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Azolla based complete feed block on growth, nutrient utilisation and blood biochemicals of Beetal X Assam hill goat kids

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Abstract

Background: Incorporating low-cost, unconventional, highly nutrient-rich Azolla in feed blocks will reduce the cost of feeding while achieving better growth performance in goat.

Materials and Methods: Twenty-four (24) Beetal x Assam Hill Goat kids were divided randomly into four equal groups. The control (T₀) group was fed with Complete Feed Block consisting of Napier grass and concentrate mixture. The T₁, T₂ and T₃ groups were fed with feed blocks where the concentrate mixture was replaced with dried Azolla (*Azolla pinnata*) at 10, 20 and 30 percent levels, respectively. The feed blocks of different groups T₀, T₁, T₂ and T₃ had 13.01, 13.01, 13.02 and 13.01 percent DCP and 69.98, 69.47, 68.20 and 68.10 percent TDN, respectively.

Result: The total and average daily feed intake differed significantly ($p < 0.01$) between the groups with significantly ($p < 0.01$) different total and average daily body weight gain. Significantly ($p < 0.01$) higher body weight gain was observed in group T₁. The feed conversion efficiency (FCE) of group T₀, T₁, T₂ and T₃ were 8.83 ± 0.16 , 8.38 ± 0.17 , 9.23 ± 0.14 and 9.57 ± 0.15 respectively, with significantly ($p < 0.01$) higher FCE in group T₁. Digestibility coefficient of DM, OM, CP and NFE differed significantly ($p < 0.01$) between the groups. The total serum protein, total serum albumin and GGT were within the normal range. The average OD values of ELISA for *Salmonella typhimurium* antigen indicated no effect of Azolla on humoral immune response. The cost of feeding per kg live weight gain was lowest in T₁ (126.31 ± 2) in comparison to T₀ (135.52 ± 2), T₂ (136.47 ± 1.94), and T₃ (138.67 ± 2.20). The study revealed that dried Azolla can be incorporated at 10 percent level in concentrate mixture of Complete Feed Block for Beetal x Assam Hill Goat kids with a distinct economic advantage.

Keywords: Azolla-based complete feed block, growth performance, Beetal X Assam hill goat, blood biochemicals

Introduction

Azolla (*Azolla pinnata*) an unconventional feed of livestock, increases the feed consumption and digestibility by increasing the amount of nutrients that animals absorb from the ration. Due to its high protein, essential amino acids, vitamins, growth-promoting intermediary, and mineral content, it can be recognised as an excellent livestock feed. Due to its high palatability, availability, and high yield, *Azolla pinnata* may serve as a substitute for concentrate, green fodder, and as a supplement to diets high in protein. It is acknowledged as the most affordable and plentiful source of protein due to its capacity to synthesize amino acids from a variety of practically limitless and easily accessible primary materials. It contains several essential amino acids, carbohydrates (34.90%), fat (3.10%), protein (20.00-25.50%) and 8.50-10.70 percent cellulose (Sithara and Kamalaveni, 2008) [10]. Hence, incorporating low-cost, unconventional feed ingredients like Azolla in feed blocks will definitely reduce the cost of feeding while achieving better growth performance. Considering the nutritional and beneficial effects of Azolla, the present experiment was conducted to investigate the impact of feeding different levels of Azolla-based Complete Feed Block on the growth, nutrient utilisation, and blood biochemical parameters of Beetal x Assam Hill Goats.

Materials and Methods

Twenty-four (24) numbers of growing kids (Beetal x Assam Hill Goat) of 3-4 months of age were divided into four (4) groups (T₀, T₁, T₂, T₃) consisting of 6 kids in each having same numbers of male or female in each group based on similarity in their average body weight in a randomized block design. In the control group (T₀), the Complete Feed Block consisted of Napier grass and concentrate mixture at a 60:40 ratio on DM basis. In the group T₁, T₂, and T₃, the concentrate mixture of Complete Feed Block was incorporated with dried Azolla at 10, 20 and 30 percent levels, respectively, along with the same level of Napier grass as in the control group (Table 1)

Table 1: Experimental treatments used for the feeding of kids in different groups

Group	Experimental treatment (n = 6)
T ₀	Complete feed block (Napier grass + Concentrate mixture)
T ₁	Complete feed block by inclusion of dried Azolla at 10% level in concentrate mixture.
T ₂	Complete feed block by inclusion of dried Azolla at 20% level in concentrate mixture.
T ₃	Complete feed block by inclusion of dried Azolla at 30% level in concentrate mixture.

The feeding trial was conducted for a period of 84 days. The blood sample was collected fortnightly up to 84 days in a clot activator vial, and the serum was separated by centrifugation at 2000×g for 5 minutes. The total serum protein, total serum albumin, and gamma-glutamyl

transpeptidase (GGT) were estimated as per the procedure mentioned in a commercially available kit. To evaluate the humoral immune response, the *Salmonella* Typhimurium inactivated antigen (10⁹ CFU/per animal) was inoculated during 4th fortnight. Two doses of antigen were injected intramuscularly to each kid, and the booster dose was inoculated after one week. Blood was collected before and after the antigen inoculation and serum was separated. After that standard protocol for ELISA was followed and OD was read at 492 nm in ELISA reader.

Results and Discussion:

Growth performance

In the present experiment, the dry matter intake was significantly higher ($p < 0.01$) in group T₁ followed by group T₀, T₂ and T₃ (Table 2). Shital *et al.* (2011) observed in Osmanabadi kids that the average daily dry matter intake per kid was higher when concentrate was replaced by 15 percent level of Azolla without any adverse effect. Significantly higher ($p < 0.01$) average daily gain (g/d) and total gain in body weight (kg) was observed in group T₁, followed by T₀, T₂ and T₃, which might be due to the higher intake of DM, DCP and TDN by group T₁. Roy *et al.* (2016) [7] reported a higher growth rate in Haryana heifers when concentrate mixture was replaced by 5 percent level of *Azolla pinnata*. Sihag *et al.* (2018) [8] also observed significantly higher average daily gain in kids fed with TMR by replacing concentrate mixture at 10 percent level with Azolla.

Table 2: Growth performance of kids under different treatment groups

Parameters	T ₀	T ₁	T ₂	T ₃
Dry matter intake (kg)	37.0 ^c ±0.04	37.72 ^a ±0.04	36.97 ^c ±0.04	36.25 ^d ±0.04
Total gain in body weight (kg)	4.25 ^b ±0.07	4.50 ^a ±0.09	4.00 ^c ±0.05	3.79 ^c ±0.05
Average daily gain in body weight (g/day)	50.68 ^b ±0.95	53.66 ^a ±1.16	47.69 ^c ±0.68	45.15 ^c ±0.70
Feed Conversion efficiency (DMI/kg gain)	8.83 ^{bc} ±0.16	8.83 ^{bc} ±0.16	9.23 ^{ab} ±0.14	9.57 ^a ±0.15

Significantly ($p < 0.01$) better FCE was observed in group T₁, followed by group T₀, T₂ and T₃. The better FCE in group T₁ where 10 percent level of Azolla was incorporated, might be due to better body weight gain compared to group T₀, T₂ and T₃. Similar findings were also reported by Sihag *et al.* (2018) [8], who observed significantly better FCR in kids fed with TMR by replacing concentrate mixture at 10 percent level with Azolla.

Nutrient Digestibility

The dry matter digestibility decreased with increasing level of Azolla in the diet (Table 3). This might be due to the increasing lignin content in the diet and occurrence of diarrhea (Tamang and Samanta, 1993) [11] amongst the experimental kids fed on Complete Feed Block containing higher level of Azolla. Ghodake *et al.* (2012) [12] reported

significant difference in digestibility coefficient of dry matter in Osmanabadi kids. Sihag *et al.* (2018) [8] observed significant difference in digestibility coefficient of OM in kids. The digestibility coefficient of CP decreased with increasing level of Azolla in group T₂ and T₃. This might be due to binding of protein with lignin and silica content of Azolla (Navanath, 2007) [5]. Similar findings were also reported by Kumari (2018) [4] who observed significantly higher CP digestibility in Black Bengal Cross kids fed with 20 percent Azolla-supplemented concentrate mixture. Although there was no significant difference ($p > 0.05$) between the groups, but numerically higher digestibility of CF was recorded in group T₁ followed by group T₀, T₂ and T₃. Significantly higher ($p < 0.01$) digestibility coefficient of NFE was seen in group T₁ and lowest in T₃.

Table 3: Digestibility coefficient of nutrients in different treatment groups

Digestibility coefficient	T ₀	T ₁	T ₂	T ₃
Dry matter	68.75 ^a ±0.38	69.81 ^a ±0.51	66.59 ^b ±1.00	64.38 ^c ±0.53
Organic matter	73.50 ^{ab} ±0.23	75.01 ^a ±0.73	71.31 ^{bc} ±1.31	69.62 ^c ±0.45
Crude protein	75.90 ^a ±0.61	77.12 ^a ±0.99	69.84 ^b ±1.70	68.62 ^b ±0.72
Crude fibre	70.83±0.62	71.49±0.70	69.34±1.47	67.18±0.94
Ethar extract	75.37±0.83	78.12±0.96	73.53±1.76	72.57±1.80
Nitrogen free extract	73.40 ^{ab} ±0.30	75.27 ^a ±0.91	72.41 ^{ab} ±1.16	70.63 ^b ±0.88

Blood biochemical profile

The fortnightly average value of total serum protein (g/dl), total Serum Albumin (g/dl), gamma glutamyl transpeptidase (U/L) has been presented in Figure 1. No significant difference was observed in the level of total serum protein between the groups. The values were well within the normal range (6.2-7.9 g/dl), indicating that there was no detrimental effect of feeding Azolla at various levels to the experimental

kids. Similar findings were reported by Kumar *et al.* (2015) [3], who observed no significant ($p>0.05$) effect of replacement of concentrate mixture with sun dried Azolla at 25 percent level in Barbari goats. Roy *et al.* (2016) [7] also observed no significant difference ($p>0.05$) in total serum protein level in different groups of Harijana heifer fed with concentrate mixture replaced with 5 percent level of Azolla.

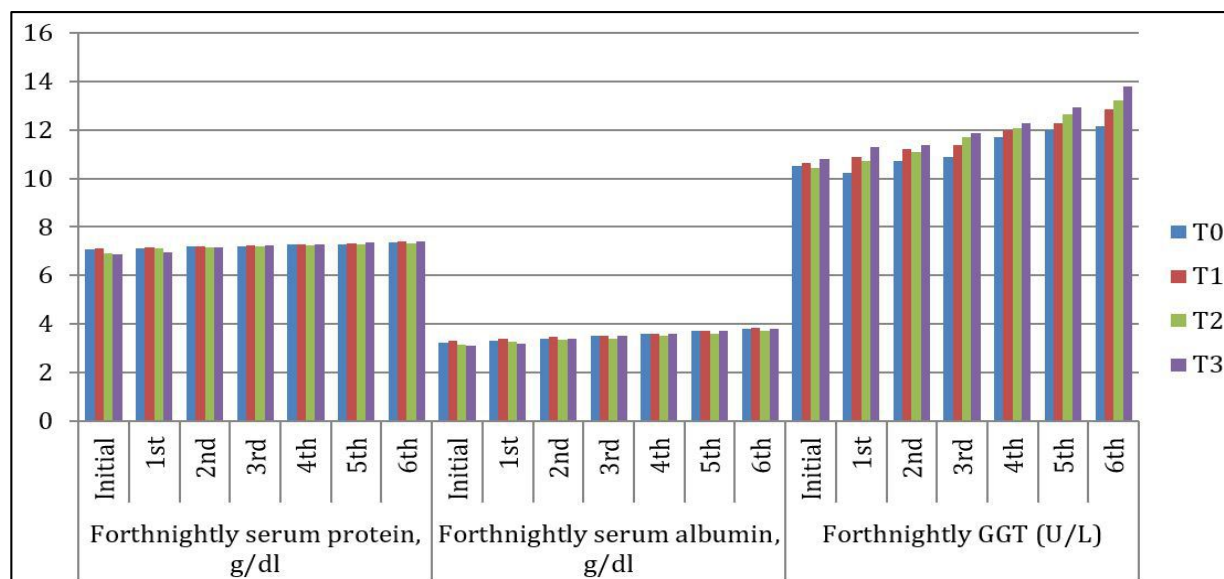


Fig 1: Fortnightly average value of serum biochemicals

In case of total serum albumin, statistical analysis showed significant difference ($p<0.05$) between the groups. Although, the significant difference ($p<0.05$) was observed at 2nd fortnight in group T₁ and T₂; and at 4th fortnight between group T₂ and T₀, all the values of total serum albumin were observed within the normal range (2.9-4.3 g/dl) indicating that there was no detrimental effect of feeding Azolla at various levels to the experimental kids. However, it was observed that there was significant lowering of serum albumin in the T₂ and T₃ groups compared to control group on 2nd and 4th fortnight that could be due to slight negative impact of Azolla at 20 and 30 percent level on liver function thereby impacting the growth rates in T₂ and T₃ groups.

The serum gamma glutamyl transpeptidase (U/L), showed no significant difference between the groups. All the values of GGT were within the normal range (0-30 U/L) indicating that there was no detrimental effect of feeding Azolla to liver function at various levels to the experimental kids. The findings were in accordance with Reddy *et al.* (2011) [6]. Although there was significant decrease of serum albumin in T₂ and T₃ groups, there was no effect on serum GGT that could be due to fact that there was no significant liver damage by the Azolla.

Humoral immune response upon inoculation bacterin *Salmonella typhimurium* antigen

The average OD value of ELISA in group T₀, T₁, T₂ and T₃ were 0.39±0.06, 0.69±0.10, 0.43±0.10 and 0.55±0.11 respectively. Statistical analysis showed there was no significant difference ($p>0.05$) between the groups suggesting Azolla incorporation in the complete feed block at 10, 20 and 30 percent level have no effect on the immune response.

Cost of Feeding

In the present experiment, the highest and lowest feed cost per kg body weight gain was observed in group T₃ and T₁, respectively. It is due to the highest and lowest body weight gain by the kids of group T₁ and T₃, respectively. The highest profit over control was observed in group T₁, indicating that dried Azolla incorporation up to 10% level in CFB is economically beneficial with higher growth performance in kids. Similar findings were also observed by Ghodake *et al.* (2012) [2], who reported economically beneficial feeding of kids with incorporation of 15% Azolla in the concentrate feed. Ahmed *et al.* (2016) [1] observed significant difference ($p<0.05$) between the groups on feeding 6, 12, 18 and 24 percent Azolla replacing with 25, 50, 75 and 100 percent linseed cake respectively. Significantly lower cost of feeding was observed in group fed with 6% Azolla. Sihag *et al.* (2018) [8] reported net saving of Rs. 7.90 per kg weight gain for feed cost of crossbred kids when feeding Azolla at 10% level on replacement of concentrate feed.

Conclusion

The present study revealed that, dried Azolla can be incorporated at 10 percent level in concentrate mixture of Complete Feed Block of Beetal x Assam Hill Goat kids with a distinct economic advantage without any adverse effect.

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