Study of Marigold Flower Powder Supplementation on Broiler Chicken Growth Performance

RAJNI ARORA

drrajni75@gmail.com

College of Veterinary and Animal Science Bikaner https://orcid.org/0000-0001-5631-5616

sakshi rathore

College of Veterinary and Animal Science Bikaner

Research Article

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Abstract

The increasing demand for natural alternatives to antibiotic growth promoters in poultry production has encouraged the exploration of plant-based feed additives. This study aimed to evaluate the effects of dietary supplementation with marigold flower powder (*Tagetes erecta*) on the growth performance and overall productivity of commercial broiler chickens.

A feeding trial was conducted using commercial broiler chicks reared under standard management and hygienic conditions for five weeks. Birds were randomly allocated to four dietary treatment groups, including a control group receiving a basal diet and three experimental groups receiving graded levels of marigold flower powder supplementation. The marigold flower powder was prepared from dried flowers, finely ground, and incorporated into the diets. Growth performance parameters, including body weight, weight gain, and feed intake, were recorded and evaluated throughout the experimental period.

Dietary inclusion of marigold flower powder positively influenced broiler performance. Supplemented groups exhibited improved growth characteristics compared with the control group, indicating enhanced nutrient utilization and productive efficiency. Feed consumption also increased in response to marigold supplementation, reflecting its favorable effect on feed acceptance and growth. Among the supplemented treatments, the intermediate inclusion level consistently produced the most desirable outcomes, demonstrating superior overall performance relative to both the control and other supplementation levels.

INTRODUCTION

Poultry farming is one of the fastest-growing sectors of Indian agriculture and has transformed from a traditional backyard activity into a highly organized commercial enterprise. Poultry meat is widely consumed due to its affordability, palatability, and relatively low fat content, making it an important source of high-quality animal protein. The increasing demand for poultry products has encouraged continuous efforts to improve broiler growth performance, feed efficiency, and product quality.

For many years, antibiotic growth promoters (AGPs) were extensively used in poultry diets to enhance growth, improve feed utilization, and reduce production costs. However, concerns regarding antimicrobial resistance, drug residues in animal products, and environmental impacts have led to restrictions on their use in several countries. Consequently, attention has shifted toward natural and sustainable alternatives, particularly plant-derived feed additives known as phytobiotics.

Phytobiotics obtained from herbs, spices, and medicinal plants possess various beneficial properties, including antimicrobial, antioxidant, anti-inflammatory, and immunomodulatory effects. These attributes can contribute to improved bird health and productivity. Among such phytobiotics, marigold (*Tagetes erecta*) has gained interest due to its rich content of bioactive compounds, including flavonoids, saponins, and carotenoids. These compounds exhibit strong antioxidant activity and play important roles in enhancing immunity, gut health, and overall physiological functions.

In addition, the increasing cost of conventional feed ingredients and the need for sustainable livestock production have stimulated interest in utilizing agricultural by-products and plant-based resources in animal nutrition. Dried marigold flower waste represents a promising, cost-effective feed additive that can contribute to both waste utilization and improved poultry performance.

Therefore, the present study was undertaken to evaluate the effect of dietary supplementation of marigold flower powder (*Tagetes erecta*) on the growth performance of commercial broiler chickens and to assess its potential as a natural alternative to antibiotic growth promoters for sustainable poultry production.

MATERIALS AND METHODS

The study was conducted at Poultry Unit, Department of Poultry Science, Department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner, Rajasthan University of Veterinary and Animal Sciences, Bikaner. The experiment was conducted over a period of 35 days, commencing on 2nd September, 2025 and concluding on 7th October, 2025. All the chicks were individually weighed and randomly distributed in four treatment groups with four replicates having 15 chicks in each replicate. The study involved one hundred and eighty (180) unsexed, apparently healthy day-old commercial broiler chicks of the same hatch, which were procured from a private hatchery in Ajmer. Experimental design for different treatment groups has been shown in Table 1. The chicks were reared under a standard deep litter system of management, adhering to recommended vaccination schedule.

Experimental Procedure

Table 1
Experimental Design for Different Treatment Groups

S. No.	Treatment group	No. of Broiler chicks/replication			Total number of Broiler chicks in each group
		R_1	R_2	R_3	
1	Control group fed basal diet without any supplementation (T_0)	15	15	15	45
2	Treatment group 1 supplemented with 0.3% Marigold Flower Powder (T_1)	15	15	15	45
3	Treatment group 2 supplemented with 0.6% Marigold Flower Powder (T_2)	15	15	15	45
4	Treatment group 3 supplemented with 0.9% Marigold Flower Powder (T_3)	15	15	15	45

METHOD OF PREPARATION OF MARIGLOD FLOWER POWDER

Fresh marigold flowers, sourced from a local market in Bikaner, were thoroughly washed with tap water. The petals were then carefully separated. The petals were then dried using a hot air oven at 60 degrees Celsius for 6–8 hours until they became crisp in the Department of Animal Nutrition. Subsequently, the dried petals were grounded into powder was prepared by grinding it mechanically. The resulting powder was sieved to ensure uniform particle size and stored in airtight containers and kept in a cool, dark and dry place to maintain its quality and potency.

COMPOSITION OF FEED AND FEEDING SCHEDULE

Broiler starter feed was supplied up to 21 days of age, after which broiler finisher feed was offered until the conclusion of the study on the 35th day. Feed was made available *ad libitum* to each group throughout the experimental period, administered twice daily in the morning and evening. The experimental diets were formulated as T_0, T_1, T_2 and T_3. The control diet was fed a basal diet without any marigold flower powder supplementation, while the T_1, T_2 and T_3 diets were supplemented with 0.3%, 0.6% and 0.9% marigold flower powder respectively.

All management procedures were conducted in accordance with established scientific guidelines.

Performance traits

1. Weekly body weight change

All day-old experimental chicks were weighted individually, and again at weekly intervals.

2. Weekly body weight gain

Broiler chicks were weighed individually at weekly intervals throughout the experimental period to determine total body weight gain and weekly weight gains was calculated by subtracting the previous week's body weight from the current week's body weight.

Weekly body weight gain = body weight (current week) – body weight (previous week)

Statistical analysis

The experimental data were subjected to statistical analysis (SPSS *Ver.* 24.0) using one way analysis of variance as described by Snedecor and Cochran (2004) to test for significant variation between treatment groups. Probabilities values of less than 0.05 ($P < 0.05$) were considered significant. Comparison of mean values was carried out by Duncan's Multiple Range Test (Duncan,1955). The results were interpreted and expressed as means ± pooled SEM.

RESULT AND DISCUSSSION

1. Average Body Weight

The mean body weight (g/bird) of broilers in the various treatment groups at different weeks is presented in Table 2 and analysis of variance is presented in Table 3. As shown in Table 2, the mean body weights of birds in all treatment groups increased progressively over the five-week trial. The differences among the treatment groups during the initial two weeks were not statistically significant. In the third week, the average live weights across the groups had significant variation ($P < 0.05$) among treatments. By the fourth week, statistical analysis indicated that the control group (T_0) had a significantly lower ($P \leq 0.01$) body weight relative to the marigold-supplemented groups. The body weight of broilers of T_2 exhibited highest body weight followed by T_1 group, while was followed by T_3 groups. T_0 group recorded the minimum body weights across the treatment groups.

At the conclusion of the experiment (fifth week), the T_2 group exhibited a highly significant ($P \leq 0.01$) mean body weight (1620.044 ± 2.03 g) compared to all other groups. It was followed by T_1 (1502.044 ± 0.86 g), which was followed by T_3 group (1398.178 ± 0.78 g). The lowest final body weight remained in T_0 group (1296.689 ± 1.15 g). Data from this study demonstrated the effects of adding Marigold Flower Powder in the broilers diet was beneficial in achieving higher final live weights relative to the control group which received only the basal diet without supplementation. The best result was found in T_2 group receiving a diet enriched with 0.6% marigold petal powder.

All experimental groups demonstrated consistent body weight growth during different weeks throughout the study period, as anticipated (Table 2). Groups receiving marigold supplementation displayed superior performance through elevated weekly body weights, although statistical analysis revealed significant differences which emerged from the third week onward. This delay can likely be because marigold's active compounds needed time to cause noticeable changes in the body. Upon the completion of the study, control group (T_0) birds weighed 1296.689 ± 1.15 g, while T_1, T_2, and T_3 groups weighed 1502.044 ± 0.86 g, 1620.044 ± 2.03 g, and 1398.178 ± 0.78g. These treated groups had 15.83%, 24.93%, and 7.82% higher live weights than control group, possibly from larger nutrient-absorbing areas in the duodenum and jejunum of marigold powder (MFP)-fed bird.

Uchewa et al. (2018) reported major weight gains in broilers drinking water with bush marigold leaf extract (MLE). El-Wahab *et al*. (2022) found the best gains in Japanese quail quail diets enriched with marigold flower extract or powder

(MFP). Rajput et al. (2012) reported higher live weights in broilers given MFE in feed. Sapcota (2022) observed major weight gains in broilers whose feeds were supplemented with marigold flower powder. Osiagor *et al.* (2023) reported substantial body weight increases in broilers provided with bush marigold leaf extract.

However, Wang et al. (2016) found no growth improvements from MFE in broilers. Foroutankhah et al. (2019) found the same results with Marigold Flower Powder, and Agiang et al. (2011) noted no effect on quail weight gain from bush marigold leaf extract in feed.

Table 2
Average Body Weight (g/bird) in different treatment groups

AGE IN WEEKS	GROUPS			
	T_0	T_1	T_2	T_3
Day-0	43.844 ± 0.13	43.867 ± 0.21	43.844 ± 0.25	43.822 ± 0.17
1	126.244 ± 0.21	126.178 ± 0.08	126.267 ± 0.16	126.244 ± 0.40
2	335.956 ± 0.29	336.356 ± 0.29	336.422 ± 0.25	336.222 ± 0.18
3	623.489^{a}±0.19	641.578^{c}±0.61	654.8^{d} ± 0.97	635.8^{b} ± 0.34
4	926.689^{a}±0.97	1044.333^{c}±1.60	1124.4^{d} ± 1.22	1002.844^{b}±1.07
5	1296.689^{a}±1.15	1502.044^{c}±0.86	1620.044^{d}±2.03	1398.178^{b}±0.78

Means having different superscript in a row differ significantly (P < 0.05) within a column

Table 3
Analysis of variance of Average Body Weight (g/bird) in different treatment groups

Age in weeks	DF Treatment	DF Replicate	DF Error	Mean Squares (Treatment)	Mean Squares (Replicate)	Mean Squares (Error)	Significance (Replicate)	Significance (Treatment)
Day-0	3	2	6	0.0029629	0.1759259	0.0983950	NS	NS
1	3	2	6	0.0044444	0.0711111	0.2162962	NS	NS
2	3	2	6	0.1277777	0.5914814	0.0744444	NS	NS
3	3	2	6	507.09172	0.4044444	79.672098	NS	*
4	3	2	6	20409.329	5.2144444	4.4569135	NS	**
5	3	2	6	57741.704	0.9781481	6.5070370	NS	**

NS = Non-Significant, * = Significant (P < 0.05) and ** = Highly Significant (P < 0.01

2. Average Body Weight Gain

The data on the Weekly and over-all Weight gain data (g per bird) across broiler treatments have been illustrated in Table 4. Findings from variance analysis showing the mean weekly and final body weight gain has been presented in Table 5. The statistical analysis of variance revealed a non-significant effect on body weight during the 1st and 2nd week of the trial while significant differences appeared among treatment groups during week 3rd, 4th and 5th week and on the overall body weight gain, a highly significant effect (P < 0.01) of marigold flower powder supplementation has been observed. The analysis indicated that birds in the Basal diet group (T_0) had a significantly (P < 0.01) reduced body weight

gain in comparison to those receiving marigold-supplemented diets and the body weight gains had significant variations among the treatment groups. By the fifth week, all marigold-fed groups (T_1, T_2, T_3) showed significantly ($P < 0.01$) higher gains than the group whose diets remained unsupplemented (T_0). Body weight gains in different treatment groups showed notable variations and thus differed significantly.

The average total body weight gain at the end of the experiment for the entire experimental period was greatest ($P < 0.01$) in the T_2 group (1576.067 ± 1.84 g), followed in descending order by T_1 (1458.01 ± 0.87 g), T_3 (1354.108 ± 0.87 g) and T_0 (1252.887 ± 1.27 g). Final mean body weight gains across treatment groups T_0, T_1, T_2 and T_3 differed significantly and among the treatment groups T_0 exhibited the lowest final gain among all treatments. Overall, the findings revealed a highly significant ($P < 0.01$) enhancement in weight gain of broilers of chickens due to adding of Marigold Flower Powder at 0.6% in feed followed by 0.3% which was followed by 0.9% and Minimum weight gain was observed in the Control group whose diet remained un-supplemented.

All tested groups displayed consistent body weight gains over the entire experimental period corresponding to elevated feed consumption. Marigold-supplemented groups demonstrated better overall performance with higher weekly body weights, although notable differences emerged only from 3rd week onwards. At study completion, control (T_0) birds gained 1252.887 ± 1.27 g, while T_1, T_2, and T_3 groups attained 1458.01 ± 0.87 g, 1576.067 ± 1.84 g, and 1354.108 ± 0.87 g, respectively. This enhancement may result from expanded absorptive surface areas in the duodenum and jejunum among marigold flower powder (MFP)-fed birds.

Uchewa et al. (2018) reported notable body weight gains in broilers administered bush marigold leaf extract (MLE) in drinking water. El-Wahab *et al.* (2022) observed superior gains in Japanese quail receiving dietary marigold flower extract (MFE) or powder (MFP). Rajput et al. (2012) documented enhanced live weight gain in broilers fed MFE, as reported by Sapcota (2022) with marigold flower powder supplementation and Osiagor *et al.* (2023) with bush marigold leaf extract.

In contrast, Wang et al. (2016) identified no body weight gain from MFE in broilers, a similar finding was observed by Foroutankhah et al. (2019) for MFP and Agiang et al. (2011) for bush marigold leaf extract in quail.

Table 4
Average Body Weight Gain (g/bird) among different treatment groups

Age in weeks	**Groups**			
	T_0	**T_1**	**T_2**	**T_3**
0–1	82.397 ± 0.25	82.287 ± 0.17	82.51 ± 0.35	82.417 ± 0.38
1–2	209.71 ± 0.50	210.173 ± 0.34	210.15 ± 0.14	209.977 ± 0.25
2–3	287.533^{a}±0.37	305.22^{c}±0.85	318.373^{d}±0.99	299.573^{b}±0.19
3–4	303.197^{a}±0.79	402.753^{c}±0.99	469.597^{d}±1.58	367.043^{b}±0.94
4–5	369.997^{a}±0.68	457.71^{c}±1.94	495.643^{d}±1.44	395.33^{b}±0.96
0–5	1252.887^{a}±1.27	1458.01^{c}±0.87	1576.067^{d}±1.84	1354.108^{b}±0.87

Means having different superscript in a row differ significantly ($P < 0.05$) within a column.

Table 5
Analysis of variance of Average Body Weight Gain (g/bird) among different treatment groups

Age in weeks	DF Treatment	DF Replicate	DF Error	Mean Squares (Treatment)	Mean Squares (Replicate)	Mean Squares (Error)	Significance (Replicate)	Significance (Treatment)
0–1	3	2	6	0.0252083	0.1860250	0.3088916	NS	NS
1–2	3	2	6	0.1371638	0.3415749	0.3423972	NS	NS
2–3	3	2	6	491.80509	0.4211999	1.7415333	NS	*
3–4	3	2	6	14484.327	8.2251750	2.3075194	NS	**
4–5	3	2	6	9878.8646	4.4280250	5.7816805	NS	**
0–5	3	2	6	57691.363	0.8265632	6.2655032	NS	**

NS = Non-Significant, * = Significant (P < 0.05) and ** = Highly Significant (P < 0.01)

CONCLUSION

The present study conducted at Rajasthan University of Veterinary and Animal Sciences, Bikaner demonstrated that dietary supplementation of marigold flower powder (MFP) exerts a positive influence on the growth performance of broiler chickens. Although no significant differences were observed during the initial two weeks, the beneficial effects became evident from the third week onward, indicating a cumulative physiological response to the phytogenic additive. Among the treatment groups, supplementation at 0.6% (T2) consistently produced the most favourable outcomes, yielding the highest body weight and body weight gain. These findings suggest that MFP enhances nutrient utilization and overall productivity, likely due to the bioactive compounds present in marigold that may improve digestion and metabolic efficiency. Conversely, increasing the inclusion level to 0.9% did not yield proportional benefits, indicating that moderate supplementation is optimal. Overall, marigold flower powder can be considered a promising natural feed additive for broiler production, with 0.6% inclusion identified as the most effective level under the conditions of this study. Its use may support improved growth performance while providing a potential alternative to synthetic growth promoters in poultry nutrition.

DECLARATIONS

AUTHORSHIP CONTRIBUTION STATEMENT

Dr. Sakshi Rathore carried out the research and wrote the article under the guidance of Dr. Rajni Arora.

ETHICS DECLARATION

All animal procedures were approved by the Institutional Animal Ethics Committee (IAEC) of College of Veterinary and Animal Science, RAJUVAS, Bikaner, Rajasthan and adhered to the guidelines set by CPCSEA. The welfare of the animals was prioritized throughout the study

CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

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DATA AVAILABILITY:

Data will be provided on request.

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