International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; 9(10): 199-202
www.biochemjournal.com
Received: 25-08-2025
Accepted: 28-09-2025

N Kowsalya
M.Tech, Department of Poultry Technology, College of Poultry Production and Management, TANUVAS, Chennai, Tamil Nadu, India

Sreyass KS
Assistant Professor, Section of Animal Sciences, SRM University, Chengalpattu, Chennai, Tamil Nadu, India

G Karthikeyan
Assistant Professor, Section of Animal Sciences, SRM University, Chengalpattu, Chennai, Tamil Nadu, India

Corresponding Author:
G Karthikeyan
Assistant Professor, Section of Animal Sciences, SRM University, Chengalpattu, Chennai, Tamil Nadu, India

Influence of dietary Azolla on growth and performance parameters in commercial broilers chicken

N Kowsalya, Sreyass KS and G Karthikeyan

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i10c.5950

Abstract
This study investigated the effect of dietary supplementation of dried Azolla at different inclusion levels on production performance parameters of commercial broiler chickens. A total of 250-day-old broiler chicks were randomly divided into five treatment groups: T_1 (Control: 100% commercial feed), T_2 (1% Azolla + 99% commercial feed), T_3 (3% Azolla + 97% commercial feed), T_4 (5% Azolla + 95% commercial feed), and T_5 (7% Azolla + 93% commercial feed). All birds were reared under standard management practices for the duration of the experiment. Significant differences were observed among the treatment groups for body weight, feed consumption, feed conversion ratio, and livability. Among all treatments, broilers fed 5% Azolla with commercial feed (T_4) demonstrated the best overall production performance. In conclusion, dietary inclusion of dried Azolla, particularly at 5%, can effectively enhance growth and production parameters in commercial broiler chickens.

Keywords: Azolla, body weight, feed consumption, feed conversion ratio, livability, broiler

1. Introduction
The quality of feed is one of the most important factors for achieving optimal growth and production performance in commercial chickens. Nutritional interventions, such as supplementation with plant-based feed additives, are increasingly used to enhance growth, feed efficiency, and overall health of broilers (Abdel-Ghany *et al*., 2020) [1]. Azolla, a fast-growing aquatic fern, is rich in protein, vitamins, and minerals, making it a promising feed supplement for poultry (Sahoo *et al*., 2019) [8]. Previous studies have shown that inclusion of Azolla in broiler diets can improve body weight, weight gain, feed efficiency, and survival rate (Khan *et al*., 2018) [5]. However, the optimal inclusion level of Azolla for maximizing production performance in commercial chickens remains variable.
The objective of the present study was to evaluate the effect of different levels of dried Azolla supplementation in commercial broiler diets on production performance parameters, including final body weight, weight gain, feed intake, feed efficiency, and survival rate.

2. Materials and Methods
A total of 90 day-old commercial broiler chicks (Vencobb 430Y) were used to evaluate the effect of dietary supplementation of dried Azolla on production performance. Azolla (*Azolla pinnata*), a species commonly used for poultry feed in India, was cultivated in selected ponds under controlled conditions, harvested, washed, and sun-dried to a moisture content of approximately 10%. The dried Azolla was then ground and mixed with commercial broiler feed according to the treatment levels. The birds were initially reared on standard commercial feed for 21 days. From day 21 to 35, the birds were randomly divided into five treatment groups, with 18 chicks per treatment. Each treatment group was further divided into three replicates of 6 chicks each (3 males and 3 females per replicate). The treatment groups were listed in Table 1.
The experimental birds were reared under standard management practices in an open-sided deep litter system. Feed and water were provided ad libitum throughout the experimental period. Growth parameters, feed intake, feed efficiency, and survival rate were recorded during the Azolla supplementation period (day 21 to 35) and data were analysed to determine the effect of different Azolla inclusion levels on broiler production performance.

Table 1: Experimental design

S. No.	Treatment groups	Treatment	No. of birds per treatment
1.	T_1	Control-100% commercial feed	18
2.	T_2	1% Azolla + 99% commercial feed	18
3.	T_3	3% Azolla + 97% commercial feed	18
4.	T_4	5% Azolla + 95% commercial feed	18
5	T_5	7% Azolla + 93% commercial feed	18
Total			90

The cumulative body weight, feed intake, feed conversion ratio, and weekly livability were documented throughout the experimental period.

2.1 Body Weight (g)
Each chick was weighed individually on the day of hatching and subsequently at the end of every week to monitor growth performance. The cumulative body weight was recorded weekly and summarized for the entire five-week experimental period.

2.2 Feed consumption (g)
Throughout the experiment, broiler chickens were provided feed *ad libitum*. A measured quantity of feed was supplied daily to each replicate group. At the end of each week, the remaining feed in the feeders was carefully collected and weighed to avoid any loss. Weekly feed intake for each replicate was calculated by subtracting the leftover feed from the total feed offered. Using these data, the cumulative average feed intake per bird was determined for each week and across the five-week trial.

2.3 Feed Conversion Ratio (FCR)
The feed conversion ratio was computed weekly and at the conclusion of the experiment based on total feed intake and body weight gain, using the following formula:

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Feed intake(g)}}{\text{Body weight gain(g)}} \times 100$$

2.4 Livability (%)
The number of chicks was recorded individually on the first day and at the end of each week to assess livability. The cumulative livability was determined weekly and for the entire five-week period. Livability percentage was calculated using the following formula:

$$\text{Livability (\%)} = \frac{\text{Number of live birds}}{\text{Total number of birds}} \times 100$$

The data obtained for various parameters were analyzed statistically using a Completely Randomized Design (CRD) following the procedures outlined by Snedecor and Cochran (1989) [9]. The treatment means were compared for statistical significance using Duncan's Multiple Range Test (Duncan, 1955) [4].

3. Results and Discussion
3.1 Body weight
The effect of dietary supplementation of dried Azolla on the cumulative body weight (g) of broiler chickens from 1 to 5 weeks of age is presented in Table 2. No significant differences (p>0.05) were observed between treatment groups during the first three weeks of rearing (day 1-21) when all birds were fed standard commercial feed.

After introduction of Azolla supplementation from day 21 to 35, significant differences (p<0.01) were observed in body weight among the treatment groups. At the fourth week, broilers fed 5% Azolla (T_4) exhibited the significantly (p<0.01) highest body weight (1297.33 g), followed by T_3 (1258.19 g) and T_2 (1239.88 g), while the control group (T_1) and T_5 had the lowest body weight 1109.31g and $1138.72^{b\pm}8.23$, respectively. At the fifth week, T_4 continued to show significantly (p<0.01) highest body weight (1921.35 g), followed by T_3 (1873.98 g) and T_2 (1857.64 g), whereas T_1 recorded the intermediate body weight (1714.20g). The 7% Azolla group (T_5) exhibited significantly (p<0.01) lowest body weight (1610.35 g) compared to all other treatment groups. The finding are consistent with previous studies reporting that moderate levels of Azolla improve growth performance due to its high protein content and favorable amino acid profile (Sahoo *et al*., 2019 [8].; Abdel-Ghany *et al*., 2020 [1].). In conclusion, moderate supplementation of Azolla (5%) can be recommended to enhance growth performance in commercial broilers during the later stage of rearing.

Table 2: Mean (±SE) cumulative body weight (g) as influenced by Dietary Azolla

Treatment	I week	II week	III week	IV week	V week
Control-100% commercial feed	$170.53^{\pm}0.13$	$412.22^{\pm}1.25$	$725.42^{\pm}3.17$	$1109.31^{b\pm}18.26$	$1714.20^{b\pm}8.68$
1% Azolla + 99% commercial feed	169.02±0.18	$401.25^{\pm}3.5$	$736.19^{\pm}4.62$	$1239.88^{ab\pm}22.13$	$1857.64^{ab\pm}9.26$
3% Azolla + 97% commercial feed	171.11±0.12	$410.72^{\pm}5.60$	$715.8^{\pm}6.62$	$1258.19^{ab\pm}13.62$	$1873.98^{ab\pm}12.68$
5% Azolla + 95% commercial feed	169.15±0.10	$414.00^{\pm}3.93$	$722.7^{\pm}4.39$	$1297.33^{a\pm}10.33$	$1921.35^{a\pm}11.54$
7% Azolla + 93% commercial feed	171.01±0.09	$409.09^{\pm}2.50$	$729.6^{\pm}5.63$	$1138.72^{b\pm}8.23$	$1610.35^{c\pm}7.53$
Significance	NS	NS	NS	**	**

Mean bearing different superscript between rows within a column differ significantly (p<0.01)

3.2 Feed consumption
The effect of dietary supplementation of dried Azolla on the cumulative feed consumption (g) of broiler chickens from 1 to 5 weeks of age is presented in Table 3.

Table 3: Mean (±SE) cumulative feed consumption as Influenced by Dietary Azolla

Treatment	I week	II week	III week	IV week	V week
Control-100% commercial feed	161.75±0.00	471.88±1.52	1015.27±4.57	1920.49^{b}±12.58	3080.25$^{b\pm}$19.31
1% Azolla + 99% commercial feed	161.83±0.00	473.75±1.50	1013.95$^{\pm}$8.54	1980.18^{ab}±22.56	3100.35$^{ab\pm}$21.22
3% Azolla + 97% commercial feed	161.88±0.00	473.73±3.90	1016.93$^{\pm}$2.92	1978.36^{ab}±17.93	3103.22^{ab}±16.19
5% Azolla + 95% commercial feed	161.65±0.00	470.67±0.42	1012.69$^{\pm}$1.86	2010.07^{a}±1.88	3131.47$^{a\pm}$4.64
7% Azolla + 93% commercial feed	161.78±0.00	472.00±2.89	1013.55$^{\pm}$4.79	1910.29^{b}±5.17	3065.27$^{b\pm}$4.07
Significance	NS	NS	NS	**	**

Mean within a column bearing different superscripts differ significantly (p<0.01)

No significant differences (p>0.05) were observed between the treatment groups during the first three weeks of age as all birds were fed standard commercial feed.

From the fourth week onwards, significant differences (p<0.01) were observed in feed consumption between the dietary groups. Broilers were fed 5% Azolla (T_4) exhibited the highest (2010.07 g) feed consumption. The lowest feed consumption was recorded in the control group (T_1-1920.49 g) and 7% Azolla group (T_5-1910.29 g).

At the fifth week, significant (p<0.01) differences were noticed in T_4 (5% Azolla) consumed the highest feed (3131.47 g), followed closely by T_3 (3103.22 g) and T_2 (3100.35 g). The control group (T_1.3080.25 g) and T_5 (7% Azolla: 3065.27 g) showed comparatively lower feed intake.

These findings suggest that moderate supplementation of Azolla at 5% enhances feed consumption in commercial broilers during the later stage of rearing, while higher inclusion levels (7%) tend to reduce intake. The results are similar with the earlier observation of (Bested and Morento,1985) [2] stated that Azolla affected the palatability of the feed and reduced feed consumption.

3.3 Feed conversion ratio

The effect of dietary supplementation of dried Azolla on the cumulative feed conversion ratio (FCR) of broiler chickens from 1 to 5 weeks of age is shown in Table 4.

Table 4: Mean (±SE) cumulative feed conversion ratio as Influenced by Dietary Azolla

Treatment	I week	II week	III week	IV week	V week
Control-100% commercial feed	0.94±0.00	1.14±0.00	1.39$^{\pm}$0.00	1.73^{a}±0.01	1.79$^{b\pm}$0.01
1% Azolla + 99% commercial feed	0.95±0.00	1.18±0.01	1.37±0.01	1.59^{ab}±0.01	1.66$^{ab\pm}$0.01
3% Azolla + 97% commercial feed	0.94±0.00	1.15±0.02	1.42±0.02	1.57^{ab}±0.04	1.65$^{ab\pm}$0.00
5% Azolla + 95% commercial feed	0.95±0.00	1.13±0.01	1.40±0.02	1.54^{a}±0.01	1.62$^{a\pm}$0.00
7% Azolla + 93% commercial feed	0.94±0.00	1.15±0.00	1.38±0.01	1.67^{b}±0.00	1.90$^{c\pm}$0.00
Significance	NS	NS	NS	**	**

Mean bearing different superscript between rows within a column differ significantly

**-Highly significant (p<0.01)

During the first three weeks of rearing, no significant differences (p>0.05) were observed between the treatment groups.

However, after the introduction of Azolla supplementation from day 21 to 35, significant differences (p<0.01) in FCR were recorded among the treatment groups. In the fourth week, broilers fed 5% Azolla (T_4) exhibited a significantly (p<0.01) better feed conversion ratio (1.54), followed by T_3 (1.57) and T_1 (1.59), while T_5 (7% Azolla) showed the poorest FCR (1.67). A similar trend continued in the fifth week, with T_4 (5% Azolla) showing the best FCR (1.62), significantly outperforming all other groups. This was followed closely by T_3 (1.65) and T_2 (1.66), while the control group (T_1) had a slightly poorer FCR (1.79). The 7% Azolla group (T_5) recorded the significantly (p<0.01) highest FCR (1.90), indicating reduced feed efficiency.

These results align with previous findings suggesting that moderate inclusion levels of Azolla (particularly at 5%) improve feed efficiency due to its favorable nutrient profile, including high protein content and balanced amino acids. Similar findings were reported by Querubin *et al*. (1986) [7]. The higher levels of fiber and tannins present in aquatic plants may have contributed to reduced nutrient utilization, which consequently led to a decline in feed conversion ratio (Muzlar *et al*., 1978) [6].

3.4 Livability

The effect of dietary inclusion of dried Azolla on the cumulative livability (%) of broiler chickens from 1 to 5 weeks of age is presented in Table 5. During the first three weeks of rearing, all treatment groups exhibited 100% livability, indicating no mortality and no significant differences (p>0.05) among the groups.

From the fourth to the fifth week, variations in livability were observed. In the fourth week, the control group (T_1) and the 7% Azolla group (T_5) showed a slightly reduced livability of 97.22%, whereas the remaining groups (T_2, T_3, and T_4) maintained 100% livability. In the fifth week, a slight reduction in livability (97.22%) was observed in T_2 (1% Azolla), and T_5 (7% Azolla), while all other groups recorded 100% livability.

Regarding cumulative livability up to the fifth week, the 3% and 5% Azolla supplemented groups (T_3 and T_4) exhibited the highest cumulative livability (100%), followed by T_1 and T_2 (97.22%), while the 7% Azolla group (T_5) recorded the lowest cumulative livability (94.44%).

Although numerical differences were noted, statistical analysis indicated no significant differences (p>0.05) among the treatment groups in terms of cumulative livability. These findings suggest that moderate levels of Azolla supplementation (3-5%) do not adversely affect the livability of broilers and can be safely incorporated into broiler diets.

The results are similar with (Castillo *et al*. 1981) [3]. who also found no toxic effect of dietary Azolla on broiler.

Table 5: Mean (±SE) cumulative livability (%) as Influenced by Dietary Azolla

Treatment	Weekly livability					Cumulative livability up to V week
	I week	II week	III week	IV week	V week	
Control-100% commercial feed	100.00	100.00	100.00	97.22	100.00	97.22
1% Azolla + 99% commercial feed	100.00	100.00	100.00	100.00	97.22	97.22
3% Azolla + 97% commercial feed	100.00	100.00	100.00	100.00	100.00	100.00
5% Azolla + 95% commercial feed	100.00	100.00	100.00	100.00	100.00	100.00
7% Azolla + 93% commercial feed	100.00	100.00	97.22	100.00	97.22	94.44

Conclusion

Broilers fed with 5% dried Azolla showed the best results in body weight gain, feed intake, and feed conversion efficiency. Hence, it is recommended to supplement broiler diets with 5% Azolla during the later growth stage to enhance production performance. However, higher inclusion levels (7%) reduce performance and livability.

References

1. Abdel-Ghany WA. A review on the use of *Azolla* species in poultry production. Journal of World's Poultry Research. 2020;10(2):378-384.
2. Bested SB, Morento SE. The effect of different percentages of *Azolla* on fattening pigs. MSAC Journal (Philippines). 1985;17:31-40.
3. Castillo LS, Gerpacio AL, Paseual FSD. Exploratory studies on *Azolla* and fermented rice hulls in broiler diets. College, Laguna (Philippines); 1981. p.6.
4. Duncan DB. Multiple range and multiple F-tests. Biometrics. 1955;11(1):1-42.
5. Khan FU, Ullah R, Kinkpe L, Hassan SU, Ahamba IS, Goswami N, *et al*. Substitution of soybean meal with *Azolla pinnata* meal improves gut histomorphology and growth performance in commercial broilers. Revista Brasileira de Ciência Avícola. 2024;26(4):001-012.
6. Muzlar AJ, Slinger SJ, Burton JH. Chemical composition of aquatic macrophytes III. Mineral composition of freshwater macrophytes and their potential for mineral nutrient removal from lake water. Canadian Journal of Plant Science. 1978;58:851-862.
7. Querubin LJ, Aloantara PF, Luis ES, Princesa AO. Chemical composition and feeding value of *Azolla* in broiler ration. Philippine Journal of Veterinary and Animal Science. 1986;12:65-70.
8. Sahoo B, Panda AK. *Azolla*: the eco-friendly super feed for poultry. Vigyan Varta. 2025;6(4):206-208.
9. Snedecor GW, Cochran WG. Statistical Methods. 8th ed. Ames (IA): Iowa State University Press; 1989.