



International Journal of Veterinary Sciences and Animal Husbandry



ISSN: 2456-2912

NAAS Rating (2026): 4.61

VET 2026; 11(7): 416-422

© 2026 VET

www.veterinarypaper.com

Received: 14-05-2026

Accepted: 18-06-2026

Namrata G Khirodkar

S.V.G.I College of Agriculture,
Jalgaon-Jamod, Buldhana,
Maharashtra, India

RB Shende

Animal Husbandry and Dairy
Science, College of Agriculture,
Nandurbar, MPKV, Rahuri,
Maharashtra, India

Prashant Kumar

Subject Matter Specialist-
Animal Science, Krishi Vigyan
Kendra, Ambedkar Nagar,
ANDUA & T, Kumarganj,
Ayodhya, Uttar Pradesh, India

Athira VS

Department of Livestock
Production and Management,
College of Veterinary and Animal
Sciences, Mannuthy, Kerala,
India

Pulkit Chugh

Department of Livestock
Production Management, Lala
Lajpat Rai University of
Veterinary & Animal Sciences,
Hisar, Haryana, India

Tushar R Bhosale

Division of Animal Husbandry
and Dairy Science, Chhatrapati
Shivaji Maharaj Krishi Vidyan
Sankul, Kashti, MPKV, Rahuri,
Maharashtra, India

Corresponding Author:

Namrata G Khirodkar

S.V.G.I College of Agriculture,
Jalgaon-Jamod, Buldhana,
Maharashtra, India

Effect of dietary garlic (*Allium sativum*) powder supplementation on growth performance of broiler chickens

**Namrata G Khirodkar, RB Shende, Prashant Kumar, Athira VS, Pulkit
Chugh and Tushar R Bhosale**

DOI: <https://www.doi.org/10.22271/veterinary.2026.v11.i7f.3666>

Abstract

The increasing global restrictions on the use of antibiotic growth promoters have intensified the search for safe and sustainable phytogenic feed additives capable of improving poultry productivity. Garlic (*Allium sativum*), owing to its rich content of organosulfur bioactive compounds, has attracted considerable attention for its antimicrobial, antioxidant, digestive stimulant, and immunomodulatory properties. The present study evaluated the effects of dietary garlic powder supplementation on the growth performance of broiler chickens. One hundred one-day-old commercial Vencobb broiler chicks were randomly allocated to five dietary treatments in a Completely Randomized Design (CRD), comprising a basal diet (T₀) and the basal diet supplemented with 0.5% (T₁), 1.0% (T₂), 1.5% (T₃), and 2.0% (T₄) garlic powder. Each treatment consisted of 20 birds, and the feeding trial was conducted for 42 days. Weekly body weight, body weight gain, feed intake, and feed conversion ratio (FCR) were recorded and analyzed using one-way analysis of variance followed by Duncan's Multiple Range Test. No significant differences ($p > 0.05$) were observed among treatments during the first two weeks. However, from the third week onward, garlic supplementation significantly influenced growth performance. Birds fed 1.5% garlic powder (T₃) achieved the highest final body weight (2879.70 g), greatest body weight gain, lowest feed intake, and the most efficient FCR (1.62) at six weeks of age ($P \leq 0.05$). Increasing the dietary garlic level to 2.0% did not produce further improvements. The enhanced performance observed at 1.5% supplementation is likely associated with improved nutrient utilization, better gut health, and enhanced metabolic efficiency. The findings indicate that dietary supplementation with 1.5% garlic powder can serve as an effective natural phytogenic alternative to antibiotic growth promoters for improving growth performance and feed efficiency in broiler chickens.

Keywords: *Allium sativum*, broiler chicken, phytogenic feed additive, body weight gain, feed conversion ratio, growth performance.

1. Introduction

The poultry industry is one of the fastest-growing sectors of animal agriculture and plays a crucial role in ensuring global food and nutritional security by providing an affordable source of high-quality animal protein. Continuous advances in genetics, nutrition, health management, and housing systems have substantially improved the growth rate, feed efficiency, and carcass yield of modern broiler chickens. Nevertheless, feed remains the major production cost, accounting for approximately 65–75% of the total cost of broiler production. Consequently, improving nutrient utilization and feed efficiency while maintaining rapid growth has become a primary objective of poultry nutrition research (Kikusato, 2021; Polycarpo *et al.*, 2022) [8, 10].

For many years, antibiotic growth promoters (AGPs) were routinely incorporated into poultry diets to enhance growth performance, improve feed conversion efficiency, and suppress enteric pathogens. However, growing concerns regarding antimicrobial resistance, antibiotic residues in poultry products, and potential risks to public health have led to severe restrictions or complete bans on the use of AGPs in several countries. These concerns have accelerated

research into natural and sustainable alternatives capable of maintaining production efficiency without contributing to antimicrobial resistance (Kikusato, 2021; Urban *et al.*, 2025) [8, 13].

Among the various alternatives investigated, phytogetic feed additives have emerged as promising substitutes for antibiotic growth promoters. These plant-derived products, including herbs, spices, essential oils, oleoresins, and plant extracts, possess multiple biological properties such as antimicrobial, antioxidant, anti-inflammatory, digestive stimulant, and immunomodulatory activities. Recent systematic reviews and meta-analyses have demonstrated that phytogetic feed additives improve growth performance, feed efficiency, intestinal health, and overall productivity in broiler chickens, making them an important component of sustainable poultry production systems (Polycarpo *et al.*, 2022; Urban *et al.*, 2025) [10, 13].

Garlic (*Allium sativum* L.), a member of the family Amaryllidaceae, is one of the most extensively studied medicinal plants used in both human and animal nutrition. Its biological activities are attributed primarily to sulfur-containing bioactive compounds, including alliin, allicin, ajoene, diallyl sulfides, and S-allyl cysteine. Allicin, produced through the enzymatic conversion of alliin by alliinase following tissue disruption, is regarded as the principal biologically active constituent responsible for many of garlic's pharmacological effects (Ankri & Mirelman, 1999; Cowan, 1999) [1, 4].

Numerous studies have demonstrated that garlic exerts broad-spectrum antimicrobial activity against pathogenic bacteria, fungi, and other microorganisms, thereby promoting a healthier intestinal microbial ecosystem. This favorable modulation of gut microbiota improves nutrient digestion and absorption while reducing microbial competition for nutrients. In addition, garlic stimulates digestive enzyme secretion, enhances intestinal morphology, improves antioxidant status, and supports immune function, collectively contributing to better nutrient utilization and growth performance. Garlic has also been reported to regulate lipid metabolism and reduce oxidative stress, thereby improving overall physiological health and production efficiency in broiler chickens (Brzóška *et al.*, 2015; Kikusato, 2021; Urban *et al.*, 2025) [2, 8, 13].

The beneficial effects of dietary garlic supplementation on broiler performance have been documented in numerous experimental studies. Raeesi *et al.* (2010) [11] reported significant improvements in growth performance and carcass characteristics following garlic powder supplementation. Similarly, Fadlalla *et al.* (2010) [6], Onyimanyi *et al.* (2011) [9], Elagib *et al.* (2015) [5], and Brzóška *et al.* (2015) [2] demonstrated improvements in body weight gain, feed efficiency, and overall productive performance in broilers receiving garlic-supplemented diets. More recently, Kairalla *et al.* (2022) [7] reported that moderate dietary inclusion of garlic powder significantly improved body weight gain, feed conversion ratio, and selected hematological and biochemical parameters without adversely affecting bird health. Furthermore, a comprehensive meta-analysis by Polycarpo *et al.* (2022) [10] confirmed that phytogetic feed additives consistently improve average daily gain and feed conversion efficiency, whereas Urban *et al.* (2025) [13] highlighted that these beneficial responses are mediated through improved digestive physiology, modulation of gut microbiota, enhanced antioxidant defense, and strengthened immune function.

Despite the growing body of evidence supporting garlic supplementation, considerable variation remains regarding the

optimum dietary inclusion level. Differences in garlic source, processing methods, concentration of bioactive compounds, broiler genotype, diet composition, and management conditions may influence the biological response. Moreover, excessive garlic supplementation may adversely affect feed palatability because of its characteristic pungent odor and sulfur-containing volatile compounds, potentially limiting productive performance. Therefore, identifying the optimum dietary inclusion level under specific production conditions remains essential before garlic can be recommended as a practical phytogetic feed additive for commercial broiler production.

Accordingly, the present study was undertaken to evaluate the effects of graded levels of dietary garlic (*Allium sativum*) powder supplementation on the growth performance of broiler chickens. Growth performance was assessed through measurements of cumulative body weight, weekly body weight gain, feed intake, and feed conversion ratio to determine the most effective dietary inclusion level for improving growth performance and feed utilization efficiency under intensive broiler production conditions.

2. Materials and Methods

2.1 Experimental Birds and Management

A total of 100 one-day-old commercial Vencobb broiler chicks were procured from a commercial hatchery and reared for 42 days at the Poultry Unit, Veterinary Polyclinic and Artificial Insemination Centre, Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra, India.

The birds were randomly allotted to five dietary treatment groups with 20 chicks per treatment under a Completely Randomized Design (CRD). All birds were reared under identical management conditions with free access to feed and clean drinking water throughout the experimental period.

2.2 Experimental Diets

A standard broiler basal diet was formulated to meet the nutrient requirements recommended by the Bureau of Indian Standards (BIS, 1992) [3]. Garlic (*Allium sativum*) powder was incorporated into the basal diet at different inclusion levels to form the experimental treatments:

Table 1: Treatment details of experimental birds

Treatment	Dietary supplementation
T ₀	Basal diet (Control)
T ₁	Basal diet + 0.5% garlic powder
T ₂	Basal diet + 1.0% garlic powder
T ₃	Basal diet + 1.5% garlic powder
T ₄	Basal diet + 2.0% garlic powder

2.3 Growth Performance Measurements

Body weight of individual birds was recorded at the beginning of the experiment and subsequently at weekly intervals using a digital weighing balance. Weekly body weight gain was calculated as the difference between two consecutive body weight measurements.

Feed intake was determined weekly by subtracting the quantity of feed refused from the total feed offered. Feed conversion ratio (FCR) was calculated as the ratio of feed intake to body weight gain.

2.4 Statistical Analysis

The experimental data were analyzed using one-way analysis of variance (ANOVA) appropriate for a Completely

Randomized Design (CRD) as described by Snedecor and Cochran (1994) ^[12]. Treatment means were compared using Duncan's Multiple Range Test (DMRT), and differences were considered statistically significant at $p < 0.05$.

3. Results and Discussion

3.1 Body Weight

The effect of dietary garlic (*Allium sativum*) powder supplementation on the cumulative body weight of broiler chickens is presented in Table 2. The initial body weight of the chicks was comparable among all treatment groups, with no significant ($p > 0.05$) differences observed, indicating

uniform allocation of birds at the start of the experiment. Similarly, cumulative body weights recorded during the first and second weeks did not differ significantly among treatments.

Significant ($P \leq 0.05$) differences in body weight became evident from the third week onwards, indicating that the growth-promoting effect of garlic supplementation was expressed after an initial adaptation period. During the third week, birds receiving 1.0% (T_2) and 1.5% (T_3) garlic powder recorded significantly higher body weights than the control and other treatment groups. This positive trend continued during the fourth, fifth, and sixth weeks of the experiment.

Table 2: Effect of dietary garlic (*Allium sativum*) powder supplementation on average weekly cumulative body weight (g/bird) of broiler chickens

Treatment	Initial	1 st Week	2 nd Week	3 rd Week	4 th Week	5 th Week	6 th Week
T ₀ (Control)	48.40	176.97	469.34	942.70 ^a	1482.90 ^a	2060.05 ^a	2604.75 ^a
T ₁ (0.5% Garlic)	48.20	178.14	469.73	958.19 ^a	1506.25 ^a	2080.90 ^a	2641.95 ^a
T ₂ (1.0% Garlic)	48.40	178.30	488.30	967.50 ^b	1529.00 ^a	2094.00 ^a	2759.10 ^b
T ₃ (1.5% Garlic)	48.11	178.78	493.88	981.70 ^b	1603.60 ^c	2279.05 ^b	2879.70 ^c
T ₄ (2.0% Garlic)	48.76	176.06	473.51	964.40 ^a	1574.40 ^b	2201.85 ^b	2753.20 ^b
Mean	48.37	177.65	478.95	962.90	1539.23	2143.17	2727.74
SE(m) $\pm$	0.45	1.28	7.72	8.45	22.74	34.76	38.14
CD ($P \leq 0.05$)	NS	NS	NS	23.73	63.86	97.58	107.09

At the end of the feeding trial, broilers supplemented with 1.5% garlic powder (T_3) attained the highest cumulative body weight (2879.70 g), which was significantly ($P \leq 0.05$) higher than all other treatment groups. Birds receiving 1.0% (T_2) and 2.0% garlic powder (T_4) achieved intermediate body weights (2759.10 g and 2753.20 g, respectively), both significantly greater than the control group but lower than T_3 . The lowest final body weight was recorded in the control group (2604.75 g), while birds fed 0.5% garlic powder (T_1) showed only a marginal improvement (2641.95 g) over the control and did not differ significantly.

The improvement in body weight observed in garlic-supplemented birds may be attributed to the biological activity of organosulfur compounds such as allicin, alliin, ajoene, and diallyl sulfides. These compounds possess antimicrobial properties that suppress pathogenic intestinal microorganisms, thereby promoting a healthier intestinal microbial ecosystem and improving nutrient digestion and absorption. Garlic has also been reported to stimulate digestive enzyme secretion, improve intestinal morphology, and enhance antioxidant status, resulting in better nutrient utilization and growth performance (Kikusato, 2021; Urban *et al.*, 2025) ^[8, 13].

The present findings are in agreement with Raesi *et al.* (2010) ^[11], who reported improved body weight in broilers supplemented with garlic powder. Fadlalla *et al.* (2010) ^[6] also observed significantly higher body weight in garlic-fed broilers, attributing the response to improved nutrient digestibility and intestinal health. Similar improvements in growth performance have been reported by Onyimonyi *et al.* (2011) ^[9], Brzóska *et al.* (2015) ^[2], and Elagib *et al.* (2015) ^[5], all of whom demonstrated that dietary garlic supplementation enhanced growth and production efficiency in broiler chickens.

Recent investigations further support these observations. Kairalla *et al.* (2022) ^[7] reported that broilers receiving moderate dietary levels of garlic powder exhibited significantly greater final body weight than the control group, with 1.5% supplementation producing the most favorable response, which closely corresponds with the findings of the

present study. Likewise, the meta-analysis conducted by Polycarpo *et al.* (2022) ^[10] concluded that phytogenic feed additives significantly improve broiler growth performance and may effectively replace antibiotic growth promoters. Furthermore, Urban *et al.* (2025) ^[13] emphasized that phytobiotics improve broiler growth by modulating gut microbiota, enhancing digestive efficiency, strengthening antioxidant defenses, and improving immune function.

Although dietary supplementation with 2.0% garlic powder (T_4) resulted in significantly greater body weight than the control group, its performance remained lower than that of birds receiving 1.5% garlic powder (T_3). This finding suggests that increasing garlic supplementation beyond the optimum level does not necessarily result in proportional improvements in growth performance. Reduced feed palatability associated with higher concentrations of garlic and possible saturation of its physiological effects may explain the diminished response at higher inclusion levels.

Overall, the present study demonstrated that supplementation of broiler diets with 1.5% garlic powder significantly improved cumulative body weight throughout the experimental period. The enhanced growth performance is likely associated with improved intestinal health, enhanced nutrient utilization, better antioxidant protection, and efficient metabolic function, indicating that 1.5% garlic powder represents the optimum dietary inclusion level among the treatments evaluated.

3.2 Body Weight Gain

The effect of dietary garlic (*Allium sativum*) powder supplementation on the weekly body weight gain of broiler chickens is presented in Table 3. During the first three weeks of the experiment, body weight gain did not differ significantly ($p > 0.05$) among the treatment groups, indicating that garlic supplementation had little influence on growth during the early brooding period. This observation may be attributed to the physiological adaptation of chicks to dietary treatments and the gradual establishment of intestinal microbiota during the initial stages of growth.

Table 3: Effect of dietary garlic (*Allium sativum*) powder supplementation on average weekly body weight gain (g/bird) of broiler chickens

Treatment	1 st Week	2 nd Week	3 rd Week	4 th Week	5 th Week	6 th Week
T ₀ (Control)	128.57	315.10	478.35	547.91 ^a	569.15 ^a	544.20 ^a
T ₁ (0.5% Garlic)	129.94	289.68	493.47	550.21 ^a	572.20 ^a	561.05 ^a
T ₂ (1.0% Garlic)	131.15	307.48	479.20	558.26 ^a	567.95 ^a	551.35 ^a
T ₃ (1.5% Garlic)	130.82	292.34	487.83	621.15 ^b	674.95 ^b	665.15 ^b
T ₄ (2.0% Garlic)	127.30	292.45	497.88	607.51 ^a	627.65 ^a	602.65 ^a
Weekly Mean	129.56	299.41	487.34	577.01	602.38	584.88
SE(m) ±	1.34	7.26	7.97	21.42	27.81	31.37
CD (P≤0.05)	NS	NS	NS	60.14	78.08	88.08

From the fourth week onwards, dietary garlic supplementation significantly ($P \leq 0.05$) influenced body weight gain. Broilers supplemented with 1.5% garlic powder (T₃) exhibited the highest body weight gain during the fourth (621.15 g), fifth (674.95 g), and sixth (665.15 g) weeks, significantly outperforming all other treatment groups. Birds receiving 2.0% garlic powder (T₄) also showed numerically higher body weight gains than the control group during the finishing period, although the improvements were lower than those recorded in T₃. The control group consistently recorded the lowest weekly weight gain during the final three weeks of the experiment.

The greater body weight gain observed in birds supplemented with 1.5% garlic powder suggests that this dietary level provided the optimum concentration of bioactive compounds required to enhance growth performance. Garlic contains sulfur-containing compounds such as allicin, alliin, ajoene, and diallyl sulfides, which improve intestinal microbial balance by suppressing pathogenic bacteria while supporting beneficial microorganisms. This favorable modulation of gut microbiota enhances nutrient digestibility and absorption, thereby increasing the availability of nutrients required for muscle accretion and tissue growth. In addition, garlic has been reported to stimulate digestive enzyme secretion, improve intestinal morphology, and enhance metabolic efficiency, collectively contributing to superior body weight gain (Kikusato, 2021; Urban *et al.*, 2025) [8, 13].

The antioxidant activity of garlic may have further contributed to improved growth by reducing oxidative stress associated with rapid muscle development. Organosulfur compounds and phenolic constituents present in garlic protect intestinal epithelial cells from oxidative damage and improve nutrient utilization efficiency. Moreover, garlic has been shown to enhance immune competence, thereby reducing the metabolic cost associated with immune responses and allowing a greater proportion of absorbed nutrients to be utilized for productive growth (Urban *et al.*, 2025) [13].

The present findings corroborate those of Raeesi *et al.* (2010) [11], who reported significantly higher body weight gain in broiler chickens supplemented with garlic powder compared with the control group. Similarly, Fadlalla *et al.* (2010) [6] observed improved weight gain following garlic supplementation and attributed the response to enhanced nutrient digestibility and improved gastrointestinal health. Onyimonyi *et al.* (2011) [9] also reported positive effects of garlic supplementation on growth performance, indicating its potential as a natural growth promoter.

Comparable observations were reported by Brzóška *et al.* (2015) [2] and Elagib *et al.* (2015) [5], who demonstrated that dietary garlic supplementation significantly improved body

weight gain and overall productive performance in broiler chickens. More recently, Kairalla *et al.* (2022) [7] found that broilers receiving moderate levels of garlic powder exhibited significantly greater weight gain than the control birds, with optimum responses observed at intermediate inclusion levels. These findings closely agree with the results of the present investigation, where 1.5% garlic powder produced the highest growth response.

The results are also supported by the comprehensive meta-analysis of Polycarpo *et al.* (2022) [10], which concluded that phytogenic feed additives consistently improve average daily gain and growth performance in broiler chickens while serving as effective alternatives to antibiotic growth promoters. Likewise, Urban *et al.* (2025) [13] highlighted that phytobiotics promote broiler growth through multiple complementary mechanisms, including modulation of gut microbiota, enhancement of digestive physiology, improvement of antioxidant defense systems, and stimulation of immune responses.

Although birds receiving 2.0% garlic powder (T₄) exhibited higher body weight gain than the control group during the finishing period, the response was lower than that observed in birds supplemented with 1.5% garlic powder (T₃). This finding suggests that increasing the dietary level of garlic beyond the optimum concentration may not proportionally improve growth performance. Reduced feed palatability or diminished biological efficiency at higher supplementation levels may account for this response, as previously suggested by Brzóška *et al.* (2015) [2] and Kairalla *et al.* (2022) [7].

Overall, the present study demonstrated that dietary supplementation with 1.5% garlic powder significantly improved body weight gain during the finishing phase of broiler production. The enhanced growth observed in this treatment is likely attributable to improved digestive efficiency, enhanced nutrient utilization, better intestinal health, and increased antioxidant and immunomodulatory activity, confirming the growth-promoting potential of garlic as a natural phytogenic feed additive.

3.3 Feed Intake

The effect of dietary garlic (*Allium sativum*) powder supplementation on the average weekly feed intake of broiler chickens is presented in Table 4. Feed intake did not differ significantly ($p > 0.05$) among treatment groups during the first three weeks of the experiment, indicating that dietary inclusion of garlic powder had no adverse effect on feed consumption during the early growth phase. The comparable feed intake observed during this period also suggests that the experimental diets were readily accepted by the birds irrespective of the level of garlic supplementation.

Table 4: Effect of dietary garlic (*Allium sativum*) powder supplementation on average weekly feed intake (g/bird) of broiler chickens

Treatment	1 st Week	2 nd Week	3 rd Week	4 th Week	5 th Week	6 th Week
T ₀ (Control)	122.27	300.58	543.61	825.65 ^a	1030.00 ^b	1042.45 ^b
T ₁ (0.5% Garlic)	121.06	298.71	539.98	802.95 ^b	1018.75 ^b	1037.55 ^b
T ₂ (1.0% Garlic)	121.97	298.35	534.14	796.93 ^a	1007.00 ^a	1016.70 ^a
T ₃ (1.5% Garlic)	120.90	286.10	515.55	792.84 ^a	996.80 ^a	1003.60 ^a
T ₄ (2.0% Garlic)	121.00	291.63	531.76	796.18 ^a	1000.10 ^a	1014.20 ^a
Weekly Mean	121.44	295.07	533.01	802.91	1010.53	1022.90
SE(m) ±	2.53	4.45	12.92	3.55	6.66	8.11
CD (P≤0.05)	NS	NS	NS	9.96	18.69	22.76

Significant ($P \leq 0.05$) differences in feed intake were observed from the fourth week onwards. During the fourth week, the highest feed intake was recorded in the control group (825.65 g), followed by T₁ (802.95 g), whereas birds supplemented with 1.0% (T₂), 1.5% (T₃), and 2.0% (T₄) garlic powder consumed significantly less feed. A similar trend was observed during the fifth and sixth weeks of the experiment. At the end of the sixth week, birds receiving 1.5% garlic powder (T₃) consumed the least amount of feed (1003.60 g), whereas the control birds recorded the highest feed intake (1042.45 g). Birds supplemented with 1.0% (T₂) and 2.0% garlic powder (T₄) exhibited intermediate feed consumption, while 0.5% garlic powder (T₁) showed values closer to the control.

The reduced feed intake observed in garlic-supplemented groups, particularly in birds receiving 1.5% garlic powder, did not adversely affect body weight gain or final body weight. On the contrary, these birds exhibited superior growth performance, indicating improved efficiency of feed utilization. This finding suggests that garlic supplementation enhanced nutrient digestibility and metabolic efficiency, enabling birds to achieve greater growth while consuming comparatively less feed.

The improvement in feed utilization may be attributed to the bioactive organosulfur compounds present in garlic, including allicin and related sulfur-containing metabolites. These compounds possess antimicrobial activity that suppresses pathogenic microorganisms within the gastrointestinal tract while promoting a balanced intestinal microbiota. Improved microbial balance enhances digestive efficiency, increases nutrient absorption, and reduces nutrient losses, thereby lowering the amount of feed required to sustain growth. Furthermore, garlic has been reported to stimulate pancreatic digestive enzymes and improve intestinal morphology by increasing villus height and absorptive surface area, leading to more efficient utilization of dietary nutrients (Kikusato, 2021; Urban *et al.*, 2025) [8, 13].

Another possible explanation for the reduced feed intake is the improvement in nutrient density utilization associated with garlic supplementation. Enhanced digestion and absorption enable birds to satisfy their nutritional requirements with comparatively lower feed consumption. Additionally, garlic possesses antioxidant properties that improve cellular metabolism and reduce oxidative stress, thereby increasing the efficiency with which absorbed nutrients are converted into body tissues rather than being utilized for maintenance functions (Urban *et al.*, 2025) [13].

The findings of the present investigation are consistent with those reported by Raeesi *et al.* (2010) [11], who observed reduced feed intake accompanied by improved growth performance in broilers supplemented with garlic powder. Fadlalla *et al.* (2010) [6] also reported that dietary garlic supplementation improved nutrient utilization and feed efficiency while reducing overall feed consumption.

Similarly, Brzóska *et al.* (2015) [2] demonstrated that broilers receiving garlic supplementation consumed slightly less feed than the control birds but achieved superior growth performance, indicating improved biological efficiency.

Comparable observations have also been reported by Elagib *et al.* (2015) [5], who found that garlic supplementation improved productive performance despite lower feed intake. Kairalla *et al.* (2022) [7] likewise reported that moderate dietary inclusion of garlic significantly reduced feed consumption while maintaining or improving growth rate, suggesting enhanced nutrient digestibility and feed utilization. Their findings closely correspond with the results of the present study, where 1.5% garlic powder supplementation produced the lowest feed intake together with the highest body weight.

The results are further supported by the meta-analysis conducted by Polycarpo *et al.* (2022) [10], which concluded that phytogenic feed additives improve digestive efficiency and frequently reduce feed intake without compromising growth performance. Similarly, Urban *et al.* (2025) [13] emphasized that phytobiotics improve feed utilization through modulation of intestinal microbiota, stimulation of digestive enzyme activity, enhancement of intestinal integrity, and improved antioxidant status, thereby reducing the amount of feed required to achieve optimum growth.

Although birds receiving 2.0% garlic powder (T₄) consumed less feed than the control group, the reduction in feed intake did not translate into additional improvements in growth compared with birds receiving 1.5% garlic powder. This observation suggests that increasing garlic supplementation beyond the optimum level may not further enhance digestive efficiency. Excessive dietary garlic may slightly affect feed palatability due to its characteristic pungent aroma and sulfur-containing volatile compounds, thereby limiting voluntary feed intake without providing additional productive benefits.

Overall, the present study demonstrated that dietary supplementation with 1.5% garlic powder significantly reduced feed intake during the finishing phase while simultaneously producing the highest body weight and body weight gain. These findings indicate that garlic improved nutrient utilization efficiency, enabling broiler chickens to achieve superior growth with lower feed consumption. Therefore, supplementation of 1.5% garlic powder appears to be the most effective dietary inclusion level for improving feed utilization and production efficiency in broiler chickens under the conditions of the present study.

3.4 Feed Conversion Ratio (FCR)

The effect of dietary garlic (*Allium sativum*) powder supplementation on the average weekly feed conversion ratio (FCR) of broiler chickens is presented in Table 5. Feed conversion ratio is an important indicator of production efficiency, reflecting the amount of feed required to produce a unit of body weight gain. Lower FCR values indicate better feed utilization efficiency and superior economic

performance.

Table 5: Effect of dietary garlic (*Allium sativum*) powder supplementation on average weekly feed conversion ratio (FCR) of broiler chickens

Treatment	1 st Week	2 nd Week	3 rd Week	4 th Week	5 th Week	6 th Week
T ₀ (Control)	0.92	1.03	1.15	1.57 ^c	1.97 ^c	2.02 ^b
T ₁ (0.5% Garlic)	0.92	1.04	1.15	1.52 ^b	1.91 ^b	2.01 ^b
T ₂ (1.0% Garlic)	0.89	1.01	1.12	1.52 ^b	1.86 ^b	1.90 ^a
T ₃ (1.5% Garlic)	0.91	1.01	1.06	1.31 ^a	1.59 ^a	1.62 ^a
T ₄ (2.0% Garlic)	0.91	1.02	1.11	1.34 ^{ab}	1.68 ^a	1.80 ^a
Weekly Mean	0.91	1.03	1.12	1.45	1.80	1.87
SE(m) ±	0.01	0.02	0.03	0.07	0.09	0.10
CD (P≤0.05)	NS	NS	NS	0.18	0.25	0.29

During the first three weeks of the experiment, no significant ($P > 0.05$) differences in FCR were observed among the treatment groups, indicating that dietary garlic supplementation had minimal influence on feed utilization during the early growth phase. The similarity in FCR during this period may be attributed to the rapid physiological development of young chicks, during which dietary treatments generally exert limited measurable effects on growth efficiency.

Significant ($P \leq 0.05$) differences in FCR became evident from the fourth week onwards. During the fourth week, birds supplemented with 1.5% garlic powder (T₃) recorded the lowest FCR (1.31), followed by 2.0% garlic powder (T₄; 1.34), whereas the highest FCR was observed in the control group (1.57). Similar trends were observed during the fifth and sixth weeks of the experiment. At the end of the sixth week, the lowest FCR (1.62) was recorded in birds receiving 1.5% garlic powder, followed by T₄ (1.80) and T₂ (1.90), whereas the highest FCR values were observed in T₀ (2.02) and T₁ (2.01). These results indicate that garlic supplementation substantially improved feed utilization efficiency, particularly at the dietary inclusion level of 1.5%.

The improved FCR observed in garlic-supplemented birds can be attributed to enhanced digestion and more efficient utilization of dietary nutrients. Garlic contains several biologically active sulfur-containing compounds, including allicin, alliin, ajoene, diallyl sulfides, and S-allyl cysteine, which possess antimicrobial, antioxidant, and digestive stimulant properties. These compounds improve intestinal microbial balance by inhibiting pathogenic bacteria while promoting beneficial microbial populations, thereby enhancing nutrient digestion and absorption. Improved intestinal health reduces nutrient losses and enables birds to convert feed more efficiently into body tissues.

Garlic has also been reported to stimulate pancreatic enzyme secretion and improve intestinal morphology by increasing villus height, crypt depth ratio, and absorptive surface area. Enhanced enzymatic activity facilitates more efficient digestion of proteins, carbohydrates, and lipids, while improved intestinal morphology increases nutrient absorption. Consequently, birds require less feed to achieve comparable or greater body weight gain, resulting in improved feed conversion efficiency (Kikusato, 2021; Urban *et al.*, 2025) [8, 13].

The antioxidant properties of garlic further contribute to improved feed efficiency by reducing oxidative stress associated with rapid growth. Organosulfur compounds neutralize reactive oxygen species and protect intestinal epithelial cells from oxidative damage, thereby maintaining intestinal integrity and improving metabolic efficiency. In

addition, garlic exhibits immunomodulatory activity, reducing metabolic energy expenditure associated with immune activation and allowing a greater proportion of dietary nutrients to be directed toward productive growth rather than maintenance functions (Urban *et al.*, 2025) [13].

The findings of the present study are consistent with those reported by Raeesi *et al.* (2010) [11], who observed significantly improved feed conversion ratio in broilers supplemented with garlic powder. Similarly, Fadlalla *et al.* (2010) [6] reported that garlic supplementation enhanced feed efficiency by improving nutrient utilization and digestive function. Onyimonyi *et al.* (2011) [9] also demonstrated that garlic supplementation significantly improved feed conversion efficiency compared with unsupplemented birds.

Comparable findings have been reported by Brzóska *et al.* (2015) [2], who observed lower FCR values and superior production efficiency in broilers receiving garlic supplementation. Likewise, Elagib *et al.* (2015) [5] demonstrated that dietary garlic improved feed conversion efficiency while enhancing overall productive performance. More recently, Kairalla *et al.* (2022) [7] reported that moderate dietary supplementation with garlic powder significantly improved feed conversion ratio, with intermediate inclusion levels producing the greatest biological response. These observations closely correspond with the findings of the present investigation, where 1.5% garlic powder resulted in the lowest FCR throughout the finishing phase.

The present results are further supported by the comprehensive meta-analysis conducted by Polycarpo *et al.* (2022) [10], which concluded that phytogetic feed additives consistently improve feed conversion ratio and nutrient utilization in broiler chickens. Similarly, Urban *et al.* (2025) [13] highlighted that phytobiotics improve feed efficiency through multiple complementary mechanisms, including modulation of intestinal microbiota, stimulation of digestive enzyme secretion, enhancement of antioxidant defense, improvement of intestinal barrier integrity, and optimization of nutrient metabolism.

Although birds receiving 2.0% garlic powder (T₄) also exhibited significantly lower FCR than the control group, the improvement was slightly less pronounced than that observed in birds supplemented with 1.5% garlic powder (T₃). This finding suggests that increasing garlic supplementation beyond the optimum level does not proportionally improve feed efficiency and may reduce the biological effectiveness of garlic due to decreased feed palatability or saturation of its physiological effects.

Overall, the present investigation demonstrated that dietary supplementation with 1.5% garlic powder produced the most efficient feed conversion ratio among all treatment groups. The improved FCR, together with the higher body weight, greater body weight gain, and lower feed intake observed in this treatment, confirms that 1.5% garlic powder represents the optimum dietary inclusion level for maximizing production efficiency in broiler chickens. These findings support the use of garlic as a natural phytogetic feed additive capable of enhancing nutrient utilization, improving growth performance, and reducing feed costs in commercial broiler production.

Conclusion

The present study demonstrated that dietary supplementation of garlic (*Allium sativum*) powder significantly improved the growth performance and feed utilization efficiency of broiler chickens, with the beneficial effects becoming evident from

the third week of the feeding trial. Among the dietary treatments evaluated, supplementation with 1.5% garlic powder produced the highest final body weight and body weight gain, the lowest feed intake, and the most favorable feed conversion ratio, indicating superior nutrient utilization compared with the control and other supplementation levels. The improved productive performance is likely associated with the antimicrobial, antioxidant, digestive stimulant, and immunomodulatory properties of the bioactive organosulfur compounds present in garlic, which enhance intestinal health, nutrient digestibility, and metabolic efficiency. Increasing the inclusion level to 2.0% did not result in further improvements, suggesting that excessive supplementation may reduce feed palatability without providing additional biological benefits. Overall, the findings indicate that 1.5% dietary garlic powder is the optimum supplementation level under the conditions of the present study and can be recommended as an effective natural phytogenic alternative to antibiotic growth promoters for improving growth performance and feed efficiency in commercial broiler production. Further studies investigating its effects on carcass traits, gut microbiota, immune response, meat quality, and economic returns under different production systems are warranted.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

Financial Support

Not available

References

1. Ankri S, Mirelman D. Antimicrobial properties of allicin from garlic. *Microbes and Infection*. 1999;1(2):125-129.
2. Brzóska F, Śliwiński B, Michalik-Rutkowska O, Śliwa J. The effect of garlic (*Allium sativum* L.) on growth performance, mortality rate, meat and blood parameters in broilers. *Annals of Animal Science*. 2015;15(4):961-975.
3. Bureau of Indian Standards. Nutrient requirements for poultry. IS 13574:1992. New Delhi: Bureau of Indian Standards; 1992.
4. Cowan MM. Plant products as antimicrobial agents. *Clinical Microbiology Reviews*. 1999;12(4):564-582.
5. Elagib HAA, El-Amin WIA, Elamin KM, Malik HEE. Effect of dietary garlic (*Allium sativum*) supplementation as a feed additive on broiler performance and blood profile. *Journal of Animal Science Advances*. 2015;5(1):58-64.
6. Fadlalla IMT, Mohammed BH, Bakhiet AO. Effect of feeding garlic on the performance and immunity of broilers. *Asian Journal of Poultry Science*. 2010;4(4):182-189.
7. Kairalla MA, El-Kholy MS, El-Hack MEA, *et al*. Effect of dietary garlic powder supplementation on growth performance, hematological and biochemical parameters of broiler chickens. *Open Veterinary Journal*. 2022;12:1-11.
8. Kikusato M. Phytobiotics to improve health and production of broiler chickens: Functions beyond the antioxidant activity. *Animal Bioscience*. 2021;34(3):345-353.
9. Onyimonyi AE, Chukwuma PC, Igbokwe CC. Growth and hypocholesterolemic properties of dry garlic powder (*Allium sativum*) on broilers. *African Journal of Biotechnology*. 2011;10(13):2666-2671.
10. Polycarpo GV, Andretta I, Kipper M, Cruz-Polycarpo VC, Dadalt JC, Rodrigues PHM, *et al*. Can phytogenic additives improve the performance of broilers? A systematic review and meta-analysis. *Canadian Journal of Animal Science*. 2022;102(4):859-877.
11. Raeesi M, Hoseini-Aliabad SA, Roofchae A, Shahneh AZ, Pirali S. Effect of periodically use of garlic (*Allium sativum*) powder on performance and carcass characteristics in broiler chickens. *World Academy of Science, Engineering and Technology*. 2010;68:1213-1219.
12. Snedecor GW, Cochran WG. Statistical methods. 8th ed. Ames (IA): Iowa State University Press; 1994.
13. Urban J, Kareem KY, Matuszewski A, Bień D, Ciborowska P, Lutostański K, *et al*. Enhancing broiler chicken health and performance: The impact of phytobiotics on growth, gut microbiota, antioxidants, and immunity. *Phytochemistry Reviews*. 2025;24(2):2131-2145.

How to Cite This Article

Khrodkar NG, Shende RB, Kumar P, Athira VS, Chugh P, Bhosale TR. Effect of dietary garlic (*Allium sativum*) powder supplementation on growth performance of broiler chickens. *International Journal of Veterinary Sciences and Animal Husbandry*. 2026;11(7):416-422.

Creative Commons (CC) License

This is an open-access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.