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Chemical evaluation of *Azolla* and its impact of dietary supplementation on the meat sensory attributes in broiler Japanese quail

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Abstract

Azolla, a small aquatic fern known for its tremendous potential as an unconventional feed resource due to its rich crude protein content and can be used as a potential natural protein source in livestock and poultry feeds and also rich in essential amino acids, minerals, and vitamins. The objective of this experiment was to evaluate the nutritive value of *Azolla* and its dietary supplementation effect on the meat sensory attributes in broiler Japanese quail.

A total of one hundred thirty-five, day-old broiler Japanese quail chicks were randomly allocated to three treatment groups *viz* T0 (Control) supplemented only basal diet whereas T1 and T2 supplemented 5% and 10% *Azolla* respectively along with basal diet on a DM basis. The experiment was conducted for 0–5 weeks in the poultry instructional and demonstration unit (PIDU) of the College of Veterinary Science and Animal Husbandry, Anjora, Durg.

Azolla was cultivated, harvested, and dried under shade, the proximate analysis of the dried *Azolla* sample revealed a dry matter content of 6.7 % and 24 % crude protein, 15 % crude fibre, 3.38 % ether extract, 16.6 % total ash, 36.3 % nitrogen-free extract (NFE), 2.18 % calcium and 0.47 % phosphorus. Findings emphasize the potential of *Azolla* as an unconventional feed supplement with respect to treatment group T1 showed better sensory attributes compared to T2. The appearance, flavour, juiciness ($p < 0.05$) and overall palatability/acceptability ($p = 0.001$) of meat in the 5 % *Azolla* -supplemented group were ranked best compared to the control group and 10 % *Azolla* -supplemented group.

Keywords: *Azolla*, proximate analysis, sensory attributes

Introduction

There are limited land resources available for growing forage or generating animal feed due to the rising need for land to generate food for a growing human population also the cost of conventional feed is high and has a detrimental effect on the producer's net profitability.

The study of unconventional feed resources as supplements or substitutes for conventional feed is an effective way to overcome the gap between demand and nutrient supply and ensure optimal livestock production throughout the year.

Azolla is an aquatic fern with tremendous promise as a feed resource. *Azolla* is an excellent choice for supplemental feeding of animals due to its symbiotic association with *Anabaena* *Azolla* and ease of cultivation with its high protein content and efficacy as a source of plant protein and provitamins, *Azolla* stands out as a potential feed option. Because of its susceptibility to drought, the term "*Azolla*" is derived from the Greek words "*azo*" and "*alloyo*" which mean "to dry" and "to kill," respectively.

In view of the above facts, the current study was conducted to evaluate the nutritional value and mineral profile of *Azolla pinnata* as a feed resource and the effect of *Azolla* supplementation on organoleptic characteristics of the meat of Japanese quail broiler.

Material and Method

Cultivation of *Azolla pinnata*

Azolla pinnata was cultivated and propagated using steel tanks with dimensions of 4.0 x 3.5 feet (length x breadth) and a depth of 45 cm. Silpaulin sheets were used to cover the tank, ensuring uniformity and protection. The fertile soil was mixed with, and water was added up to a height of 25-30 cm.

Followed by the inoculation of pure fresh *Azolla* culture, after 7-8 days the tank is fully filled with *Azolla*.



Fig 1: Cultivation of *Azolla*

Collection, Storage and Processing of *Azolla*

The growth rate of *Azolla pinnata* was observed to be very fast, with the entire tank being covered within 8-10 days and harvested every 7th day. Harvesting was done by carefully removing mature, healthy *Azolla* plants from the tank and thoroughly washed in clean water to remove any pollutants or impurities and shade-dry in a well-ventilated area for a few days then dried *Azolla* samples were grounded to a particle size of 1 mm by using a vertical feed grinding machine, in the Department of Animal Nutrition at the College of Veterinary Science & A.H. Anjora, Durg, Chhattisgarh and stored in an air-tight sealed bag for further use.



Fig 2: Grounded-dried-*Azolla*

Proximate Analysis of *Azolla pinnata*

Properly weighted samples of dried *Azolla* were analysed in triplicate for their proximate composition as per AOAC (2005) [3]. Calcium (Ca) and Phosphorus (P) contents were analysed as per the methods described by Talpatra *et al.*, (1940) [15] and Fiske and Subba Rao (1925) [8] respectively.

Location of study

In the poultry instructional and demonstration unit (PIDU) of the College of Veterinary Science and A.H., Anjora, Durg.

Experimental design

The experiment was conducted on 135 numbers of day-old chicks of Japanese quails. The duration of the experiment was 0-5 weeks. Day-old chicks were randomly allocated to three treatment groups and each treatment group had 3 replicates with 15 birds in each. The quail feed for starter and finisher was formulated according to ICAR (2013) [9] recommendation. For each growth phase 3 types of diets were formulated, diet 1 as control (T0) with no *Azolla*, diets 2 and 3 contained 5% (T1) and 10% (T2) *Azolla* replacing the ingredients in the control diet on a DM basis

Statistical Analysis

Snedecor and Cochran Completely Randomized Design (CRD) was used to do a one-way Analysis of Variance (ANOVA) on the data in order to understand the findings (1994). Using Duncan Multiple Range Test, the importance of the difference and interaction was evaluated (DMRT).

Meat Sensory Attributes

At the end of the experiment, organoleptic evaluation of meat was carried out by experts, who were regular consumers of quail meat in their diet. both breast and thigh meat samples were evaluated after boiling of meat with salt and water, and cut into pieces along the major axis. Ten experienced panelists were chosen from the staff members of the College of Veterinary Science & A.H. Anjora, DSVCKV Durg, Chhattisgarh at the Department of Livestock Production and Technology. Samples were coded with random numbers and were evaluated for organoleptic attributes like Appearance/colour, Flavour, Texture, Juiciness, and Overall palatability/acceptability, scoring marks ranked 1-8 (8=Excellent, 7=Very good, 6=Good, 5=Fair, 4=Slightly poor, 3=Moderately poor, 2=Very poor, 1=Extremely poor) scale.

Result and Discussion

1. Chemical Evaluation of *Azolla*

In the current study, the chemical composition of *Azolla* was analyzed. The findings revealed that it contained 6.7% dry matter (DM), 24% crude protein (CP), 3.8% crude fat, 15% crude fibre, 36.3% nitrogen-free extract (NFE), 16.6% total ash, 3.64% acid-insoluble ash (AIA) (Table 1).

The DM content of 6.7% in *Azolla* was consistent with the findings of Sujatha *et al.* (2013) [12], indicating the reliability of the present study's results. Similarly, Alalade and Iyayi (2006) [1] reported a CP value of 24%, which aligns with the result obtained in this study. However, other studies reported slightly higher CP values, such as 25.46% by Shamna *et al.* (2013) and 26.50% by Bhatt *et al.* (2020) [4].

The ash content in *Azolla* was found to be 16.6%, which is similar to the value reported by Swain *et al.* (2018). However, higher ash content ranging from 17.34% to 29.17% has been reported by Anitha *et al.* (2016) [2] and Bolka *et al.* (2011) [5].

The calcium (Ca) and phosphorus (P) content in *Azolla* were determined to be 2.18% and 0.47%, respectively, in the present study. These values are within the wide range of Ca (0.58% to 2.58%) and P (0.26% to 1.29%) concentrations reported by Cheryl *et al.* (2014) [6] and Alalade and Iyayi (2006) [1]. The variation in mineral content could be influenced by factors such as temperature, soil composition, water quality, and other external factors

Table 1: Chemical Evaluation of *Azolla* (On DM basis)

S.N.	Particulars	<i>Azolla</i>
1	Dry matter	6.7
2	Crude protein	24
3	Crude fibre	15
4	Ether Extract	3.8
5	Total ash	16.6
6	Nitrogen free extract	36.3
7	Calcium	2.18
8	Phosphorus	0.47

2. Meat Sensory Attributes

The effect of various levels of dried *Azolla* on meat sensory

attributes has been depicted in Table 2 and observed that a significant effect of dietary inclusion of dried *Azolla* on various sensory attributes viz appearance, flavour, juiciness ($p<0.05$) and overall acceptability ($p=0.001$) of meat in the 5% (T₁) *Azolla*-supplemented group was ranked best compared to the control (T₀) and 10% (T₂) *Azolla* -supplemented group. Our findings are supported by the findings of previous researchers Tugiyanti *et al.* (2019) [14] who found that the quail meat tenderness of *Azolla* -supplemented birds was better compared to non-supplemented ones. Rana *et al.* (2017) [10] also reported better acceptability of poultry meat in the 5% *Azolla* -supplemented group compared to the control.

Table 2: Effect of different dietary inclusion levels of *Azolla* on organoleptic characteristics of meat from 35 days old quail broiler

Sensory Attributes	T0 (control)	T1 (5%)	T2 (10%)	Sig.	P Value
Appearance	6.77b±0.15	7.22a±0.04	6.63b±0.07	S	*0.012
Flavour	6.57b±0.09	7.12a±0.01	6.77b±0.09	S	*0.005
Juiciness	7.09b±0.05	7.21a±0.02	7.15b±0.01	S	*0.055
Texture	6.87b±0.09	7.23a±0.04	6.87b±0.13	S	*0.105
Overall palatability	7.06b±0.01	7.50a±0.06	7.22b±0.05	S	**0.001

Superscripts are read row-wise for comparison of means. Means in the same row with different superscripts

a, b, c are significantly different *($p<0.05$), **($p<0.01$), NS= Non-Significant

Conclusion

The present study's results indicate that *Azolla* has a promising chemical composition, with significant levels of DM, CP, and ash content. *Azolla* can serve as a potential source of protein and a valuable feed ingredient for poultry also a significant effect of dietary inclusion of dried *Azolla* on various sensory attributes viz appearance, flavour, juiciness and overall palatability except texture was experienced and group T₁ (5% *Azolla* supplementation) birds.

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