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# Effect of *Azolla* (*Azolla pinnata*) feed on the growth of broiler chicken

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## Abstract
Poultry and in particular ducks and chickens can be raised on a diet including fresh *Azolla*. the nutrient digestibility of crude protein, crude fat, and crude fiber were not affected by the level of *Azolla* in the ration, and that broilers can readily digest the crude fiber in *Azolla*, but not that in rice bran, so that digestibility is not a limiting factor when *Azolla* is used. Nutritive value of *Azolla* is well documented which shows that it is a good source of protein with almost all essential amino acid required for animal nutrition (notably lysine). Furthermore, it also provides macronutrients like calcium, magnesium, potassium and vitamins like vitamin A (precursor beta-carotene) and B12. All these facts suggested that *Azolla* can be used as unconventional feed with protein supplement for many species including ruminants, poultry, pigs and fish.

**Keywords:** Poultry, diet, protein, *Azolla*, nutrition, vitamin

## Introduction
The poultry industry has traditionally been one of the most profitable businesses in India's agriculture, providing nutritious meats and eggs for human consumption within the shortest possible time. Although the poultry industry in India has made remarkable progress during last 3 decades, yet the escalating cost and unavailability of the feed ingredients are the major deterrent for target production. Feed is the most expensive of all inputs and about 70% of production cost is accounted for feed alone [10]. As feed related improvement in the performance has a profound effect on profitably, the poultry nutritionists have been trying to find out alternative cost effective, non-conventional feed ingredients. Aquatic plant species, because of their growth habit, appear not to accumulate secondary plant compounds and therefore offer a greater potential than tree leaves as a source of protein for monogastric animals [3].

The greens (green plants) have long been recognized as the cheapest and most abundant potential source of proteins because of their ability to synthesize amino acids from a wide range of virtually unlimited and readily available primary materials [8]. Any assessment of the potential of leaf meals in non ruminant nutrition necessitates a comparative review of nutrient content [3, 6]. Though the pigmenting efficiency of leaf meals for broiler chickens remains virtually unexplored, the attributes of leaf meals for egg yolk pigmentation have long been recognized [13, 17]. Poultry and in particular ducks and chickens can be raised on a diet including fresh *Azolla*. the nutrient digestibility of crude protein, crude fat, and crude fiber were not affected by the level of *Azolla* in the ration, and that broilers can readily digest the crude fiber in *Azolla*, but not that in rice bran, so that digestibility is not a limiting factor when *Azolla* is used. Nutritive value of *Azolla* is well documented which shows that it is a good source of protein with almost all essential amino acid required for animal nutrition (notably lysine). Furthermore, it also provides macronutrients like calcium, magnesium, potassium and vitamins like vitamin A (precursor beta-carotene) and B12. All these facts suggested that *Azolla* can be used as unconventional feed with protein supplement for many species including ruminants, poultry, pigs and fish [9]. *Azolla* is an aquatic free floating fern belonging to the family Salviniaceae. Nutritive value of *Azolla* is well documented which shows that it is a good source of protein with almost all essential amino acid required for animal nutrition (notably lysine).

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## 2. Materials and Methods

For the research purpose the *Azolla* was collected from local water bodies. It was then dried in the sunlight for 3/4 days. After sun drying, it was ground and stored in the plastic bags until used for feeding. Chemical analysis of *Azolla* (Table 1) has been done:

**Table 1**: Chemical analysis of *Azolla*

| Sl. No | Nutrients | *Azolla* ( %DM) |
|---|---|---|
| 1 | Crude Protein | 25.08 |
| 2 | Ether extract (EE) | 3.95 |
| 3 | Crude Fibre | 14.39 |
| 4 | Nitrogen Free Extract (NFE) | 38.73 |
| 5 | Total Ash | 17.5 |
| 6 | Calcium | 2.06 |
| 7 | Phosphorus | 0.72 |

Chicks were weighed and equally and randomly divided and distributed in five dietary treatments groups ($T_1$, $T_2$, $T_3$, $T_4$ and $T_5$) having three replications in each. Each dietary treatment group consists of 30 chicks distributed in three replicated pens, with 10 chicks in each. The chicks were maintained on a 24 hours consistent lighting schedule and proper ventilation was ensured. The birds in the control group ($T_1$) were fed diet without *Azolla* while as in other groups fish meal was replaced by *Azolla* 5% ($T_2$), 10% ($T_3$), 15% ($T_4$) and 20% ($T_5$).

The data obtained were statistically assessed by the Analysis of Variance (ANOVA) through SPSS (17.0) software considering replicates as experimental units. Duncan's multiple range test was used to test the significance of difference between the differences of significant at $p \leq 0.0$ [7].

## 3. Result and Discussion

Chemical composition of the *Azolla* was analyzed and presented in the Table 1. The analysis was carried out following the Kjeldhal method was used for crude protein estimation [2]. The results of chemical analysis of *Azolla* (Table 1) revealed presence of 23.08% Crude protein (CP), 3.95% Ether extract (EE), 14.39% Crude fiber (CF), 38.73% Nitrogen free extract (NFE), 17.5% Total ash, 2.06% Calcium and 0.72% Phosphorus on dry matter basis.

The crude protein level of *Azolla* was found 25.08 percent. The result was close to the crude protein level found by the Sreemannaryana [11]. Singh [13] also reported that the crude protein might vary from 25-37.36 percent. Ether extract content of *Azolla* was 3.95 percent, the composition may vary but similar result was reported by Singh [13] and Sreemannaryana [11]. Nitrogen free extract (NFE) content of *Azolla* sample was 38.73 percent. The result is similar to the the observation of Bhuyan [4].

**Table 2:** Average body weight (gm) measured in weakly, of the broilers at different dietary treatments

| Age in week | Treatments | | | | |
|---|---|---|---|---|---|
| | $T_1$ (0%) | $T_2$ (5%) | $T_3$ (10%) | $T_4$ (15%) | $T_5$ (20%) |
| Initial week (1st week) | 123.01 | 125.3 | 122.37 | 122.10 | 122.5 |
| 2nd week | 213.7 | 215.6 | 215.51 | 210.3 | 211.67 |
| 3rd week | 455.37 | 458.8 | 526.66 | 423.6 | 421.63 |
| 4th week | 752 | 760.60 | 850.80 | 725.70 | 712.6 |

The body weights of broiler chicken were shown in the above table. The body weight differed significantly at 3 and 4 weeks of age. In both the weeks almost similar trend in body weight were obtained. In this experiment, the diet containing of 10% ($T_3$) level of *Azolla* meal was best in respect of body weight (850.80g) while $T_2$ (5%) diet was second the best (740.60g) in 4 weeks of age. But in case of higher *Azolla* meal content shows the negative impact as we have observed in $T_4$ (15%) and $T_5$ (20%) treatments. The result is similar with the earlier observation of While Cambel [18]. In this experiment same meal was replaced by *Azolla* meal. The digestible protein percent in sesame meal was 89.9 percent [3] but in *Azolla* meal it was 56.6 percent [15]. So use of higher level of *Azolla* meal may had negative effect on body weight as in $T_4$ (15% *Azolla* meal) and $T_5$ (20% *Azolla* meal). Although Subudhi and Singh [12, 13] found the best result using 5% *Azolla* meal. The higher level of *Azolla* ($T_3$ and $T_4$) meal resulted poor growth than the other treatments. This might be due to higher level of NDF in *Azolla* meal is the main limiting factor for efficient utilization in monogastic animals. Tamany [15] reported higher lignin might cause poorer growth as against the diet containing 15 and 20 percent *Azolla* meal.

**Table 3**: Correlation Matrix for Average weight comprising variable dietary *Azolla* (0-20%) of different treatments.

| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ |
|---|---|---|---|---|---|
| $T_1$ | 1 | | | | |
| $T_2$ | .389 | 1 | | | |
| $T_3$ | .302 | .996 | 1 | | |
| $T_4$ | -.856 | .143 | .234 | 1 | |
| $T_5$ | .996 | .469 | .385 | -.807 | 1 |
| ** Correlation is significant at the 0.01 level (2- tailed) | | | | | |

No bird died in any treatment group during the experimental period, indicating that the inclusion of *Azolla* in feed had no deleterious effect on broiler chicken. The final body weights were improved significantly ($p<0.05$) in birds fed 10% *Azolla* ($T_3$) when compared with the control group, thus confirming the results of While Cambel [18] who observed improvement in live weight of broiler chicks fed 10% *Azolla* meal in the diet. However, as the level of *Azolla* was increased ($T_4$ and $T_5$), it resulted in decreased body weights as was reported by Parthasarthy [10]. Reduction in the body weight due to higher *Azolla* levels (15 and 20%) might be due to higher level of NDF [5] and lignin [3] in *Azolla* meal which are the main

limiting factors for its efficient utilization. There was a significant ($p$>0.05) decrease in feed consumption of all the groups fed *Azolla* in diet compared to control. Lowest feed consumption was observed in the group fed 20% *Azolla* in the diet ($T_5$), confirming the results of Alalade [1] who reported decrease in feed consumption with an increase in the level of *Azolla* up to 15% in the diet of poultry birds. The decrease in the feed consumption has been attributed by to reduced palatability [11] and increased bulkiness of *Azolla* [3] which reduces its utilization.

## 4. Conclusion

Sun dried *Azolla* on chemical analysis showed that rich in crude protein, trace minerals and vitamins and hence it can be used as livestock feed as a unconventional feed. The best result we can expect from 5-10% *Azolla* content meal as we have seen through the experiment. Therefore based on the results obtained, it may be concluded that dietary replacement of 5-10% protein source by *Azolla* has a positive impact on improvement in terms of body weight and net returns per bird. Therefore, 5-10% *Azolla* may be incorporated in the diets of broiler chicken to make the broiler production more profitable. From the above discussion it may be concluded that *Azolla* is a good source of protein and may be used upto 10% level in the broiler diet for better performance. *Azolla* meal is an unconventional feed ingredients at low price and may be used as a poultry feed to reduce feed cost.

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