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Effect of different forms of garlic (*Allium sativum*) supplementation on growth performance, feed and water intake of grampriya breed of poultry

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Abstract

The present investigation evaluated the effect of different forms of garlic (*Allium sativum*) on growth performance, feed and water intake of Grampriya poultry. Two hundred day-old straight-run chicks were randomly allotted to five dietary treatments with four replications of 10 birds each in a Completely Randomised Design. The treatments were T₁, basal ration (control); T₂, 3 per cent fresh garlic; T₃, 3 per cent garlic powder; T₄, 3 per cent black garlic powder; and T₅, 1 per cent each of fresh garlic, garlic powder and black garlic powder. Birds were reared for 10 weeks under uniform management. At the tenth week, the highest live body weight was recorded in T₃ (1434.39 g), followed by T₁ (1414.77 g), T₄ (1386.57 g), T₂ (1378.91 g) and T₅ (1367.63 g). Treatment differences were non-significant up to the fifth week and became significant from the sixth week onward. Cumulative feed intake was highest in T₁ (2990.96 g/bird) and lowest in T₃ (2962.35 g/bird), while cumulative water intake was highest in T₄ (7156.63 ml/bird) and lowest in T₅ (6762.10 ml/bird). Overall feed conversion ratio was best in T₃ (2.07), followed by T₁ (2.12), T₄ (2.16), T₂ (2.17) and T₅ (2.18). Mortality was low overall (4.0 per cent). The findings indicate that 3 per cent garlic powder was the most effective form for improving growth and feed utilisation without adversely affecting voluntary feed intake.

Keywords: Garlic, Grampriya, growth performance, feed intake, water intake, feed conversion ratio)

Introduction

Poultry production in India has developed into an organised and technology-intensive sector, with increasing demand for affordable animal protein. Grampriya is a medium-sized poultry breed suited to rural, backyard and semi-intensive production systems and is adapted to the agro-climatic conditions of Maharashtra (Singh, 2011) [16]. The increasing emphasis on antibiotic-free poultry production has stimulated interest in phyto-genic feed additives. Garlic is one of the promising botanical additives because it contains alliin, which is converted to allicin by alliinase when the tissue is crushed. Garlic and its bioactive compounds have been associated with antimicrobial, antioxidant and growth-promoting effects (Puvaca *et al.*, 2015; Rehman and Munir, 2015) [12, 13]. Previous studies have reported improved growth and feed efficiency with garlic supplementation, although the response depends on the form and inclusion level. Onibi *et al.* (2009) [10], Fadalla *et al.* (2010) [4] and Atuahene *et al.* (2013) [1] reported positive growth responses to garlic, while Tanti *et al.* (2015) [18] found garlic powder superior to fresh and black garlic for final body weight. Senthilkumar *et al.* (2015) [15] also reported improved growth performance and feed efficiency with garlic powder. The Grampriya study of Barkade *et al.* (2024) [2] similarly showed superior tenth-week body weight and feed conversion in the best-performing dietary treatment. Water intake may also vary with feed composition and additive characteristics. Therefore, the present study was undertaken to compare fresh garlic, garlic powder, black garlic powder and their combination in Grampriya poultry.

Objectives

1. To study the effect of different forms of garlic on growth performance of Grampriya breed of poultry.
2. To determine the effect of different forms of garlic on feed and water intake in different treatment groups.

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Materials and Methods

The experiment was conducted at the Poultry Unit, Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, Maharashtra, to evaluate the response of Gramapriya poultry to different forms of garlic (*Allium sativum*). Two hundred commercial straight-run, day-old Gramapriya chicks were procured from Parvati Hatcheries, Georai, district Beed. The chicks were individually weighed, wing-banded and randomly allotted on a similar body-weight basis to five treatments, each containing 40 birds with four replications of 10 birds each, following a Completely Randomised Design.

The dietary treatments were T₁: standard basal ration (control); T₂: basal ration + 3 per cent fresh garlic; T₃: basal ration + 3 per cent garlic powder; T₄: basal ration + 3 per cent black garlic powder; and T₅: basal ration + 1 per cent each of fresh garlic, garlic powder and black garlic powder. Birds were reared on deep litter in a well-ventilated shed for 10 weeks under uniform brooding, lighting, vaccination and managemental conditions. Standard commercial pre-starter, starter and finisher rations were supplied during 2-10, 11-24 and 25-72 days, respectively. Feed and clean drinking water were offered in measured quantities and residues were recorded to determine actual intake.

Weekly live body weight and weight gain were recorded up to 10 weeks. Weekly feed and water consumption were recorded and expressed as g/bird/week and ml/bird/week,

respectively. Feed conversion ratio was calculated as feed consumed divided by weekly body-weight gain. The observations were subjected to analysis of variance appropriate to a Completely Randomised Design, and treatment means were compared using the critical difference (CD) at the 5 per cent level of significance following Snedecor and Cochran (1994) [17].

Results and Discussion

1. Growth performance

1.1 Weekly live body weight

The weekly live body weight of Gramapriya birds differed little among treatments during the first five weeks, but treatment effects became significant from the sixth week onward. At ten weeks, T₃ (3 per cent garlic powder) recorded the highest live body weight of 1434.39 g, followed by T₁ (1414.77 g), T₄ (1386.57 g), T₂ (1378.91 g) and T₅ (1367.63 g). Thus, garlic powder was the only form that produced a numerical improvement over the control, although the final difference between T₃ and T₁ was not significant. The result agrees with Onibi *et al.* (2009) [10], Fadalla *et al.* (2010) [4], Atuahene *et al.* (2013) [1] and Tanti *et al.* (2015) [18], who reported improved body weight with garlic supplementation, particularly garlic powder. The pattern also agrees with Barkade *et al.* (2024) [2], who observed that the best-performing Gramapriya treatment had the highest tenth-week body weight.

Table 1: Average weekly live body weight (g/bird) of Gramapriya birds under different treatments

Treatment	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
T ₁	84.69	141.16	226.88	342.88	455.79	600.37 ^{ab}	773.47 ^{ab}	963.99 ^{ab}	1164.89 ^{ab}	1414.77 ^a
T ₂	83.38	140.42	225.41	340.85	452.35	589.06 ^b	757.35 ^b	947.06 ^b	1141.83 ^b	1378.91 ^{bc}
T ₃	85.86	141.98	226.97	342.46	454.30	617.03 ^a	791.40 ^a	987.22 ^a	1191.28 ^a	1434.39 ^a
T ₄	84.63	141.74	226.69	342.94	450.65	591.18 ^b	765.24 ^{ab}	949.45 ^b	1141.48 ^b	1386.57 ^{bc}
T ₅	82.60	141.00	225.28	342.57	452.90	588.62 ^b	751.72 ^b	936.05 ^b	1128.92 ^b	1367.63 ^c
SE±	0.82	0.51	0.55	0.89	1.16	6.69	8.78	10.57	12.33	14.38
CD at 5%	2.46	1.54	1.66	2.65	3.49	20.14	26.46	31.86	37.18	43.34
GM	84.23	141.26	226.25	342.34	453.19	597.25	767.83	956.75	1153.68	1396.45

Note: Values with different superscripts in a column differ significantly ($p < 0.05$).

Weekly weight gain followed the general pattern of live body weight. Treatment differences were non-significant from the second to the sixth week and became significant from the seventh week onward. Cumulative gain from the second to the tenth week was highest in T₃ (1348.52 g), followed by T₁ (1330.09 g), T₄ (1301.96 g), T₂ (1295.53 g)

and T₅ (1285.04 g). The improved response to garlic powder may be related to better utilisation of nutrients and the biological activity of garlic constituents. Similar positive effects of garlic powder on growth have been reported by Patel *et al.* (2014) [11] and Senthilkumar *et al.* (2015) [15].

Table 2: Average weekly weight gain (g/bird) of Gramapriya birds under different treatments

Treatment	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
T ₁	56.47	85.72	116.00	112.92	144.58	173.10 ^a	190.52 ^{ab}	200.90 ^a	249.88 ^a
T ₂	57.04	84.99	115.44	111.50	136.71	168.29 ^{ab}	189.70 ^{bc}	194.78 ^b	237.08 ^c
T ₃	56.12	84.99	115.49	111.84	162.73	174.37 ^a	195.82 ^a	204.06 ^a	243.10 ^{bc}
T ₄	57.12	84.95	116.25	107.71	140.53	174.06 ^a	184.21 ^c	192.04 ^b	245.09 ^{ab}
T ₅	58.40	84.28	117.29	110.33	135.72	163.10 ^b	184.33 ^c	192.87 ^b	238.72 ^c
SE±	0.75	0.64	1.04	1.27	7.05	2.09	1.79	1.76	2.04
CD at 5%	2.26	1.94	3.13	3.85	21.27	6.31	5.40	5.30	6.16
GM	57.03	84.98	116.09	110.86	144.05	170.58	188.91	196.92	242.77

Note: Values with different superscripts in a column differ significantly ($p < 0.05$).

2. Feed and water intake

2.1 Cumulative feed consumption

The effect of garlic form on weekly feed consumption was non-significant ($P > 0.05$) throughout the experimental period except in the fourth week, when intake was lowest in T₃ (210.50 g) and highest in T₂ (222.35 g). Cumulative feed

consumption over ten weeks was highest in T₁ (2990.96 g/bird) and lowest in T₃ (2962.35 g/bird), with T₂ (2976.46 g), T₄ (2977.93 g) and T₅ (2970.87 g) intermediate; the spread of 28.61 g between the extremes was well within the critical difference of 79.79 g and the treatments were therefore statistically at par. The fact that T₃ consumed the

least cumulative feed while producing the highest final body weight indicates improved feed utilisation rather than increased voluntary feed intake. This observation is in agreement with reports that botanical additives can improve

feed efficiency without necessarily increasing feed intake (Islam *et al.*, 2017; Senthilkumar *et al.*, 2015; Kumar *et al.*, 2019; Namdeo *et al.*, 2024) ^[5, 7, 9, 15].

Table 3: Cumulative feed consumption (g/bird) of Grampriya birds under different treatments

Treatment	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
T1	88.14	196.91	327.49	547.61	808.20	1134.04	1549.49	1987.10	2445.11	2990.96
T2	89.88	199.08	330.87	553.22	814.70	1139.90	1558.84	1994.73	2450.94	2976.46
T3	88.10	197.82	323.83	534.33	793.47	1117.27	1531.48	1971.60	2427.16	2962.35
T4	89.41	198.81	328.67	549.07	809.77	1135.28	1553.20	1990.00	2447.12	2977.93
T5	90.02	196.56	326.67	541.88	805.04	1132.14	1548.01	1984.12	2437.22	2970.87
SE±	0.64	1.70	3.13	5.31	7.76	10.91	14.66	17.85	21.86	26.47
CD at 5%	1.91	5.14	9.46	16.02	23.40	32.90	44.21	53.81	65.96	79.79
GM	89.10	197.83	327.50	545.22	806.24	1131.72	1548.20	1985.51	2441.51	2975.71

Note: Values are cumulative means; SE±, CD at 5% and GM are presented in the final rows.

2.2 Cumulative water consumption

Cumulative water consumption was highest in T₄ (7156.63 ml/bird), followed by T₂ (7134.85 ml), T₃ (6963.95 ml), T₁ (6858.25 ml) and T₅ (6762.10 ml). Cumulative intake did not differ significantly among treatments during the first two weeks ($P>0.05$); significant differences ($P<0.05$) appeared from the third week and persisted to the tenth. Throughout this later phase T₂ (fresh garlic) and T₄ (black garlic powder) consistently recorded the highest water intake, while T₅ recorded the lowest, falling below even the control at the ninth and tenth weeks. The greater water consumption

of the fresh and black garlic groups may be associated with the moisture content and the pungent, thirst-inducing sulphur compounds of these forms. Conversely, the lower intake in T₅ was consistent with its lower feed intake and final body weight. Islam *et al.* (2017) ^[5] reported no significant difference in water intake of broilers given a botanical additive, while Samale (2004) ^[14] and Dayat *et al.* (2023) ^[3] observed that the water requirement of birds is closely linked to the quantity and composition of the feed and additive consumed.

Table 4: Cumulative water consumption (ml/bird) of Grampriya birds under different treatments

Treatment	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
T1	172.34	388.88	670.74	1061.05	1623.21	2289.28	3154.07	4244.81	5517.94	6858.25
T2	175.04	394.69	690.02	1083.18	1672.82	2361.00	3261.31	4399.41	5734.84	7134.85
T3	174.66	398.68	690.99	1077.33	1638.95	2311.63	3186.01	4310.85	5612.12	6963.95
T4	175.29	393.32	689.67	1088.91	1670.46	2366.38	3267.74	4424.23	5771.53	7156.63
T5	176.01	392.82	683.53	1070.91	1633.05	2299.78	3162.49	4228.62	5496.20	6762.10
SE±	1.27	2.66	4.49	5.25	11.41	13.76	17.73	25.71	33.35	41.74
CD at 5%	3.83	8.01	13.54	15.83	34.39	41.46	53.44	76.17	100.53	125.82
GM	174.66	393.68	684.99	1076.27	1647.70	2325.61	3206.32	4321.58	5626.53	6975.15

Note: Values are cumulative means; SE±, CD at 5% and GM are presented in the final rows.

2.3 Feed conversion ratio

The overall feed conversion ratio was most efficient in T₃ (2.07), followed by T₁ (2.12), T₄ (2.16), T₂ (2.17) and T₅ (2.18). Against the critical difference of 0.07, T₃ was significantly superior to T₂, T₄ and T₅, but remained at par with the control. Weekly feed conversion ratios did not differ significantly during the second, third and fifth weeks, whereas significant differences ($P<0.05$) were recorded in the fourth, sixth, seventh, eighth, ninth and tenth weeks. From the sixth to the ninth week T₃ consistently recorded the most favourable (lowest) conversion, in keeping with its

high body weight and comparatively low feed intake; in the tenth week, however, T₄ (2.17) and T₁ (2.18) were numerically the most efficient, closely followed by T₃ (2.20), while T₂ (2.22) and T₅ (2.24) were the least efficient. T₅ recorded the poorest conversion in five of the nine weeks analysed, confirming that feeding the three forms together at 1 per cent each brought no additive gain in feed efficiency. The improved feed conversion in the garlic powder group agrees with Senthilkumar *et al.* (2015) ^[15], Karangiya *et al.* (2016) ^[6] and Makwana *et al.* (2019) ^[8].

Table 5: Feed conversion ratio of Grampriya birds under different treatments

Treatment	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total
T1	1.93	1.52	1.90 ^{ab}	2.31	2.28 ^{ab}	2.40 ^c	2.30 ^c	2.28 ^c	2.18 ^{bc}	2.12 ^{ab}
T2	1.92	1.55	1.93 ^a	2.35	2.39 ^a	2.49 ^b	2.30 ^c	2.34 ^b	2.22 ^a	2.17 ^a
T3	1.96	1.48	1.82 ^c	2.32	2.00 ^b	2.40 ^c	2.25 ^d	2.23 ^d	2.20 ^b	2.07 ^b
T4	1.92	1.53	1.90 ^{ab}	2.42	2.33 ^a	2.40 ^c	2.40 ^a	2.38 ^a	2.17 ^c	2.16 ^a
T5	1.82	1.54	1.84 ^{bc}	2.39	2.42 ^a	2.55 ^a	2.36 ^b	2.35 ^{ab}	2.24 ^a	2.18 ^a
SE±	0.04	0.025	0.02	0.04	0.09	0.01	0.012	0.009	0.009	0.028
CD at 5%	0.12	0.077	0.06	0.12	0.28	0.030	0.037	0.029	0.027	0.07
GM	1.90	1.53	1.87	2.35	2.28	2.44	2.31	2.31	2.20	2.13

Note: Values with different superscripts in a column differ significantly ($P<0.05$). SE± = standard error of the mean; CD = critical difference; GM = general mean.

2.4 Mortality

Overall mortality was 4.0 per cent. Mortality was 5.0 per cent in T₁, 2.5 per cent each in T₂, T₃ and T₅, and 7.5 per cent in T₄. Because only one to three birds died in individual treatment groups, the observed differences should be interpreted cautiously. The overall level remained below the approximately 7 per cent mortality reported for Grampriya up to ten weeks under semi-intensive conditions (Singh, 2011) [16].

Conclusion

Among the forms tested, garlic powder at 3 per cent of the diet gave the best overall growth performance and feed utilisation in Grampriya birds. It produced the highest tenth-week live body weight (1434.39 g), the lowest cumulative feed intake (2962.35 g/bird) and the best overall FCR (2.07). Garlic supplementation did not appreciably depress voluntary feed intake, while water intake varied according to the form of garlic. The results indicate that garlic powder was the most promising form for improving biological performance under the conditions of the present experiment.

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