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Effect of different forms of garlic (*Allium sativum*) on carcass traits, sensory quality, serum lipid profile and economics of Grampriya breed of poultry

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Abstract

A ten-week feeding experiment was conducted to assess the effect of different forms of garlic (*Allium sativum*) on carcass traits, sensory quality, serum lipid profile and economics of Grampriya poultry production. Two hundred day-old straight-run chicks were randomly distributed into five treatments with four replications of 10 birds each. T₁ received the basal ration, T₂ received 3 per cent fresh garlic, T₃ received 3 per cent garlic powder, T₄ received 3 per cent black garlic powder and T₅ received 1 per cent each of fresh garlic, garlic powder and black garlic powder. At the end of the experiment, T₃ recorded the highest dressed weight (1011.24 g) and dressing percentage (70.50%). The sensory panel gave T₃ the highest scores for appearance and colour (8.25), flavour (8.13), juiciness (8.13), texture (8.13) and overall acceptability (8.13); only appearance and colour differed significantly among treatments. In contrast, T₂ produced the most favourable serum lipid profile, with the lowest total cholesterol (85.23 mg/dl), triglycerides (20.40 mg/dl), LDL-cholesterol (34.94 mg/dl), VLDL-cholesterol (4.08 mg/dl) and LDL: HDL ratio (0.76). The highest net profit was obtained in T₁ (Rs. 106.18/bird), followed by T₂ (Rs. 95.50) and T₃ (Rs. 84.33), whereas T₄ recorded only Rs. 11.84/bird. Thus, garlic powder was the most promising form for carcass and eating quality, fresh garlic was most favourable for serum lipid status, while the control was most profitable under the prevailing input prices.

Keywords: Garlic, Grampriya, carcass traits, sensory quality, serum lipid profile, economics

Introduction

Garlic is widely investigated as a phytochemical feed additive because of its sulphur-containing bioactive compounds and reported antimicrobial, antioxidant and hypolipidemic activities. Dietary garlic has been associated with changes in growth, carcass yield, meat quality and blood biochemical parameters, but the response may vary with processing and inclusion level. Fadalla *et al.* (2010) [2] reported improved carcass yield with garlic supplementation, while Karangiya *et al.* (2016) [4] and Singh *et al.* (2024) [15] reported beneficial effects of garlic-containing diets on carcass and cut-up parts.

Processing can alter the composition and sensory characteristics of garlic. Fresh garlic retains native alliin and alliinase, whereas drying and fermentation alter the profile of sulphur compounds. Earlier studies have also reported reductions in serum or muscle cholesterol following garlic supplementation (Bamidele and Adejumo, 2012; Majdi *et al.*, 2022; Sewatkar *et al.*, 2024) [1, 7, 14]. At the same time, economic response depends not only on biological performance but also on the cost of the additive and its inclusion level (Safa *et al.*, 2014; Makwana *et al.*, 2015) [6, 12]. Therefore, the present study compared fresh garlic, garlic powder, black garlic powder and their combination with respect to carcass, sensory, serum lipid and economic responses in Grampriya poultry.

Objectives

1. To study the carcass, sensory and chemical quality of meat.
2. To work out economics of production.

Materials and Methods

The present experiment was carried out at the Poultry Unit of the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, Maharashtra, with the objective of evaluating the performance of Grampriya poultry birds supplemented with different forms

of garlic (*Allium sativum*). A total of 200 commercial straight-run, day-old Grampriya chicks were obtained from Parvati Hatcheries, Georai, District Beed. On arrival, the chicks were individually weighed, wing-banded for identification, and randomly distributed into five dietary treatment groups on the basis of comparable initial body weight. Each treatment consisted of 40 birds, further divided into four replicates of 10 birds each, following a Completely Randomised Design (CRD).

The experimental treatments consisted of T₁: standard basal ration without garlic supplementation (control); T₂: basal ration supplemented with 3 per cent fresh garlic; T₃: basal ration supplemented with 3 per cent garlic powder; T₄: basal ration supplemented with 3 per cent black garlic powder; and T₅: basal ration supplemented with 1 per cent each of fresh garlic, garlic powder and black garlic powder. The birds were reared under deep-litter housing conditions in a well-ventilated poultry shed for a period of 10 weeks. Throughout the experimental period, all birds were maintained under uniform conditions with respect to brooding, lighting, vaccination and other management practices. Commercial pre-starter, starter and finisher rations were provided during the respective age periods of 2-10, 11-24 and 25-72 days. Feed and clean drinking water were supplied in measured quantities, and the remaining feed and water were recorded to calculate the actual intake of the birds.

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).

Additional observations and analytical procedures

At the end of the 10-week experiment, two birds from each treatment having live weight representative of the treatment mean were selected, starved for 12-14 hours and slaughtered for carcass evaluation. Live weight, weight after de-blooding, dressed weight, dressing percentage and yields of thigh, wing, drumstick, breast, giblet, neck, percentage were recorded. For sensory evaluation, cooked meat samples were assessed by a trained panel using a nine-point descriptive scale for appearance and colour, tenderness, flavour, juiciness, texture and overall acceptability.

Blood samples collected at slaughter were allowed to clot and centrifuged to obtain serum. Total cholesterol, triglycerides and HDL-cholesterol were estimated using the procedures described in the experimental methods; LDL-cholesterol was calculated by the Friedewald equation and VLDL-cholesterol as triglycerides divided by five. Economics of production included the cost of chicks, feed, garlic/additives, medicine, vaccination, litter and other stated inputs. Net profit per bird was calculated as selling price minus total cost of production.

Results and Discussion

1. Carcass traits

Carcass performance generally followed the pattern of live body weight. T₃ recorded the highest live body weight (1434.39 g), weight after de-blooding (1371.59 g), dressed weight (1011.24 g) and dressing percentage (70.50%). T₃ also recorded the highest numerical yields of drumstick (15.48%), breast (23.90%), giblet (6.80%) and neck (4.50%), while T₂ had the lowest dressing percentage (67.20%). The higher carcass yield associated with garlic powder agrees with Fadalla *et al.* (2010), Karangiya *et al.* (2016) and Singh *et al.* (2024) [2, 4, 15], who reported improved carcass or cut-up yields with phyto-genic supplementation. The results also indicate that combining the three forms at 1 per cent each did not provide an additive carcass benefit.

Table 1: Carcass traits of Grampriya birds under different treatments

Traits	T ₁	T ₂	T ₃	T ₄	T ₅	SE±	CD@5%
Live body weight (g)	1414.77	1378.91	1434.39	1386.57	1367.63	1.00	3.01
Weight after de-blooding (g)	1361.62	1321.93	1371.59	1341.41	1320.43	0.70	2.11
Dressed weight (g)	986.09	926.63	1011.24	951.19	945.99	1.12	3.38
Dressing (%)	69.70a	67.20b	70.50a	68.60ab	69.17ab	0.82	2.47
Thigh (%)	14.28	14.39	14.46	14.70	14.21	0.82	2.47
Wing (%)	8.70	8.53	8.99	9.12	8.28	0.70	2.11
Drumstick (%)	15.18	14.60	15.48	14.75	14.90	1.14	3.44
Breast (%)	23.50	23.27	23.90	23.38	23.70	1.15	3.47
Giblet (%)	6.19	6.25	6.80	5.85	5.91	0.70	2.11
Neck (%)	4.33	3.87	4.50	4.12	4.27	0.70	2.11

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

2. Sensory evaluation

The sensory panel consistently preferred meat from T₃. Garlic powder recorded the highest scores for appearance and colour (8.25), flavour (8.13), juiciness (8.13), texture (8.13) and overall acceptability (8.13). T₄ recorded the highest tenderness score (7.75), whereas T₂ had the lowest appearance and colour score (6.00). Statistical differences were significant only for appearance and colour; differences

in tenderness, flavour, juiciness, texture and overall acceptability did not exceed the respective critical differences. The better sensory performance of garlic powder is consistent with Kim *et al.* (2009) [5], while the relatively lower scores of fresh garlic may reflect the stronger characteristic odour and pungency of the unprocessed form.

Table 2: Sensory (organoleptic) evaluation scores of meat of Grampriya birds under different treatments

Treatment	Appearance & colour	Tenderness	Flavour	Juiciness	Texture	Overall acceptability
T ₁	7.13 ^{ab}	7.63	7.50	7.50	7.50	7.13
T ₂	6.00 ^b	6.13	6.88	6.75	6.75	7.00
T ₃	8.25 ^a	7.50	8.13	8.13	8.13	8.13
T ₄	7.25 ^{ab}	7.75	7.75	7.75	7.75	7.75
T ₅	6.50 ^{ab}	6.63	6.50	6.50	6.63	6.50
SE±	0.72	0.73	0.62	0.64	0.63	0.55
CD @ 5%	2.17	2.21	1.87	1.95	1.90	1.67

Note: 9 = very desirable and 1 = very undesirable. Values with different superscripts in a column differ significantly ($P < 0.05$)

3. Chemical analysis: serum lipid profile

The serum lipid response differed markedly from the growth and carcass response. T₂ (fresh garlic) recorded the lowest total cholesterol (85.23 mg/dl), triglycerides (20.40 mg/dl), LDL-cholesterol (34.94 mg/dl), VLDL-cholesterol (4.08 mg/dl) and LDL:HDL ratio (0.76). Compared with the control, fresh garlic reduced total cholesterol by about 17.8 per cent and LDL-cholesterol by about 24.5 per cent. The

favourable lipid response is in agreement with Bamidele and Adejumo (2012), Majdi *et al.* (2022) and Sewatkar *et al.* (2024) ^[1, 7, 14], who reported reductions in cholesterol and related lipid fractions following garlic supplementation. In the present experiment, however, garlic powder and black garlic powder did not show the same hypolipidemic response, indicating that processing form can materially influence the biological effect of the additive.

Table 3: Serum lipid profile of Grampriya birds under different treatments

Treatment	Cholesterol (mg/dl)	Triglycerides (mg/dl)	HDL-Cholesterol (mg/dl)	LDL-Cholesterol (mg/dl)	VLDL-Cholesterol (mg/dl)	LDL/HDL
T ₁	103.70	25.82	52.26	46.27	5.16	0.88
T ₂	85.23	20.40	46.21	34.94	4.08	0.76
T ₃	116.32	41.24	51.20	56.87	8.25	1.14
T ₄	126.47	51.49	59.36	56.81	10.30	0.96
T ₅	108.51	48.63	54.21	44.57	9.73	0.82
SE±	0.28	0.13	0.16	0.11	0.019	0.01
CD @ 5%	0.86	0.39	0.48	0.34	0.057	0.03

4. Economics of production

Economic performance was governed largely by the cost of the garlic form used. The lowest total cost of production was recorded in T₁ (Rs. 162.63/bird), followed by T₂ (Rs. 166.49), T₃ (Rs. 188.20), T₅ (Rs. 201.95) and T₄ (Rs. 251.61). The highest net profit was obtained in the control (Rs. 106.18/bird), followed by fresh garlic (Rs. 95.50) and garlic powder (Rs. 84.33), while black garlic powder gave

only Rs. 11.84/bird. Fresh garlic cost Rs. 50/kg, garlic powder Rs. 300/kg and black garlic powder Rs. 1000/kg, making the processed forms substantially more expensive. The result contrasts with some earlier reports of improved profitability with garlic, but is consistent with the principle that inclusion level and relative additive cost determine economic return (Safa *et al.*, 2014; Makwana *et al.*, 2015; Karangiya *et al.*, 2016) ^[4, 6, 12].

Table 4: Economics of production (Rs./bird) of Grampriya birds under different treatments

Particulars	T ₁	T ₂	T ₃	T ₄	T ₅
Cost of day-old chick	30.00	30.00	30.00	30.00	30.00
Garlic/powder/black garlic powder consumed (g/bird)	0	89.29	89.14	89.51	89.19*
Cost of additive (Rs./kg)	0	50	300	1000	50+300+1000
Cost of additive consumed per bird (Rs.)	0	4.46	26.74	89.51	40.14
Average total feed consumed per bird (g)	2990.96	2976.46	2962.35	2977.93	2970.87
Cost of feed (Rs./kg)	41.00	41.00	41.00	41.00	41.00
Cost of feed consumed per bird (Rs.)	122.63	122.03	121.46	122.10	121.81
Total feed + additive cost per bird (Rs.)	122.63	126.49	148.20	211.61	161.95
Body weight at 10th week (g)	1414.77	1378.91	1434.39	1386.57	1367.63
Cost of medicine, vaccine, litter (Rs./bird)	10.00	10.00	10.00	10.00	10.00
Total cost of production per bird (Rs.)	162.63	166.49	188.20	251.61	201.95
Average price realized @ Rs.190/kg live weight (Rs.)	268.81	261.99	272.53	263.45	259.85
Net profit per bird (Rs.)	106.18	95.50	84.33	11.84	57.90

* In T₅, approximately 29.73 g each of fresh garlic, garlic powder and black garlic powder were consumed per bird

Conclusion

Garlic powder at 3 per cent was the most effective treatment for carcass yield and sensory quality, with the highest dressed weight, dressing percentage and favourable organoleptic scores. Fresh garlic at 3 per cent produced the most favourable serum lipid profile, particularly for total cholesterol, triglycerides, LDL-cholesterol, VLDL-

cholesterol and LDL:HDL ratio. However, under the prevailing input prices, the control ration returned the highest net profit, followed by fresh garlic and garlic powder. Black garlic powder and the three-way combination were economically inferior because their higher additive costs were not compensated by sufficient biological gains. Thus, the appropriate garlic form should be selected

according to the production objective: garlic powder for carcass and eating quality, fresh garlic for lipid-related objectives, and careful cost consideration for commercial adoption.

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