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Effect of incorporation of mulberry leaf powder in basal diet on growth performance of Kaveri poultry

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Abstract

Two hundred day-old Kaveri chicks were randomly distributed into five groups of forty birds each, comprising a control (T₁, basal diet without mulberry leaf powder) and four treatment groups fed a basal diet supplemented with mulberry leaf powder (MLP) at graded levels of 2, 3, 4, and 5 per cent (T₂, T₃, T₄, and T₅, respectively), starting from the second week of age. Each group was further subdivided into four replicates of ten birds. Weekly body weight, cumulative weight gain, feed and water intake, feed conversion ratio, carcass traits, sensory attributes, and meat chemical composition were monitored through the twelfth week of the trial.

At twelve weeks, live body weight was significantly lower ($P < 0.05$) in the control group T₁ (1655.30 g/bird) compared to all MLP-supplemented groups. Among treatments, body weight increased progressively with MLP inclusion level, with T₅ achieving the highest final weight (2080.00 g/bird), followed by T₄ (1976.00 g/bird), T₃ (1930.41 g/bird), and T₂ (1866.23 g/bird), with significant differences observed among all groups. Cumulative feed intake followed a comparable pattern, being lowest in the control T₁ (4065.23 g/bird) and highest in T₅ (4805.12 g/bird), followed by T₃ (4667.57 g/bird), T₂ (4462.62 g/bird), and T₄ (4281.30 g/bird). These findings indicate that dietary MLP supplementation enhanced both growth performance and feed consumption in Kaveri poultry in a dose-dependent manner.

Keywords: Mulberry leaf powder, kaveri poultry, body weight gain, feed intake, growth performance, dietary supplementation, dose-dependent response

1. Introduction

Poultry farming is one of the fastest-growing sectors of Indian agriculture, with the national poultry population reaching 851.81 million in 2019, an increase of 16.8% over 2012 (20th Livestock Census). The Indian poultry market, valued at USD 30.46 billion in 2024, is projected to grow at a CAGR of 8.10% to reach USD 66.37 billion by 2034 (Anonymous, 2025) [1]. Feed remains the largest constraint on profitability in poultry production, accounting for 60-75% of total costs, with protein sources contributing over 40% of feed expenses (Islam *et al.*, 2014) [4]. Conventional protein ingredients such as soybean meal and fish meal are costly and price-volatile, driving interest in cheaper, locally available alternatives (Ferket and Abel, 2006) [4]. Mulberry (*Morus alba*) leaves are increasingly recognized as a promising unconventional feed resource due to their high crude protein content, balanced amino acid profile, and rich supply of bioactive compounds such as flavonoids and polyphenols with antioxidant and hypolipidemic properties (Islam *et al.*, 2014) [5]. However, their use has traditionally been limited to ruminant feeding because mature leaves contain anti-nutritional factors such as tannin, which can reduce production performance in monogastric animals (Bing *et al.*, 2024) [3]. Processing methods such as fermentation have been shown to overcome this limitation: Ding *et al.* (2021) reported that supplementing broiler diets with fermented mulberry leaf powder improved nutrient digestibility, average daily gain, feed conversion ratio, and meat quality traits including amino acid and beneficial fatty acid content, without adverse effects on growth performance. This suggests that even unfermented mulberry leaf powder, when included at appropriately graded levels, may offer similar nutritional benefits. The Kaveri breed, a backyard poultry strain noted for low mortality, early maturity, and strong field adaptability, has demonstrated superior growth compared to local strains under farmer-managed conditions (Banja *et al.*, 2017) [2], making it a suitable candidate for nutritional evaluation.

However, no study has yet examined the effect of mulberry leaf powder supplementation specifically in Kaveri birds. The present study was therefore undertaken to evaluate the effect of graded levels of mulberry leaf powder on growth performance, feed conversion ratio, and carcass and meat quality in Kaveri poultry.

2. Materials and Methods

2.1 Experimental Site

The study was conducted in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Badnapur, Vasantao Naik Marathwada Krishi Vidyapeeth (VNMKV), Parbhani, Maharashtra, India.

2.2 Experimental Birds and Design

Two hundred day-old Kaveri chicks, pre-vaccinated against Marek's disease, were procured from the Krishi Vigyan Kendra (KVK), Kharpudi, District Jalna, following standard procurement procedures. Chicks were individually weighed (35-50 g body weight), wing-banded for identification, and randomly allotted to five dietary treatment groups in a Completely Randomized Design (CRD). Each treatment consisted of 40 birds, further divided into 4 replicates of 10 birds each. The dietary treatments were as follows: T₁ (control, basal diet without any additive), T₂ (basal diet + 2% mulberry leaf powder), T₃ (basal diet + 3% mulberry leaf powder), T₄ (basal diet + 4% mulberry leaf powder), and T₅ (basal diet + 5% mulberry leaf powder).

2.3 Preparation of Mulberry Leaf Powder

Fresh mulberry (*Morus alba*) leaves were collected from the mulberry plot maintained at the Department of Entomology, College of Agriculture, Badnapur. The leaves were shade-dried for three days, after which they were ground into a fine powder and incorporated into the respective experimental diets at graded levels.

2.4 Housing and Management

Brooders, waterers, and feeders were thoroughly cleaned, washed, and disinfected prior to chick placement. Birds were reared under a deep litter system, with brooding temperature maintained between 26.6 and 35 °C (85-95 °F) for the first two weeks. During brooding, chicks were fed maize crumbles for the initial three days, followed by commercial pre-starter (0-7 d), starter (8-21 d), and finisher (22-90 d) diets. The experimental mulberry leaf powder-supplemented diets were introduced from the second week and continued until the end of the twelfth week. Birds in each treatment group were fed separately, offered feed twice daily, and provided clean drinking water *ad libitum*. Leftover feed was collected and weighed each morning to determine intake. Standard health care and a routine vaccination schedule were followed throughout the trial.

2.5 Growth Performance

Body weight and weight gain: Ten randomly selected birds per treatment were weighed weekly during morning hours, and weekly weight gain was calculated as:

Weekly weight gain (g) = Final weight – Initial weight

Feed intake: Daily feed consumption was recorded as the difference between feed offered and feed remaining after 24 h, summed weekly. Feed intake per bird was calculated as:

Feed intake/bird/week (g) = Total feed consumed per week ÷ Total number of birds

Feed conversion ratio (FCR)

FCR was calculated as:

FCR = Feed consumption (g) ÷ Body weight gain (g)

3. Results and Discussion

3.1 Body Weight Gain

The average initial live body weight of day-old Kaveri chicks was comparable across all treatment groups (T₁: 32.06 g; T₂: 32.15 g; T₃: 31.14 g; T₄: 32.10 g; T₅: 32.08 g/bird), confirming uniform distribution of experimental birds at the start of the trial (P>0.05). From the first week onward, significant differences (P<0.05) emerged among treatments and persisted throughout the 12-week experimental period.

At the end of the twelfth week, live body weight was significantly lowest in the control group T₁ (1655.30 g/bird) and increased progressively with the level of mulberry leaf powder (MLP) inclusion, reaching 1866.23 g/bird in T₂, 1930.41 g/bird in T₃, 1976.00 g/bird in T₄, and a maximum of 2080.00 g/bird in T₅ (Table 1). Weekly cumulative gain also showed treatment-dependent variation, with SE(m) values ranging from 1.59 to 4.96 g/bird and critical differences of 4.84-14.98 g/bird across weeks, though the week of peak gain differed among treatments (e.g., T₄ peaked at week 4 with 291.30 g/bird, while T₃ and T₂ peaked later at week 9).

The dose-dependent improvement in body weight with MLP supplementation may be attributed to the rich nutrient profile of mulberry leaves, including high-quality protein, essential amino acids, vitamins, and bioactive compounds that enhance nutrient digestibility and feed utilization. These findings agree with Islam *et al.* (2014) [5], who reported improved body weight in broilers fed mulberry leaf meal, and with Bing *et al.* (2024) [3], who concluded that mulberry leaf inclusion enhances growth performance as an effective alternative protein source in poultry diets. The week-to-week fluctuation in gain observed here, rather than a strictly linear trend, is consistent with Paudel *et al.* (2015) [8], who reported similarly variable weekly gains in broilers fed azolla meal, suggesting that such fluctuation is a normal feature of leaf-meal supplementation trials rather than an inconsistency specific to MLP.

3.2 Feed Intake

Weekly feed consumption increased progressively with age across all treatment groups, and MLP-supplemented birds consistently consumed more feed than the control. During the first week, intake ranged from 84.88 g/bird (T₁) to 89.14 g/bird (T₅), and this pattern of higher intake with increasing MLP level was sustained throughout the trial, peaking during weeks 9-10 (e.g., 485.00-590.00 g/bird/week across T₁-T₅ at week 10).

Cumulative feed consumption at the twelfth week was lowest in the control T₁ (4065.23 g/bird) and highest in T₅ (4805.12 g/bird), followed by T₃ (4667.57 g/bird), T₂ (4462.62 g/bird), and T₄ (4281.30 g/bird) (Table 2). Statistical analysis confirmed significant differences (P<0.05) among treatments during most weeks of the trial.

The higher feed intake in MLP-supplemented groups may be linked to improved palatability, greater nutrient availability, and the presence of bioactive compounds that

enhance feed utilization and support growth. This is consistent with Islam *et al.* (2014) ^[5], who reported significantly higher feed intake in broilers fed 2.5% mulberry leaf meal (2700 g) compared to controls (2350 g), and with Safa and Tazi (2014) ^[9], who observed increased feed consumption in broilers fed *Moringa oleifera* leaf meal. Simol *et al.* (2012) ^[10] similarly found no adverse effect on feed intake with mulberry leaf powder up to 30% inclusion, with reductions only at 40-50%; since the present study used

a narrower range (up to 5%), the absence of any depressive effect on intake aligns with their observations. In contrast, Panja (2013) ^[7] and Margareta *et al.* (2015) ^[6] reported no significant effect of mulberry leaf meal on feed intake at lower inclusion levels, suggesting that the intake response to MLP may vary with bird strain and rearing conditions — a divergence from the present study possibly explained by differences in genotype (Kaveri vs. commercial broiler strains) and inclusion range.

Table 1: Effect of dietary supplementation of mulberry leaf powder (MLP) on weekly live body weight (g/bird) of Kaveri poultry

Treatment	Initial	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
T ₁ (Control)	32.06	91.32 ^c	161.54 ^d	270.36 ^c	402.14 ^e	564.81 ^e	678.30 ^d	811.91 ^e	960.30 ^d	1148.30 ^c	1318.30 ^e	1483.30 ^d	1655.30 ^d
T ₂ (2% MLP)	32.15	95.42 ^b	177.24 ^c	295.62 ^b	482.19 ^d	588.25 ^d	781.14 ^c	921.23 ^d	1111.23 ^c	1309.23 ^b	1490.30 ^d	1676.23 ^c	1866.23 ^c
T ₃ (3% MLP)	31.14	98.29 ^{ab}	172.44 ^c	298.36 ^b	505.76 ^c	630.23 ^c	802.75 ^c	1009.80 ^c	1173.41 ^{bc}	1383.41 ^b	1578.41 ^c	1776.41 ^b	1930.41 ^{bc}
T ₄ (4% MLP)	32.10	97.45 ^{ab}	185.55 ^b	298.45 ^b	589.75 ^b	703.25 ^b	873.78 ^b	1116.36 ^b	1284.93 ^{ab}	1494.93 ^a	1679.93 ^b	1849.93 ^b	1976.00 ^b
T ₅ (5% MLP)	32.08	99.43 ^a	194.43 ^a	359.75 ^a	620.28 ^a	737.20 ^a	982.82 ^a	1191.54 ^a	1320.78 ^a	1560.78 ^a	1765.78 ^a	1945.78 ^a	2080.00 ^a
SE(m)±	0.59	0.94	1.78	2.94	6.20	4.08	9.24	19.06	36.92	32.91	26.97	25.70	27.92
CD at 5%	N.S.	2.88	5.41	8.95	18.86	12.41	28.12	57.99	112.31	100.11	82.04	78.19	84.95

Means bearing different superscripts (a-e) within a column differ significantly ($p < 0.05$). N.S. = Non-significant.

Table 2: Effect of dietary supplementation of mulberry leaf powder (MLP) on cumulative feed consumption (g/bird) of Kaveri poultry

Treatment	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
T ₁ (Control)	84.88	255.30 ^c	485.16 ^c	744.90 ^c	1029.85 ^c	1339.23 ^d	1700.07 ^d	2105.23 ^c	2560.23 ^c	3045.23 ^c	3545.23 ^c	4065.23 ^d
T ₂ (2% MLP)	86.24 ^{bc}	258.92 ^{bc}	492.27 ^{bc}	757.75 ^c	1078.93 ^{bc}	1447.49 ^c	1847.76 ^c	2292.62 ^{bc}	2812.62 ^{bc}	3347.62 ^{bc}	3897.62 ^b	4462.62 ^{bc}
T ₃ (3% MLP)	87.18 ^{abc}	262.44 ^{abc}	511.18 ^{abc}	784.70 ^{bc}	1115.56 ^b	1506.31 ^{bc}	1951.73 ^{bc}	2412.57 ^b	2947.57 ^b	3502.57 ^b	4077.57 ^b	4667.57 ^{ab}
T ₄ (4% MLP)	88.06 ^{ab}	266.00 ^{ab}	520.88 ^{ab}	801.14 ^b	1141.56 ^b	1552.24 ^b	2010.58 ^b	2506.30 ^{ab}	3051.30 ^{ab}	3581.30 ^b	4056.30 ^b	4281.30 ^{cd}
T ₅ (5% MLP)	89.14 ^a	269.50 ^a	530.32 ^a	848.90 ^a	1259.66 ^a	1682.60 ^a	2165.28 ^a	2705.12 ^a	3315.12 ^a	3905.12 ^a	4420.12 ^a	4805.12 ^a
SE(m)±	0.79	3.19	10.20	13.54	28.13	31.88	40.82	75.28	91.28	100.00	85.64	100.00
CD at 5%	2.40	9.71	31.04	41.18	85.57	96.98	124.18	228.98	277.67	304.18	260.52	304.18

Means bearing different superscripts (a-d) within a column differ significantly ($p < 0.05$).

Conclusion

The present study demonstrated that dietary supplementation of mulberry leaf powder (MLP) significantly improved growth performance in Kaveri poultry in a dose-dependent manner. Birds fed graded levels of MLP recorded progressively higher live body weight and feed intake compared to the control, with the 5% MLP group (T₅) achieving the best overall performance the highest final body weight (2080.00 g/bird) and cumulative feed consumption (4805.12 g/bird) among all treatments. These improvements are attributable to the rich protein, amino acid, vitamin, and bioactive compound content of mulberry leaves, which likely enhanced nutrient digestibility, feed utilization, and overall metabolic efficiency in the birds.

The findings confirm that mulberry leaf powder can be effectively incorporated into the basal diet of Kaveri poultry, up to 5%, without any adverse effect on feed intake or growth performance. Given its low cost, local availability, and favourable impact on productive performance, MLP represents a viable, economical, and nutritionally beneficial alternative feed ingredient for Kaveri poultry production, particularly in regions where mulberry is already cultivated for sericulture. Further research incorporating higher inclusion levels, longer feeding durations, and detailed carcass and meat-quality assessments would help establish the optimal MLP inclusion rate for maximizing both growth performance and economic returns in Kaveri poultry farming systems.

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Conflict of interest

The authors declare that they have no conflict of interest.

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