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## Effect of feeding green Azolla (*Azolla pinnata*) on rumen parameters in Sirohi kids

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### Abstract

The aim of this study was to determine the effect of feeding green Azolla (*Azolla pinnata*) on rumen parameters in Sirohi kids. A feeding trial of ninety days was conducted on 16 Sirohi kids of 4-6 months of age. These kids were randomly distributed in four groups with four kids in each group. The experimental kids were divided in four treatment groups viz. T<sub>1</sub> - Control (Basal roughage + concentrate); T<sub>2</sub> (Basal roughage + concentrate + 150gm green Azolla); T<sub>3</sub> (Basal roughage + concentrate + 250 gm green Azolla); and T<sub>4</sub> (Basal roughage + concentrate + 350 gm green Azolla). All the kids were offered basal roughages (methi straw) *ad lib*. The results revealed that highly significant ( $P < 0.01$ ) effect of green Azolla (*Azolla pinnata*) supplementation in concentrate diet on rumen parameters (rumen pH and total volatile fatty acids) in Sirohi goat kids. It was concluded that green Azolla (*Azolla pinnata*) improved the rumen parameters in Sirohi kids when fed @ 250gm with concentrate diet.

**Keywords:** Azolla, methi, rumen, total volatile fatty acid

### Introduction

India's livestock sector is one of the largest in the world with 535.78 million of livestock population which consist of 27.80% goats (20<sup>th</sup> livestock census, 2019). Livestock sector comprised 4.11% of the total GDP and 25.6% of agriculture GDP in India.

Goats have multifaceted utility as a livestock species and play significant role in rural economy. Rearing of goats is very useful for small and marginal farmers and landless labourers especially in the areas, where crops and dairy farming are not economical. Goat plays an important role in generating employment in rural areas. Being small in size, they do not require any large management skills and can be easily handled and managed by women and children. Goats can survive in areas with low quality vegetation. In India, goats are mainly fed on crop residues, green fodder, top feeds and non-conventional feed resources (Nehra *et al.*, 2020) [15].

According to National Bureau of Animal Genetics Resources (ICAR-NBAGR), there are 34 registered breeds of goat in India, which constitute 20-25 percent of total goat population. The Sirohi goats are valuable germ-plasm because of its better production performance in the harsh climatic conditions (Sharma *et al.*, 2016) [18]. Sirohi goat is a dual-purpose goat breed distributed in arid and semi-arid regions of central and southern Rajasthan. Meat production is the most important feature of this breed and the prolificacy of the breed is within acceptable limits. This has proved to be an excellent goat breed with respect to disease resistance, adaptability to dry or hot climate, growth and production performance under poor quality range conditions (Tomar *et al.*, 1998) [21].

There is huge potential in enhancing the productive performance of Sirohi goats through nutritional interventions. There are various newer and non-conventional feeds which may be incorporated for goat feeding such as Azolla. 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 (Hossiny *et al.*, 2008) [8]. Due to ease of cultivation, high productivity and good nutritive value it is used as a beneficial fodder supplement by various researchers (Singh & Subudhi, 1978; Prabina & Kumar, 2010) [19, 16]. *Azolla pinnata* tried as a feed for broiler chicken (Alalade & Iyayi, 2006

[1]; Balaji *et al.*, 2009 [3]; Dhupal *et al.*, 2009 [7]; Bolka, 2011 [4], goats (Samanta & Tamang, 1993) [17] and buffalo calves (Indira *et al.*, 2009) [10].

In recent years, Azolla has attracted the attention of researchers because of its high potential as a feed resource for livestock (Kathirvelan *et al.*, 2015) [11]. There are reports on the use of Azolla as feed supplement for livestock, in which normal feed protein sources have been replaced by Azolla (Chatterjee, 2013; Kumar and Chander, 2017; Arvindraj *et al.*, 2017) [6, 13, 2]. The present investigation was under taken to study the effect of Azolla (*Azolla pinnata*) feeding on rumen parameters in Sirohi kids.

## Materials and Methods

### Production of Azolla

For present experiment, Azolla was produced in water troughs of size 12.5 m X 1.0 m X 0.40 m. About 2-2.5 kg of cow manure was dissolved in 3.5 liters of water and spread evenly in the water trough. Fresh Azolla seeds were inoculated in water troughs at 0.5kg/m<sup>2</sup>. Azolla was spread all over trough within 15 days and build up a thick mat like structure. Azolla was harvested and washed for three times to avoid the superfluous material before feeding to kids.

### Experimental Animals and design

Sixteen male Sirohi kids of almost same age group (4-6 months) and of uniform affirmation were selected randomly. These male kids were divided in to four groups for feeding trial. Each group had four kids. These animals were given measured amount of experimental feed and fresh and clean drinking water *ad lib*. The kids were stall fed throughout the experimental period. The experimental Sirohi male kids were distributed by completely randomized block design on the basis of body weight into four groups of four kids in each and subjected to different treatment.

### Experimental feeds

Experimental Sirohi kids were fed with the basal roughage (methi straw), concentrate mixture with and without green Azolla (*Azolla pinnata*). Experimental kids were divided in four treatment groups viz. T<sub>1</sub> - Control (Basal roughage + concentrate); T<sub>2</sub> (Basal roughage + concentrate + 150gm green Azolla); T<sub>3</sub> (Basal roughage + concentrate + 250 gm green Azolla); and T<sub>4</sub> (Basal roughage + concentrate + 350 gm green Azolla).

The experimental animals were fed as per ICAR (2013) [9] feeding standard to meet their nutrient requirement.

### Experiment

A feeding trial of 90 days was conducted on 16 Sirohi male kids divided in to four treatment groups of four kids in each group to study the effect of feeding green Azolla (*Azolla pinnata*) on rumen parameters.

### Processing of rumen liquor

Rumen liquor of kids was strained through four layer of muslin cloth. The strained rumen liquor (SRL) was brought to the laboratory in pre warmed (39 °C) thermos flask for further analysis of total volatile fatty acids. The rumen liquor samples were collected from experimental kids after hours of feeding with the small ruminant stomach tube and rumen parameters were estimated at end of experimental feeding.

### pH determination

Rumen fluid pH was determined immediately after collection using portable digital pH meter (pen type) at the site of collection

### Total volatile fatty acids determination

Total volatile fatty acids (TVFS) were determined according to the method of Barnett and Reid (1957) [5] using Markham still distillation apparatus.

### Statistical Procedure

The data obtained in the experiment were analyzed using statistical procedures as suggested by Snedecor and Cochran (1994) [20] and significance of mean difference was tested by Duncan's New Multiple Range Test (DNMRT) as modified by Kramer (1957) [12].

## Results and Discussion

### Rumen Liquor pH

The overall mean values of pH of rumen liquor were recorded as 6.35, 6.32, 6.30 and 6.25 in T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> groups, respectively (Table 1). Statistical analysis of data revealed that there was highly significant effect of feeding green Azolla (*Azolla pinnata*) along with concentrate diet on pH of rumen liquor among different treatment groups (Table 2). The results indicated that pH of rumen liquor was highest in T<sub>1</sub> group (i.e. concentrate diet without green *Azolla pinnata*) and lowest in T<sub>4</sub> group (i.e. concentrate diet with 350 gm green *Azolla pinnata*). T<sub>1</sub> group was comparable with T<sub>2</sub> group (i.e. concentrate diet with 150 gm green *Azolla pinnata*) whereas T<sub>3</sub> group (i.e. concentrate diet with 250 gm green *Azolla pinnata*) comparable with T<sub>4</sub> group. The rumen liquor was found to decreased with increased level of green Azolla. Similar findings were reported by Kumar *et al.* (2015) [14]. Kumar *et al.* (2015) [14] reported that pH of rumen liquor was increased with incorporation of sun dried Azolla meal in the concentrate mixture.

### Total volatile fatty acids

The overall mean total volatile fatty acid (TVFA) concentrations were recorded in various treatment groups and has been presented in Table 1. The overall mean values of TVFA were found to be 15.65, 15.78, 17.32 and 16.33 mEq/l in T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> groups, respectively. Statistical analysis of data revealed that there was highly significant effect of feeding green Azolla (*Azolla pinnata*) on TVFA concentration (Table 2). On comparison of means total volatile fatty acid (TVFA) concentrations was found highest in T<sub>3</sub> group (i.e. concentrate diet with 250 gm green *Azolla pinnata*) followed by T<sub>4</sub> group (i.e. concentrate diet with 350 gm green *Azolla pinnata*) than T<sub>2</sub> group (i.e. concentrate diet with 150 gm green *Azolla pinnata*). The lowest values of TVFA was found in T<sub>1</sub> (control) group (i.e. concentrate diet without green *Azolla pinnata*).

Similar findings were reported by Kumar *et al.* (2015) [14]. In contrast to present study, Kumar *et al.* (2015) [14] reported that total volatile fatty acid (TVFA) concentrations decreased with incorporation of sun dried Azolla meal in the concentrate mixture.

### Conclusion

The statistical analysis of data showed highly significant ( $P < 0.01$ ) effect of feeding green Azolla (*Azolla pinnata*) on pH of rumen liquor and total volatile fatty acid (TVFA). The

results indicated that pH of rumen liquor was highest in T<sub>1</sub> group and lowest in T<sub>4</sub> group whereas, TVFA concentrations was highest in T<sub>3</sub> group and lowest values in T<sub>1</sub> (control) group. The statistical analysis of data showed highly significant ( $P<0.01$ ) effect of feeding green Azolla (*Azolla pinnata*) along with concentrate diet on haemoglobin, packed cell volume, blood glucose and total serum protein in Sirohi goat kids under different treatment groups. Whereas, non-significant effect of feeding green Azolla (*Azolla pinnata*) was observed on blood urea nitrogen and serum creatinine. It was concluded that green Azolla (*Azolla pinnata*) @ 250 gm along with concentrate diet was a viable proposition to improve rumen parameters (pH of rumen liquor and total volatile fatty acid) of Sirohi kids in arid and semi-arid region.

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**Table 1:** Mean values of Rumen pH and TVFA in Sirohi Goat Kids under different treatment groups

Attribute	Treatment groups				
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	S.Em±
pH	6.35 <sup>a</sup>	6.32 <sup>a</sup>	6.30 <sup>a</sup>	6.25 <sup>b</sup>	0.02
TVFA	15.65 <sup>d</sup>	15.78 <sup>c</sup>	17.32 <sup>a</sup>	16.33 <sup>b</sup>	0.38

**Note:** Means superscripted with any one different letters within a row for a particular data differ significantly from each other.

**Table 2:** ANOVA of Rumen Parameters

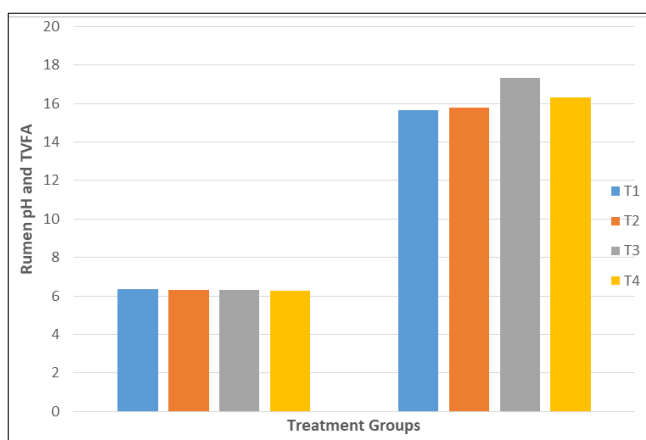
Attribute	SOV	DF	MSS	F – Value	Level of Sig.
Rumen pH	Block	3	0.001	0.525	NS
	Treatments	3	0.007	7.186	**
	Error	9	0.001	-	-
TVFA	Block	3	0.001	1.122	NS
	Treatments	3	2.307	3170.565	**
	Error	9	0.001	-	-

NS = Non-Significant

\* = Significant at 5% level of probability ( $P<0.05$ )

\*\* = Significant at 1% level of probability ( $P<0.01$ )

**Note:** Means superscripted with any one different letters within a row for a particular data differ significantly from each other.



**Fig 1:** Rumen Parameters (Rumen pH and TVFA) in Sirohi Kids under Different Treatment Groups

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