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## Technological innovation to harnessing the nutritional power of Azolla-apple pomace as an innovative feed for backyard poultry

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### Abstract

This study explores the potential of utilizing a novel feed combination comprising Azolla (water fern) and apple pomace for backyard poultry. Azolla, a nutrient-rich aquatic fern, and apple pomace, a byproduct of apple processing, offer a balanced nutritional profile suitable for poultry diets. The experiment aimed to evaluate the effects of incorporating Azolla and apple pomace into the feed on the growth performance, egg production, and overall health of backyard poultry. The study involved a feeding trial with different experimental groups receiving varying proportions of Azolla and apple pomace in their diet. Parameters such as body weight gain, feed conversion ratio, egg production, and egg quality were monitored throughout the trial. The results indicate that the inclusion of Azolla and apple pomace positively influenced the growth and productivity of the backyard poultry, providing a cost-effective and sustainable alternative to conventional feeds. Furthermore, the nutritional analysis revealed that the combined Azolla-apple pomace feed offered essential nutrients, including proteins, vitamins, and minerals, contributing to the overall well-being of the poultry. The study suggests that this alternative feed formulation could be a viable option for small-scale poultry farmers, promoting resource efficiency and reducing dependence on traditional feed sources.

**Keywords:** Azolla-apple, innovation, nutritional, poultry, water fern

### 1. Introduction

In recent years, the quest for sustainable and nutritionally enriched poultry feed has driven researchers and farmers alike to explore alternative and unconventional sources. Among the promising solutions emerging is the combination of Azolla, a nutrient-rich aquatic fern, and apple pomace, a byproduct of apple processing (Li *et al.*, 2017)<sup>[1]</sup>. This dynamic duo presents itself as a compelling option for backyard poultry enthusiasts seeking a cost-effective and environmentally friendly approach to enhance the health and productivity of their feathered flocks. Azolla, commonly referred to as the "green gold of the 21st century," is a floating fern that thrives in aquatic environments. Its exceptional nutritional profile makes it an attractive option for supplementing traditional poultry diets (Saxena *et al.*, 2017)<sup>[2]</sup>. Rich in protein, essential amino acids, vitamins, and minerals, Azolla has the potential to contribute significantly to the overall well-being and growth of poultry. By combining it with apple pomace, a byproduct often overlooked in waste management, poultry farmers can create a synergistic feed formula that not only maximizes nutrition but also addresses environmental concerns (Alonso *et al.*, 2015)<sup>[3]</sup>. Apple pomace, the residue left after apple juice extraction or cider production, is abundant and poses a disposal challenge for many apple processing facilities. However, its high fiber content and moderate levels of nutrients make it a valuable component in animal feed formulations. When blended with Azolla, apple pomace not only acts as a source of dietary fiber but also contributes essential vitamins and minerals, enhancing the overall nutritional diversity of the feed (Pekel *et al.*, 2020)<sup>[4]</sup>.

This innovative approach not only capitalizes on the nutritional benefits of Azolla and apple pomace but also aligns with the principles of sustainability. By repurposing apple pomace that would otherwise be considered waste and integrating it into poultry diets, backyard farmers can reduce their ecological footprint while optimizing the efficiency of their operations.

As we delve deeper into the exploration of Azolla-apple pomace feeds for backyard poultry, this study aims to shed light on the potential advantages, challenges, and best practices associated with this novel feeding strategy. By doing so, we hope to empower poultry enthusiasts with the knowledge needed to make informed decisions about incorporating this innovative feed into their flock management practices, ushering in a new era of sustainable and nutritionally optimized backyard poultry farming.

## 2. Materials and Methods

The study employed randomized complete block design, with different dietary treatments incorporating Azolla and apple pomace. Azolla was harvested from local water bodies, and apple pomace was obtained from nearby orchards/processing units of Sopore Jammu and Kashmir. Samples were collected in triplicate for compositional analysis. Experimental diets were formulated by replacing a percentage of conventional poultry feed with a combination of Azolla and apple pomace. Different ratios were tested to determine the optimal blend for poultry nutrition and 2:3 ratio of Azolla: Apple pomace was found to be optimal blend for poultry nutrition. Healthy backyard poultry (e.g., layers or broilers) was selected for the feeding trial. The birds were allocated to different treatment groups with balanced representation.

The feeding trial was conducted over a specified period, and parameters such as feed intake, body weight gain, feed conversion ratio, and egg production were monitored. The birds were given ad libitum access to water throughout the trial. Data on growth performance, feed utilization, and egg production (if applicable) were recorded daily. At the end of the trial, representative samples of eggs and poultry meat were collected for nutritional analysis.

Statistical analysis was performed using appropriate software to assess the significance of differences between treatment groups. ANOVA and post hoc tests will be employed, with a significance level set at  $p < 0.05$ .

## 3. Results

Combination of Azolla-Apple Pomace feed significantly improved the breast angle and shank length compared to the birds that were fed with Conventional Feed poultry feed (Table 1). The effects of feed replacement on the growth and development of the chicken are summarized in Table 1. In contrast, to control chicks fed Conventional Feed, Combination of Azolla-Apple Pomace groups average body weight gain (BWG) was increased comparatively ( $p < 0.05$ ). The Control group resulted in significantly lower BWG.

Broilers fed with a combination of Combination of Azolla-Apple Pomace had a significantly higher body weight gain (BWG) than those fed with normal diet. Data concerning feed consumption (FC) and FCR of backyard poultry affected by the diet and supplementations are shown in Table 1. Feed consumption was significantly decreased in backyard poultry fed with normal feed compared to Combination of Azolla-Apple Pomace Feed. Only the Combination of Azolla-Apple Pomace was able to improve FCR in comparison to another group.

## 4. Discussion

Backyard poultry farming is a vital component of sustainable agriculture, providing households with a source of protein and income. As the demand for poultry products continues to rise, there is a growing need for innovative and cost-effective feed alternatives. This discussion explores the potential of using a combination of Azolla and apple pomace as a nutritious and sustainable feed option for backyard poultry. Azolla, a small aquatic fern, is rich in protein, essential amino acids, vitamins, and minerals. Studies have shown that incorporating Azolla into poultry diets enhances growth rates, improves feed conversion efficiency, and provides a well-balanced nutrient profile. Apple pomace, a byproduct of cider and juice production, contains valuable nutrients such as fiber, antioxidants, and polyphenols. Incorporating apple pomace into poultry diets has been found to positively influence meat quality, egg production, and overall health.

Combining Azolla and apple pomace in poultry feed can offer synergistic benefits. Azolla's protein content complements the fiber-rich composition of apple pomace, creating a balanced and well-rounded diet for poultry. This blend has the potential to enhance egg production, improve immune function, and reduce the environmental impact of poultry farming. Utilizing Azolla and apple pomace as poultry feed aligns with the principles of economic and environmental sustainability. Both Azolla and apple pomace are low-cost, locally available resources, reducing the economic burden on small-scale poultry farmers. Additionally, the incorporation of these ingredients promotes the efficient utilization of agricultural byproducts, contributing to waste reduction and a more sustainable poultry production system. While the use of Azolla and apple pomace as poultry feed shows promise, challenges such as seasonal availability, storage, and palatability need to be addressed. Further research is required to optimize the formulation and assess long-term effects on poultry health and productivity.

**Table 1:** Comparison of health and carcass parameters of backyard poultry under alternative feeding regimen (Apple Pomace: Azolla) and comparison with commercial feed.

Parameters	Group I (Azolla: Apple Pomace)	Group II (Commercial Feed)
Breast Angle (°)	57.23 ± 3.45	51.81 ± 1.45 <sup>a</sup>
Shank Length	6.56 ± 1.09	5.55 ± 1.90 <sup>a</sup>
Keel Length	11.19 ± 1.45	9.56 ± 1.45 <sup>a</sup>
Final body wt (g) at 6 weeks age	1125.56 ± 45.56	1215.23 ± 34.14 <sup>a</sup>
Body weight gain (g) from 1-6 weeks	1267.56 ± 56.89	980.56 ± 33.78 <sup>a</sup>
Feed Consumption (g) from 1-6 weeks	3124.34 ± 23.45	2137.67 ± 45.19 <sup>a</sup>
FCR from 1-6 weeks	1.345 ± 0.89	1.167 ± 0.040 <sup>a</sup>

<sup>a</sup> Values with different superscripts vary significantly across different group.

## 4. Conclusion

In conclusion, the combination of Azolla and apple pomace holds significant potential as an alternative and sustainable feed option for backyard poultry. By harnessing the

nutritional benefits of these two ingredients, poultry farmers can improve the health and productivity of their flocks while contributing to a more sustainable and circular agricultural system.

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