significant (P>0.05) difference due to supplementation of garlic and fenugreek alone and in combination. Javandel *et al.,* (2008) reported non-significant effect of garlic on intestine length of broilers. Likewise, Abbas (2010) reported non-significant effect of fenugreek on intestine and caecum lengths in broilers.

It could be concluded that 0.25% garlic supplementation can benefit broilers in terms of body weight, feed efficiency and livability than 0.5% level. Therefore garlic supplementation at 0.25% level in feed can result in better production efficiency and economics in broiler production.

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