

Adding Different Types of Commercial Garlic to Drinking Water and Their Effect on Some Productive Traits of Broiler Chickens**Marwan Shalan Khalaf AL-Nasree and Maad A.K. Albaddy**

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Abstract

The experiment was conducted in the broiler hall of the Animal Production Department at the College of Agriculture / Tikrit University for the period from 17/2/2025 to 24/3/2025 to study the effect of using different types of commercial garlic in drinking water and its impact on some productive traits of broiler chickens. A total of 225 one-day-old Ross 308 broiler chicks were used, placed in floor pens, and divided into five treatments. Each treatment contained three replicates, and within each replicate, there were fifteen birds. The first treatment was the control group. The birds were fed a ready-made starter diet from the Middle East factory until 10 days of age. Subsequently, experimental diets mixed in the feed mill of the College of Agriculture / Tikrit University were used. A grower diet was used from 11 to 24 days of age, and then the diet was switched to a finisher diet, fed from 25 to 35 days of age (Table 1). Feeding was ad libitum. The experimental materials were added to the drinking water starting from 10 days to 35 days of age. The additions were 500 ml/1000 liters for the second treatment, 350 ml/1000 liters for the third treatment, 200 ml/1000 liters for the fourth treatment, and 200 g/1000 liters for the fifth treatment, according to the recommendations of the manufacturing companies, using plastic manual feeders and drinkers.

The results of the statistical analysis showed no significant differences in live body weight at 10 days of age (the beginning of the experiment), nor were there significant differences in body weight at 24 and 35 days of age. A significant decrease in feed consumption was also observed at 25-35 days of age, as the first treatment recorded an increase in feed consumption compared to the other treatments, and there was no significant difference between the second treatment and the control treatment. A significant decrease was also observed in the addition treatments compared to the control treatment in the total amount of feed consumed. No significant differences were observed at 11-24 days of age in the amount of feed consumed. No significant differences were observed in the rate of weight gain at any age. The experiment revealed significant differences in feed conversion efficiency during the 11-35 day age period, with a notable improvement observed in the third, fourth, and fifth treatments compared to the control group. No significant differences were found between these treatments and the second group.

Keywords: Garlic, Ross308, weight gain, feed conversion efficiency**Introduction**

Broiler production is considered one of the most important pillars for providing high-quality animal protein, given its fast production cycle and high efficiency in converting feed into meat, making it an effective economic sector and a fundamental contributor to achieving food security (Choi et al., 2023). The success of this industry relies on the application of precise feeding programs that contribute to meeting nutritional requirements and enhancing the birds' health and production quality (Zampiga et al., 2021). Poultry nutrition faces several challenges related to the environment and climatic conditions, and heat stress is one of the most impactful challenges on the birds, as it leads to a decrease in feed consumption and disturbances in metabolic processes. As indicated by Bhawa et al. (2023), there is a reliance on modern nutritional strategies such as using natural antioxidants and certain vitamins and organic minerals to reduce the negative effects of stress and improve the bird's immunity, which contributes to maintaining adequate performance under various conditions.

With the global trend towards producing poultry meat free of antibiotics, gut health has become a central focus in raising production efficiency and reducing economic losses resulting from infections and immune challenges (Wickramasuriya et al., 2022). The intestine is the vital organ most closely associated with nutrient absorption and the bird's immune response, and any disruption in the balance of the intestinal microbiome negatively reflects on growth, feed conversion ratio, and meat quality (Yadav et al., 2023). Hence, the importance of using natural additives like garlic arises, as its active sulfur compounds work to inhibit harmful microbes and promote the growth of beneficial bacteria such as *Lactobacillus*, which improves intestinal integrity and reduces the need for prophylactic antibiotics (Qui et al., 2024). Regarding diet components, the focus is no longer solely on energy or crude protein sources, but has also shifted to functional feed additives, which have gained importance following restrictions on the use of antibiotics as growth promoters. Supporting gut health is a primary objective in this regard, as the intestine is currently viewed not only for absorption and digestion but also as a major part of the bird's immune system.

Kogut (2016) also pointed out the possibility of improving microbial balance within the intestine using probiotics, organic acids, and some plant extracts, which help boost immunity and improve feed conversion efficiency. With escalating global interest in reducing the use of antibiotics in poultry farming due to the bacterial resistance and health risks they cause, researchers have turned to safe, natural alternatives that enhance bird health and maintain productivity without leaving drug residues in animal products. Garlic (*Allium sativum*) is among the most prominent of these alternatives due to its active compounds, primarily allicin, which possess antimicrobial and antioxidant properties, thereby enhancing digestive health and immunity (Abd El-Ghany et al., 2024).

Studies have proven that adding garlic extracts to drinking water is a practical and easy-to-apply method, as it allows for the rapid absorption of vital compounds without the need to significantly modify the diet. This addition also contributes to improving intestinal structure by increasing villus height and crypt depth, which positively reflects on the efficiency of nutrient utilization and the feed conversion ratio (Islam and Khan, 2024).

Recent research indicates that antibiotic alternatives, including garlic extracts, contribute to reducing reliance on antibiotics, supporting gut health and immunity, and improving the quality of the final product, thereby enhancing sustainability in the poultry industry (Wang et al., 2024).

The study aimed to obtain commercial garlic extracts and compounds available in local markets that are used by breeders, to study and use them in broiler rearing, to demonstrate their effect on the productive performance of broiler chickens, and to determine which formulation is best without affecting the health and quality of the chickens.

Materials and Methods

A total of 225 one-day-old Ross 308 broiler chicks, obtained from Al-Alamein hatchery in Saladin Governorate, were used. They were placed in floor pens and divided into five treatments. Each treatment contained three replicates, with fifteen birds per replicate. The first treatment was the control group. The birds were fed a ready-made starter diet from the Middle East factory until 10 days of age. Subsequently, experimental diets mixed in the feed mill of the College of Agriculture / Tikrit University were used. A grower diet was used from 11 to 24 days of age, and then the diet was switched to a finisher diet, fed from 25 to 35 days of age (Table 1). Feeding was ad libitum.

The experimental materials were added to the drinking water starting from 10 days of age until 35 days of age using plastic manual feeders and drinkers. The lighting program was 23 hours of light / 1 hour of darkness. The temperature was 34°C at the beginning of the experiment and was reduced to 24°C at the end of the experiment. The following traits were studied: body weight, weight gain, feed intake, and feed conversion efficiency. Data were statistically analyzed using a Completely Randomized Design (CRD) to study the effect of the treatments on the studied traits. Significant differences among means were compared using Duncan's multiple range test (Duncan, 1955), and the SAS statistical program (2005) was used for statistical analysis.

Table 1: Illustrates the materials used in each treatment

T1	I	Control treatment where no additive was used in drinking water	No addition
T2	II	Garlic 40,000 mg/l, Thyme 40,000 mg/l, Thymol 16,000 mg/l, Cinnamaldehyde 14,000 mg/l	500ml / 1000 liter
T3	III	Garlic Oregano, Vitamin E 5,000 mg/l, Azadiracta Indica 20,000 mg/l, Ocimum Sanctum 10,000 mg/l, Phyllanthus emblica 5,000 mg/l, Vitamin B12 1,000 mg/l, Betaine 30,000 mg/l, Methionine 30,000 mg/l, Magnesium Sulfate 15,000 mg/l	350 ml / 1000 liter
T4	IV	Garlic oil extract, Coriander extract, Vitamin A 6,000 IU, Vitamin E 12,000 mg/l	200 ml / 1000 liter
T5	V	Pure Allicin Powder 250gm/kg	200gm / 1000 liter

Table (2): Components of broiler chicken diets (Grower and Finisher) with calculated chemical composition

Feed Ingredients	Diets: Grower	Diets: Finisher
Yellow Corn (%)	60.23	65.82
Soybean Meal (48%)	33.62	28.45
Lysine	0.13	0.14
*Premix (%)	2.5	2.5
Sunflower Oil (%)	2.15	2.03
Dicalcium Phosphate (%)	0.9	0.6
Limestone (%)	0.1	0.1
DL-Methionine (%)	0.12	0.11
Table Salt (%)	0.25	0.25
Total	100	100
Calculated Chemical Composition		
Metabolizable Energy (kcal/kg feed)	3050	3100
Crude Protein (%)	21.51	19.5
Crude Fiber (%)	2.3	2.28
Lysine (%)	1.18	1.08
Methionine (%)	0.59	0.56
Methionine + Cystine (%)	0.92	0.86
Calcium (%)	0.87	0.79
Phosphorus (%)	0.42	0.36

- *** Premix (%):** Calcium 20.40%; Phosphorus 4.90%; Sodium 5.00%; Chloride 7.79%; Crude Protein 10.00%; Crude Fat 2.65%; Crude Fiber 0.25%; Ash 78.09%; Lysine 1.60%; Methionine 6.00%; Threonine 0.16%; Methionine+Cystine 6.05%, Supplement (). * ** The chemical composition values of the feed ingredients included in the diet formulation were calculated according to NRC (1994).

Results and Discussion

Live Body Weight

Table 3 shows the average live weight at 10, 24, and 35 days of age, where no significant difference appeared among the experimental treatments at ages 10, 24, and 35 days.

Table (3): Addition of different types of commercial garlic in drinking water and its effect on live body weight (g)

T1	306.67 ± 1.92	1278.89 ± 36.54	2046.0 ± 66.21
T2	296.78 ± 1.93	1312.22 ± 47.75	2111.6 ± 93.87
T3	304.89 ± 2.47	1329.56 ± 18.40	2266.2 ± 43.28
T4	294.56 ± 5.79	1298.22 ± 34.89	2274.9 ± 109.99
T5	292.44 ± 2.44	1258.00 ± 37.90	2153.1 ± 59.09
Level of Significance	N.S	N.S	N.S

- Control treatment, T2 Garlic extract 500ml/1000L, T3 Garlic and herbs 350ml/1000L, T4 Garlic oil 200ml/1000L, T5 Garlic powder 200g/1000L.
- * Indicates the presence of significant differences among treatments.
- Different letters in the same column indicate significant differences among treatments at a probability level of (P ≤ 0.05).
- N.S indicates no significant differences among treatments.

Weight Gain

Table 4 demonstrated the absence of significant differences across all age stages, and this table proves that the "net growth" was very close among all groups. In connection with Table (3), we find that the birds in the garlic groups consumed significantly less feed but achieved the same "weight gain" as the control group. The lack of significance here is evidence of the treatment's success in raising metabolic efficiency, as the same amount of meat was produced with a lesser amount of feed.

Table (4): Addition of different types of commercial garlic in drinking water and its effect on the rate of weight gain (g)

T1	972.22 ± 36.74	767.11 ± 30.09	1739.33 ± 66.19
T2	1015.44 ± 48.62	799.38 ± 110.38	1814.82 ± 92.05
T3	1024.67 ± 20.34	936.64 ± 38.44	1961.31 ± 42.77
T4	1003.66 ± 32.82	976.68 ± 123.89	1980.34 ± 105.73
T5	965.56 ± 36.38	895.10 ± 93.15	1860.66 ± 61.43
Level of Significance	N.S	N.S	N.S

- Control treatment, T2 Garlic extract 500ml/1000L, T3 Garlic and herbs 350ml/1000L, T4 Garlic oil 200ml/1000L, T5 Garlic powder 200g/1000L.
- * Indicates the presence of significant differences among treatments.
- Different letters in the same column indicate significant differences among treatments at a probability level of (P ≤ 0.05).
- N.S indicates no significant differences among treatments.

Feed Consumed

Table 5 shows no significant differences at 11-24 days of age. At 25-35 days of age, a decrease in feed consumption was observed in the second, third, fourth, and fifth treatments compared to the control treatment, and there was no significant difference between the second treatment and the control treatment. Also, a decrease in the amount of feed consumed was observed at 11-35 days of age in the second, third, fourth, and fifth treatments compared to the control treatment. This indicates that after 14 days of addition from age 10 to 24, the active substances in garlic had not produced a sufficient cumulative effect on digestion and absorption in the birds, and the effect on their appetite. However, significant differences appeared at 35 days of age due to the continuous addition, as feed consumption decreased in all treatments compared to the first treatment. This is because the effect of the organic sulfur compounds found in garlic led to intestinal integrity and increased absorption efficiency of nutrients; therefore, the bird requires less feed to meet its nutritional and physiological needs (Al-Rabadi et al., 2020; Priyankarung et al., 2022).

Table (5): Addition of different types of commercial garlic in drinking water and its effect on the rate of feed consumption (g)

T1	1574.33 ± 51.83	1591.56 ± 51.22 a	3165.89 ± 43.03 a
T2	1540.45 ± 69.41	1460.22 ± 31.87 ab	3000.67 ± 63.17 b
T3	1587.33 ± 38.74	1388.22 ± 64.61 b	2975.55 ± 57.74 b
T4	1587.33 ± 38.74	1409.33 ± 32.84 b	2996.66 ± 10.01 b
T5	1565.78 ± 17.72	1342.22 ± 40.73 b	2908.00 ± 34.29 b
Level of Significance	N.S	*	*

- Control treatment, T2 Garlic extract 500ml/1000L, T3 Garlic and herbs 350ml/1000L, T4 Garlic oil 200ml/1000L, T5 Garlic powder 200g/1000L.
- * Indicates the presence of significant differences among treatments.
- Different letters in the same column indicate significant differences among treatments at a probability level of (P ≤ 0.05).

- N.S indicates no significant differences among treatments.

Feed Conversion Efficiency (FCR)

Table 6 showed no significant differences at the first age period (11-24 days) and the second (25-35 days). However, during the total age period (11-35 days), feed conversion efficiency improved for the third, fourth, and fifth treatments compared to the first treatment (control), and there was no significant difference between them and the second treatment. The significant improvement in the total period may be due to the ability of garlic over time to improve the intestinal environment and resist pathogens, which explains the increased feed conversion efficiency (Morais et al., 2023; Singh et al., 2019).

Table (6): Addition of different types of commercial garlic in drinking water and its effect on feed conversion efficiency (g feed / g weight gain)

T1	1.63 ± 0.09	2.08 ± 0.02	1.82 ± 0.06 a
T2	1.53 ± 0.14	1.92 ± 0.33	1.66 ± 0.09 ab
T3	1.55 ± 0.11	1.49 ± 0.12	1.52 ± 0.06 b
T4	1.58 ± 0.02	1.49 ± 0.18	1.52 ± 0.09 b
T5	1.63 ± 0.07	1.53 ± 0.18	1.57 ± 0.05 b
Level of Significance	N.S	N.S	*

- Control treatment, T2 Garlic extract 500ml/1000L, T3 Garlic and herbs 350ml/1000L, T4 Garlic oil 200ml/1000L, T5 Garlic powder 200g/1000L.
- * Indicates the presence of significant differences among treatments.
- Different letters in the same column indicate significant differences among treatments at a probability level of ($P \leq 0.05$).
- N.S indicates no significant differences among treatments.

Conclusions

1. The addition of garlic to drinking water did not lead to significant differences in body weight and weight gain.
2. The addition of garlic to drinking water led to reduced feed consumption and an improvement in feed conversion efficiency.

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