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TK Choramale
Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharashtra, India

AR Bhoyar
Assistant Professor, Division of Animal Husbandry and Dairy science, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharashtra, India

Dr. MM Yadav
Assistant Professor. Veterinary Science, AHDS Section, RCSM College of Agriculture, Kolhapur, Maharashtra, India

GK Bhosale
Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati. Maharashtra, India

YB Sonawane
Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati. Maharashtra, India

Corresponding Author:
TK Choramale
Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharashtra, India

Effect of lysine and methionine supplementation on body weight gain in broilers

TK Choramale, AR Bhoyar, MM Yadav, GK Bhosale and YB Sonawane

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Abstract
The present study investigated the impact of lysine and methionine supplementation on growth performance and body weight gain in broiler chickens. A total of 160 Vencobb 300 day-old chicks were randomly allocated into four treatment groups: T_0 (control), T_1 (0.25%), T_2 (0.50%), and T_3 (0.75%) supplementation levels. Birds were reared under a floor pen system for six weeks and fed a basal diet with respective amino acid levels. Growth performance was assessed weekly. Results revealed a significant ($p \leq 0.01$) improvement in body weight and weight gain across supplemented groups compared to the control. At six weeks, T3 exhibited the highest final body weight (2535.82 g), followed by T_2 (2291.50 g), T_1 (1985.50 g), and T_0 (1862.12 g). The findings demonstrate that lysine and methionine supplementation enhances broiler growth performance, with 0.75% inclusion yielding superior results.

Keywords: Lysine, methionine, amino acid supplementation, body weight gain, growth efficiency.

1. Introduction
India's poultry sector is one of the fastest-growing areas in agriculture, outpacing crop production with an annual growth rate of 8-10% in eggs and broilers. India ranks fifth in global egg production and eighteenth in broiler output, driven by rising incomes, urbanization, and affordable poultry prices. The sector is also benefiting from vertically integrated operations that enhance efficiency and reduce consumer costs. Poultry production is one of the fastest-growing sectors in India's agricultural economy, significantly outpacing the growth of traditional crop production. This rapid expansion is driven by rising per capita income, increasing urbanization, and the affordability of poultry products. Among poultry species, broilers are especially important due to their ability to efficiently convert feed into high-quality meat. To meet the increasing demand for animal protein and improve the growth rate of broilers, optimizing the nutritional composition of feed is crucial. However, regional disparities remain states like Andhra Pradesh, Tamil Nadu, Telangana, and West Bengal dominate production, while eastern and central regions lag in both output and consumption. To meet nutritional recommendations, broiler meat production must rise significantly, which calls for better bird performance through high-quality, cost-effective diets. With growing demand and investment, India's poultry market is projected to grow from INR 1,750 billion in 2018 to INR 4,340 billion by 2024, at a CAGR of 16.2%. It is widely recognized that the interaction between crude protein and Lysine plays a crucial role in influencing the growth performance and carcass quality of poultry. Therefore, the dietary need for crude protein primarily reflects the requirement for the Lysine it provides (Rezae *et al.* 2004) [8].

2. Materials and Methodology
The experiment was conducted at the Poultry Farm, Dr. Sharadchandra Pawar College of Agriculture, Baramati. A total of 160 day-old Vencobb 300 broiler chicks were procured from a local hatchery, weighed individually upon arrival, and randomly distributed into four dietary treatment groups with 40 chicks per treatment. Each group was replicated four times. Birds were reared in a floor pen system for six weeks and fed a standard basal diet formulated using locally available ingredients, tailored to three growth phases: Pre-starter (0-10 days), starter

(11-21 days), and finisher (22-42 days). Feed and water were provided *ad libitum*. In total, the study involved four treatments, with 160 birds per group. The experiment was replicated four times and utilized a Completely Randomized Design (CRD). The treatment groups included a control group receiving only the basal diet, and three experimental groups supplementation percentages of lysine and methionine with basal diet at 0.25%, 0.50% and 0.75%, respectively.

3. Results and Discussion

3.1 Body weight

The mean initial body weight (g) of day-old broilers chicks were 41.75, 42.12, 42, 41.82 for treatment T_0, T_1, T_2 and T_3 respectively. The average cumulative body weights (g) at 1st week of age for T_0, T_1, T_2 and T_3 were 115.35, 124.25, 136.75, 155.32 respectively. The highest body weight (g) was observed in T_3 (155.32) followed by T_2, T_1 and T_0. The body weight of broilers in treatment T_3 was highly significantly (p<0.01) higher over other treatments and none of the treatments were at par with each other. The average cumulative body weights (g) of broilers at 2nd week of age for T_0, T_1, T_2 and T_3 were 256.87, 318.25, 324.25, 372.07 respectively. The highest body weight (g) was observed in T_3 (372.07) followed by T_2, T_1 and lowest in T_0. The broilers in treatment T_3 was had significantly (p<0.01) higher weight over other treatment. The body weights of broilers in various treatments differ significantly from each other.

The average cumulative body weights (g) of birds at 3rd week of age for T_0, T_1, T_2 and T_3 were 537.12, 613.75, 707.25, 800.82 respectively. The highest body weight (g) of broilers was observed in T_3 (800.82) followed by T_2, T_1 and lowest in T_0. The body weights broilers in treatment T_3 was significantly (p<0.01) higher over other treatments and none of the treatments were at par with each other. The average cumulative body weights (g) of broilers at 4th week of age for T_0, T_1, T_2 and T_3 were 899.00, 978.00, 1116.30, 1243.57 respectively. The highest body weight (g) was observed in T_3 (1243.57) followed by T_2, T_1 and lowest in T_0. The body weight in treatment T_3 was significantly (p<0.01) higher over other treatments. The body weights of broilers under different treatment differed from each other.

The average cumulative body weights (g) of broilers at 5th week of age for T_0, T_1, T_2 and T_3 were 1295.87, 1381.00, 1620.50, 1825.82 respectively. The highest body weight (g) was observed in T_3 (1825.82) followed by T_2, T_1 and lowest in T_0. The body weight in treatment T_3 was significantly (p<0.01) higher over other treatments and body weights of birds in on none of the par with each other. The average cumulative body weights (g) of broilers at 6th week of age for T_0, T_1, T_2 and T_3 were 1862.12, 1985.50, 2291.50, 2535.82 respectively. The body weights of broilers under various treatments differed significantly from each other highest in T_3 followed by T_2, T_1 and T0.

The analysis of growth performance in broiler chicken revealed that the highest body weight was achieved by the group fed a 0.75% lysine and methionine with 98.50% basal diet (T_3). Reaching a total weight of 2535.82 g. This group was closely followed by those receiving a 50% lysine and methionine (T_2), with a body weight of 2291.50 g, and the 0.25% lysine and methionine (T_1), which reached 1985.50 g. The control group (T_0) recorded the lowest weight at 1862.12 g. These results highlight the positive impact of supplementation of lysine and methionine in broiler diets, suggesting that higher supplementation level may enhance growth performance. However, it is crucial to recognize that the study focused only on 0.25%, 0.50%, and 0.75% supplementation levels, leaving the optimal level open for further research. (See Figure 1).

The observed growth pattern underscores the advantageous effect of adding Lysine and Methionine in the diet. Based on the data, an inclusion level of 0.75% Lysine and 0.75% Methionine appears to be the most effective among the tested levels. Kheiri *et al*. (2016) [5] found that effect of different levels of Lysine and threonine on growth performance of broilers chicks and concluded that by increasing Lysine level (120%), and different levels of threonine (interaction Lysine and Threonine) was related to the highest body weight gain. According to the result of this study, an improvement in, growth performance.

3.2 Body weight gain

By the end of the 1st week of the experimental period, the mean body weights gains of broilers were 73.60 g, 82.35 g, 94.75 g, and 113.50 g for T_0, T_1, T_2, and T_3, respectively. The highest weight gain was noted in T_3 (113.5 g), followed by T_2, T_1, and the lowest gain was in T_0. In the 2nd week of experimental period, the mean body weights (g) of broilers gains were 141.52 g, 194.00 g, 197.50 g, and 216.62 g for T_0, T_1, T_2, and T_3, respectively. The highest weight gain was noted in T_3 (216.61 g), followed by T_2, T_1, and lowest gain in T_0.

At the end of 3rd week experimental period, the mean body weight gains were 280.25 g, 295.50 g, 373.00 g, 428.75 g, for T_0, T_1, T_2, and T_3, respectively. The highest weight gain was noted in T_3 (428.75 g), followed by T_2, T_1 and the lowest gain in T_0. This trend persisted in the 4th week of the experimental period, the mean body weight (g) of broilers gains were 361.88 g, 364.25 g, 408.30 g, and 442.75 g for T_0, T_1, T_2, and T_3, respectively. The greatest weight gain was noticed in T_3 (442.75 g), followed by T_2, T_1, and the lowest gain was in T_0.

At the end of 5th week of experimental period, the mean body weight gains of broilers were 396.87 g, 403.00 g, 504.20 g, and 582.25 g for T_0, T_1, T_2, and T_3, respectively. The highest weight gain was noted in T_3 (582.25 g), followed by T_2, T_1, and the lowest gain was in T_0.

By the end of 6th week of experimental period, the mean body weight gains (g) of broilers were 566.25 g, 604.50 g, 671.00 g, and 710.00 g for T_0, T_1, T_2, and T_3, respectively. The highest weight gain was noted in T_3 (710 g), followed by T_2, T_1, and lowest gain was in T_0. The gain in body weights of broilers in various treatments differed significantly from each other.

Pirzado *et al*. (2016) [6] found that markedly high (p<0.05) in broilers fed with Lysine 12 g/kg (1457.1±15.72g/bird) compared to that of broilers with level of 13 g/kg (1346.6±29.56g/bird), 14 g/kg (1301.3±30.00 g/bird) and 10 g/kg (1263.3±13.48g/bird) respectively. Overall, these findings underscore the benefits of supplementation of lysine and methionine into poultry diets, especially in promoting growth and improving feed efficiency. Further studies are needed to determine optimal supplementation rates and their long term impacts on growth performance and gut health in poultry (See Figure 2).

Table 1: Effect of dietary addition lysine and methionine on body weight (g) of broilers

Treatments	Body weight (g)						
	Initial weight	1st week	2nd week	3rd week	4th week	5th week	6th week
T_0	41.75	115.35^{d}	256.87^{d}	537.12^{d}	899.00^{d}	1295.87^{d}	1862.12^{d}
T_1	42.12	124.25^{c}	318.25^{c}	613.75^{c}	987.00^{c}	1381.00^{c}	1985.50^{c}
T_2	42.00	136.75^{b}	324.25^{b}	707.25^{b}	1116.30^{b}	1620.50^{b}	2291.50^{b}
T_3	41.82	155.32^{a}	372.07^{a}	800.82^{a}	1243.57^{a}	1825.82^{a}	2535.82^{a}
Overall Mean	41.92	132.91	320.36	664.73	1059.22	1530.80	2168.73
S.E.M.±	0.49	0.86	1.47	1.93	2.35	2.00	2.42
CD	NS	2.65	4.53	5.97	7.24	6.19	7.46

Means bearing different superscripts in the same column differ significantly (p<0.05)

Table 2: Effect of dietary addition of lysine and methionine on body weight gain (g) of broilers

Treatments	Body weight gain (g)					
	1st week	2nd week	3rd week	4th week	5th week	6th week
T_0	73.60^{d}	141.52^{d}	280.25^{d}	361.88^{d}	396.87^{d}	566.25^{d}
T_1	82.35^{c}	194.00^{c}	295.50^{c}	364.25^{c}	403.00^{c}	604.50^{c}
T_2	94.75^{b}	197.50^{b}	373.00^{b}	408.30^{b}	504.20^{b}	671.00^{b}
T_3	113.50^{a}	216.62^{a}	428.75^{a}	442.75^{a}	582.25^{a}	710.00^{a}
Overall Mean	91.05	187.81	344.37	394.26	471.58	637.93
S.E.M.±	0.69	1.02	1.21	1.50	1.39	1.41
CD	2.13	3.15	3.73	4.65	4.28	4.35

Means bearing different superscripts in the same column differ significantly (p<0.05)

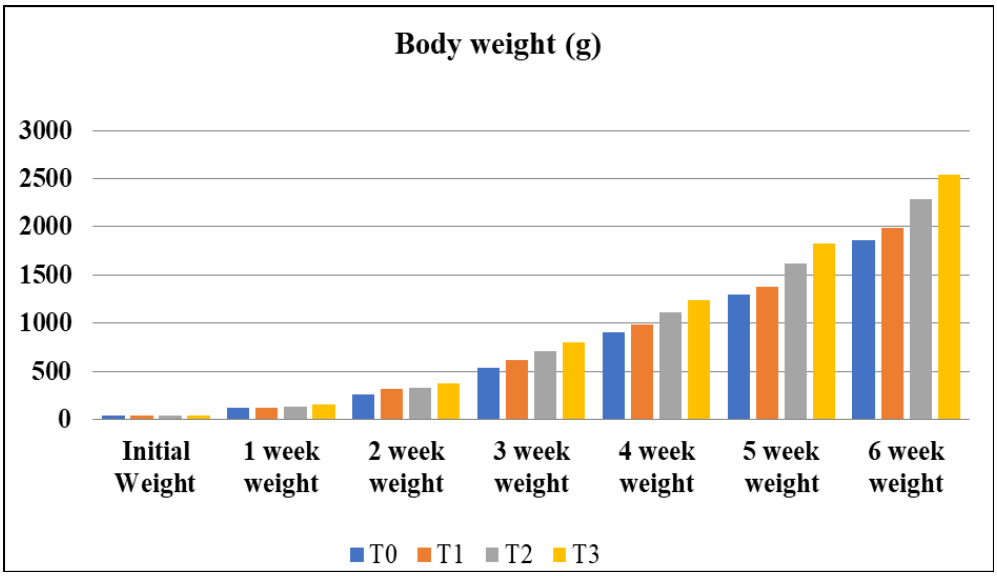

Fig 1: Weekly changes in the body weights of different groups of broilers

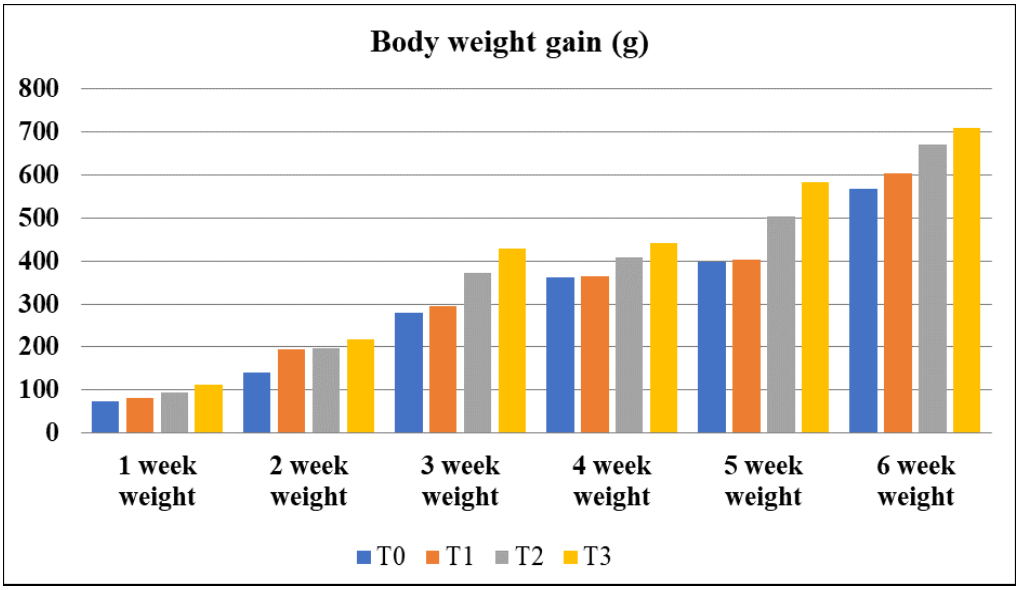

Fig 2: Weekly changes in the body weight gain of different groups of broilers

4. Conclusion

The findings of the present study clearly demonstrate that dietary supplementation with lysine and methionine significantly improves growth performance in broiler chickens. The highest body weight was recorded in birds administered 0.75% lysine and methionine, indicating the effectiveness of this supplementation level. The consistent superiority of the T_3 treatment group across the experimental duration emphasizes the potential of these essential amino acids in enhancing broiler productivity.

The observed progressive increase in body weight across all treatment groups confirms a positive correlation between the inclusion level of lysine and methionine and key growth parameters. Statistically significant differences noted at each assessment interval suggest that elevated supplementation levels not only facilitate greater weight gain but may also contribute to improved feed conversion efficiency. Thus, the incorporation of lysine and methionine in broiler diets represents a promising nutritional strategy for optimizing growth performance and promoting sustainable poultry production systems.

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Conflict of Interest

Not available

Financial Support

Not available

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