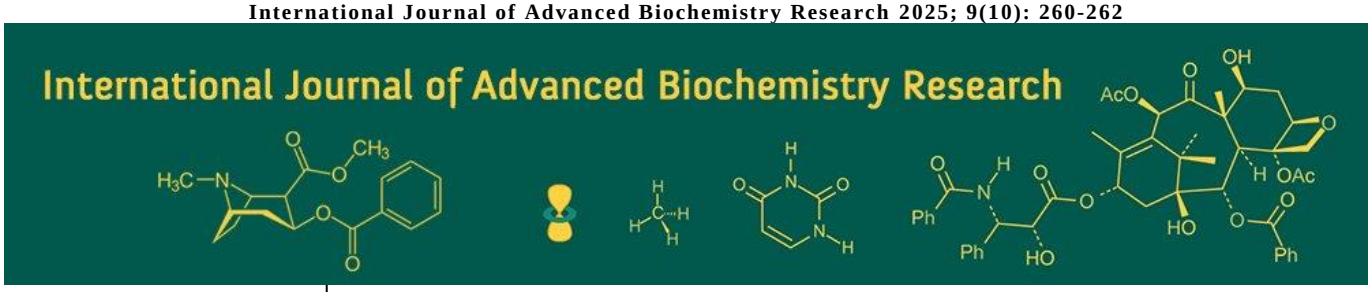

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Effect of supplementation of betaine hydrochloride on growth performance in broilers

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Abstract
An experiment was conducted on 120 day-old Cobb broiler chicks to study the effect of betaine hydrochloride on growth performance. The chicks were randomly divided into four dietary treatments (T_1 to T_4) each comprising three replicates of ten birds for 42 days. T_1 was fed with control diet based on BIS (2007) [2] standards, while treatments T_2, T_3, and T_4 were supplemented with 0.1, 0.2 and 0.25% betaine hydrochloride, respectively. The studies revealed that supplementation of betaine hydrochloride exhibited significantly higher body weights and improved feed conversion ratio compared to the control group. However, no significant differences were observed in feed intake and survivability across all groups at the end of the experiment. It was concluded that supplementing betaine hydrochloride improved growth performance in broilers.

Keywords: Betaine hydrochloride, body weight, feed intake, feed conversion ratio, survivability

Introduction
India's poultry industry is one of the fastest-growing segments of its agricultural sector, with meat production rising from 6.69 million tonnes in 2014-15 to 10.25 million tonnes in 2023-24, reflecting a CAGR of 4.85%. Per capita meat availability reached 7.39 kg in 2023-Livestock production remains vital for rural livelihoods, offering employment and income to farmers and marginalized communities. Animal-derived foods are rich in essential nutrients. Proteins from animal sources show high digestibility (90-97%) compared to plant-based proteins (75-99%). Poultry meat, primarily composed of water and fat, is a valuable source of protein, iron, selenium, zinc and B-complex vitamins (Chand *et al.*, 2017) [3].

India's poultry sector, driven largely by commercial operations is experiencing rapid growth due to rising demand for affordable protein. Feed supplements are widely used to enhance production efficiency with betaine emerging as a key additive. Betaine, a trimethyl derivative of glycine found in plants and animal tissues, contains both carboxylate and quaternary ammonium groups (Shakeri *et al.*, 2020) [10]. It functions as a methyl donor in homocysteine-to-methionine conversion and as a non-ionic osmolyte that regulates cellular hydration (Day, 2016) [4]. Extracted from sugar beet molasses, betaine has shown benefits in broilers including improved coccidiosis treatment, growth performance, carcass quality, heat stress mitigation and enhanced immunity (Ghasemi and Nari, 2020) [7].

Betaine at the metabolic level donates methyl groups for transmethylation reactions involved in synthesizing compounds like creatine and carnitine, potentially reducing the need for methionine and choline (Eklund *et al.*, 2005) [5]. It improves feed efficiency and weight gain, and under heat stress, conserves energy by reducing Na^+/K^+ pump activity, redirecting it toward growth (Hassan *et al.*, 2005) [8]. Supplementation via feed or water supports hydration and energy balance (Eklund *et al.*, 2005) [5]. Its osmoprotective effects may enhance intestinal development and nutrient absorption (Afrin *et al.*, 2018) [1].

Materials and Methods
The research outlined in this study was conducted at the Department of Poultry Science, Veterinary College Hebbal, Bengaluru. A total of 120 day-old commercial broiler chicks were procured from Venkateshwara Hatcheries Pvt. Ltd. for this study and betaine hydrochloride was obtained from Higain Feeds & Farms Pvt. Ltd., Mandya.

Upon arrival, the chicks were weighed individually and randomly assigned to four experimental groups. Each group consisted of three replicates, with 10 chicks per replicate. In accordance with the Bureau of Indian Standards (BIS) 2007 [2] guidelines, the control group (T_1) received a basal diet, while groups T_2, T_3, and T_4 were supplemented with 0.1, 0.2, and 0.25% betaine hydrochloride in the basal diet, respectively.

Throughout the six-week duration of the experiment, the chicks were reared using the deep litter system and had access to feed and water *ad libitu*m. Standard management practices were adhered to diligently to ensure the welfare and health of the experimental subjects.

Vaccines for Marek's disease (HVT strain), Newcastle disease (Live BI strain) and Infectious bursal disease (intermediate strain) were sourced from Ventri Biologicals, Bengaluru. The study protocol was approved by the Institutional Animal Ethics Committee of KVAFSU, Bidar, Karnataka.

Data were recorded on weekly body weight, feed intake, feed conversion ratio (FCR) and survivability throughout the experimental period and it was statistically analysed.

Results

The results of the present study revealed no significant difference ($p \leq 0.05$) in the body weight of the birds fed with betaine hydrochloride in basal diet compared to the control group from first week to the third week of the experiment. However, showed a significant improvement ($p \leq 0.05$) in body weight compared to the control group from the fourth week to the sixth week of the experimental period. The results of the effect of betaine hydrochloride supplementation on weekly cumulative body weight (g/bird/week) are presented in Table 1.

There was no significant difference ($p > 0.05$) in the feed consumption of the birds fed with betaine hydrochloride compared to the control group from first week till sixth week of the experiment. The results of the effect of betaine hydrochloride supplementation on weekly cumulative feed intake (g/bird/week) are presented in Table 2.

There was no significant difference ($p \leq 0.05$) in the feed conversion ratio of the birds fed with 0.1, 0.2 and 0.25% betaine hydrochloride in basal diet compared to control group from the first week to the third week of the experiment. However, showed a significant improvement ($p \leq 0.05$) in feed conversion ratio compared to the control group from the fourth week to the sixth week of the experiment period. The results of the effect of betaine hydrochloride supplementation on weekly cumulative feed conversion ratio are presented in Table 3.

The results of the present study revealed survivability at the end of the experiment were 96.67, 96.67, 100 and 96.67 in T_1, T_2, T_3 and T_4 groups, respectively. Statistical analysis revealed no significant difference ($p \leq 0.05$) in survivability among different treatment groups.

Discussion

The results of the present study revealed birds receiving 0.1, 0.2 and 0.25% betaine hydrochloride exhibited significantly higher body weights and improved feed conversion ratio compared to the control group. However, no significant differences were observed in feed intake and survivability across all groups.

The results of the present study were in agreement with El-Shinnawy (2015) [6], who reported that supplementation of betaine (1.0 g per kg) significantly ($p < 0.05$) improved body weight gain than other groups. Researcher noted the positive impact may be due to the reduced fat deposition, redirecting energy towards lean muscle growth and body weight.

The present study was also in agreement with Jahanian and Rahmani (2008) [9], who examined the impact of dietary betaine supplementation (Betafine) as a substitute for choline on feed consumption in broiler chickens. They noted that there was no significant effect on feed intake ($p > 0.05$) of broilers compared to the control group.

The current findings were also in consistent with those of Shubhnish *et al.* (2025) [11], who concluded that feed conversion ratio was significantly ($p < 0.05$) improved by betaine supplementation (2.0 g per kg) compared to control group. Researchers reported the positive impact may be due to betaine's ability in improving gut morphology and function, enhancing antioxidant status, reducing metabolic demands and modulating the immune system, allowing for better nutrient partitioning and feed efficiency.

The current findings were also in consistent with Waldroup *et al.* (2005) [12], who conducted a study on the effect of supplementation of betaine on the survivability of broiler chickens. The researchers found no significant difference ($p > 0.05$) in survivability among broilers compared to control group.

Table 1: Effect of supplementation of betaine hydrochloride on weekly cumulative body weight (g/bird) (Mean±SE) in broilers.

Experimental group	Week					
	I	II	III	IV	V	VI
T_1	186.27±0.788	481.59±2.33	885.17±7.32	1379.93±7.16a	1966.41±9.79a	2462.90±9.78a
T_2	190.47±1.93	491.80±4.30	896.23±7.17	1419.79±7.82b	2021.79±4.31b	2568.59±13.84b
T_3	190.97±1.68	488.47±3.99	903.73±9.10	1427.73±7.76b	2024.57±5.98b	2574.30±11.17b
T_4	188.17±1.64	487.72±3.85	886.83±7.47	1418.79±6.58b	2020.31±7.48b	2565.24±9.59b

a,b Means in the same column with different superscript differ significantly ($p \leq 0.05$)

Table 2: Effect of supplementation of betaine hydrochloride on weekly cumulative feed consumption (g/bird) (Mean±SE) in broilers.

Experimental group	Week					
	I	II	III	IV	V	VI
T_1	155.54±0.835	556.01±4.97	1148.37±2.59	1947.36±3.05	2978.44±32.68	4078.58±11.58
T_2	156.01±0.589	585.82±3.74	1144.74±13.47	1953.88±16.95	2982.65±5.59	4096.11±11.77
T_3	157.89±0.618	581.37±4.15	1172.12±8.68	1965.94±9.66	2966.41±4.66	4081.21±16.91
T_4	157.50±1.40	586.09±6.01	1161.47±3.41	1954.85±6.48	2969.29±6.40	4084.43±23.33

Table 3: Effect of supplementation of betaine hydrochloride on weekly cumulative Feed Conversion Ratio (Mean±SE) in broilers.

Experimental group	Week					
	I	II	III	IV	V	VI
T_1	1.112±0.003	1.321±0.004	1.380±0.004	1.461±0.009b	1.552±0.005b	1.688±0.005b
T_2	1.100±0.005	1.327±0.004	1.363±0.004	1.424±0.006a	1.508±0.003a	1.625±0.010a
T_3	1.095±0.008	1.316±0.001	1.368±0.004	1.424±0.009a	1.502±0.001a	1.615±0.004a
T_4	1.096±0.005	1.316±0.006	1.367±0.004	1.423±0.005a	1.505±0.003a	1.617±0.005a

a,b Means in the same column with different superscript differ significantly ($p \leq 0.05$)

Conclusion

The present study revealed that addition of 0.1, 0.2 and 0.25% betaine hydrochloride in basal diet was beneficial in improving the growth performance in broilers. However, since there was no significant difference among 0.1, 0.2 and 0.25% betaine hydrochloride on growth performance, it was concluded that addition of 0.1% betaine hydrochloride is beneficial in improving growth performance in broilers.

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