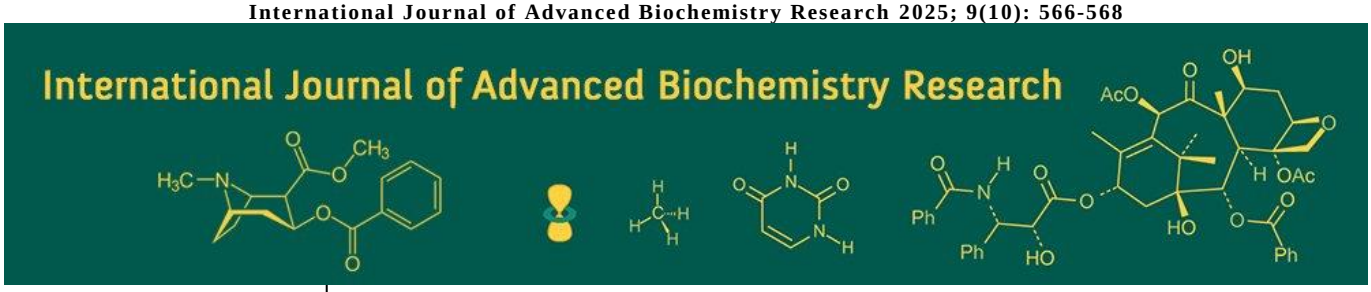

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Effect of supplementation of organic acids on growth performance in broilers

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Abstract
A 42-day feeding experiment was carried out to assess the influence of dietary organic acid supplementation on the growth performance of broiler chickens. A total of 120 day-old Cobb broiler chicks were randomly assigned to four dietary treatments, each with three replicates containing ten birds. The control group (T_1) was provided a basal diet formulated as per BIS (2007) guidelines, while T_2, T_3, and T_4 diets were supplemented with organic acids at 0.05%, 0.075%, and 0.1%, respectively. Uniform management and vaccination schedules were maintained throughout the trial. Supplementation of organic acids significantly ($p \leq 0.05$) enhanced body weight gain, feed intake, and feed conversion ratio compared to the control. It was concluded that dietary inclusion of organic acids improves broiler growth performance without influencing survivability.

Keywords: Organic acid diet, broiler performance, body weight, feed intake, feed conversion ratio, livability

Introduction
The poultry industry stands as one of the fastest-growing sectors within global livestock production, providing an affordable and high-quality source of animal protein through meat and eggs. However, intensive rearing practices expose birds to stress and enteric pathogens, which can adversely affect gut health and productivity. Traditionally, antibiotic growth promoters (AGPs) were employed to overcome these challenges, but their extensive use has raised serious concerns regarding antimicrobial resistance and residue accumulation, leading to global restrictions (Dibner & Buttin, 2002) [3].

Organic acids and their salts have emerged as effective alternatives to AGPs. They are known to improve intestinal integrity, enhance digestion, and inhibit the proliferation of pathogenic bacteria by reducing gut pH and altering microbial enzyme activity. A low intestinal pH below 5 creates unfavorable conditions for pathogens such as *E. coli*, *Salmonella*, and *Campylobacter*, while supporting beneficial microbes and promoting digestive enzyme activity.

These acids reduce buffering capacity in feed and water, disrupt bacterial enzymes such as decarboxylases and catalases, and inhibit nutrient transport systems within pathogenic organisms. Research has demonstrated that dietary organic acids improve intestinal morphology (Yang *et al.*, 2018) [10], regulate microbial populations (Ma *et al.*, 2021) [7], and enhance feed efficiency. Moreover, they have been reported to improve nutrient digestibility, mineral utilization, and recovery from metabolic stress (Fattah *et al.*, 2008) [5].

Materials and Methods
A total of 120 day-old Cobb broiler chicks were procured from Venkateshwara Hatcheries Pvt. Ltd., Bengaluru. The organic acid preparation (Acidac Gold) was obtained from Bionnar Health Care Pvt. Ltd., Kannur, Andhra Pradesh. Upon arrival, chicks were weighed individually and randomly distributed into four dietary treatments under a completely randomized design. Each treatment consisted of three replicates with ten birds per replicate.

The control group (T_1) received a basal diet formulated according to BIS (2007) [2] standards, while T_2, T_3, and T_4 were supplemented with 0.05%, 0.075%, and 0.1% organic acids, respectively. The birds were housed under a deep-litter system for 42 days with ad libitum access to feed and water.

Uniform management, lighting, and vaccination schedules were maintained throughout.

All experimental procedures were approved by the Institutional Animal Ethics Committee of KVAFSU, Bidar, Karnataka. Weekly data on body weight, feed consumption, feed conversion ratio (FCR), and survivability were recorded and analyzed statistically using appropriate methods.

Results

1. Body Weight

Cumulative body weight data are summarized in Table 1. Statistical analysis showed significant differences ($p \leq 0.05$) among treatment groups. Broilers fed diets supplemented with organic acids (T_2, T_3, and T_4) attained higher body weights than those in the control (T_1). However, differences among the supplemented groups were not significant. These results indicate that organic acid inclusion at 0.05-0.1% enhances growth performance in broilers.

2. Feed Intake

Cumulative feed intake results (Table 2) revealed significant ($p \leq 0.05$) variation among treatments. Birds in T_2, T_3, and T_4 consumed more feed than those in T_1, with no notable differences among the supplemented groups. This suggests that inclusion of organic acids in diets improved overall feed consumption and palatability.

3. Feed Conversion Ratio (FCR)

Feed conversion ratio results (Table 3) indicated significant improvement ($p \leq 0.05$) in groups receiving organic acids. Birds in T_2, T_3, and T_4 exhibited better FCR compared to the control, with no statistical differences among the supplemented groups. This improvement demonstrates that organic acids enhance nutrient utilization and feed efficiency.

4. Survivability

At the end of the trial, survivability percentages for T_1, T_2, T_3, and T_4 were 96.67, 96.67, 100, and 96.67%, respectively. Statistical analysis showed no significant ($P > 0.05$) variation among treatments, indicating that organic acid supplementation had no adverse effect on livability.

Discussion

The improved body weight observed in broilers fed organic acid-supplemented diets agrees with the findings of Fik *et al.* (2021) [6], who reported higher growth performance in birds receiving citric acid at 0.50%, 1%, and 1.50% through drinking water. The enhancement could be due to the positive influence of organic acids on gut microbial balance, leading to better nutrient assimilation and digestive efficiency.

However, these results differ from those of Marin *et al.* (2014) [8], who evaluated a blend of organic acids (ascorbic, citric, malic, sorbic, and tartaric acids) and found no significant improvement in body weight.

Feed intake was also significantly influenced by dietary organic acids, consistent with Skinner *et al.* (1991) [9], who observed increased feed intake in broilers supplemented with fumaric acid at 0.125% and 0.50%. The enhancement in feed intake may be attributed to improved gut health and reduced microbial load. Conversely, Doke *et al.* (2016) [4] reported reduced feed intake in Raja II broilers fed citric and fumaric acids at 1-2%, indicating that high levels may negatively influence palatability.

Feed conversion efficiency improved significantly ($p \leq 0.05$) in the present study. This agrees with Fik *et al.* (2021) [6], who found better FCR in broilers supplemented with citric acid. Enhanced FCR is often linked to improved digestion and reduced pathogenic activity within the gut. However, Doke *et al.* (2016) [4] reported no improvement in FCR at higher inclusion levels, suggesting that the optimal level may vary by strain or dietary composition.

Survivability was unaffected by dietary treatments, indicating that organic acids are safe for inclusion in broiler diets at the tested levels. This is consistent with the results of Doke *et al.* (2016) [4], who found no adverse effects on livability in broilers receiving organic acid supplementation.

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

Experimental group	Weeks					
	I	II	III	IV	V	VI
T_1	149.61±2.310^a	578.39±2.500^a	1127.48±5.05^a	1961.69±8.92^a	2979.19±3.13^a	4101.56±10.48^a
T_2	156.83±0.840^b	584.17±1.820^b	1145.49±4.03^b	1972.15±6.93^b	2990.52±1.82^b	4144.31±8.25^b
T_3	159.12±1.230^b	591.26±0.730^b	1149.09±1.45^b	2000.20±6.81^b	2996.79±1.83^b	4163.33±11.94^b
T_4	160.27±1.030^b	589.54±0.570^b	1143.93±1.29^b	1977.64±5.87^b	2989.43±1.96^b	4115.69±11.93^b

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

Experimental group	Weeks					
	I	II	III	IV	V	VI
T_1	179.33±1.14^a	467.30±3.24^a	876.48±5.79^a	1378.76±7.03^a	1965.38±9.69^a	2459.52±9.65^a
T_2	189.10±1.53^b	486.55±3.98^b	903.07±7.35^b	1417.36±6.76^b	2021.68±8.07^b	2563.86±9.82^b
T_3	190.87±1.42^b	488.07±4.06^b	910.80±7.86^b	1426.57±7.82^b	2020.33±5.86^b	2577.07±9.24^b
T_4	192.40±1.75^b	490.87±4.43^b	902.83±6.33^b	1418.17±7.75^b	2017.21±4.81^b	2569.17±13.92^b

Table 3: Effect of supplementation of organic acids on weekly cumulative Feed conversion ratio (Mean ± SE) in broilers.

Experimental group	Week					
	I	II	III	IV	V	VI
T_1	1.125±0.001^b	1.374±0.004^b	1.380±0.004^b	1.473±0.007^b	1.553±0.009^b	1.700±0.005^b
T_2	1.099±0.004^a	1.327±0.004^a	1.334±0.004^a	1.438±0.003^a	1.514±0.003^a	1.646±0.002^a
T_3	1.100±0.002^a	1.338±0.010^a	1.329±0.009^a	1.449±0.003^a	1.518±0.002^a	1.645±0.016^a
T_4	1.101±0.002^a	1.327±0.004^a	1.336±0.008^a	1.442±0.001^a	1.517±0.002^a	1.632±0.013^a

Conclusion

The findings of this study demonstrate that supplementing broiler diets with organic acids at 0.05%, 0.075%, and 0.1% significantly improves body weight gain, feed intake, and feed conversion ratio compared to an unsupplemented control. However, differences among the supplemented levels were not significant, and survivability remained unaffected. Therefore, inclusion of organic acids at 0.05% is recommended as the most efficient and economical level to enhance growth performance in broiler chickens.

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