

Effect of replacement of concentrate mixture with chaya (*Cnidoscolus aconitifolius*) fodder meal on feed intake and digestibility of nutrients in growing goats

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ABSTRACT

Chaya is a drought tolerant, disease resistant plant of Central America. It is perennial in nature with high nutrient content. Chaya was introduced in India at Indian Grassland and Fodder Research Institute, Jhansi in 2006 to test its use as a fodder plant. Chaya fodder meal was prepared by harvesting leaves and soft stems (70–90 days old growth), chaffed and dried in the sun. 24 Bundelkhandi (age 157.8±5.2 days; 19.19±0.88 kg) goats were randomly divided into 4 treatment groups of 6 animals each. The animals were fed concentrate mixture (CP 20%) @ 2% of body weight, containing barley grain, mustard cake, wheat bran, mineral mixture and salt (T₁). In treatment T₂, 50% of the concentrate mixture was replaced by chaya fodder meal; in T₃, 75% and in T₄, 100% was replaced with chaya fodder meal. All the animals were given *ad lib.* oat hay. Average daily DM intake ranged from 524 to 619 g in T₁ to T₄. The dry matter intake (kg/100 kg b wt.) ranged from 2.71 (T₄) to 3.3 (T₂). The digestibility (%) of dry matter ranged from 57.3 (T₄) to 63.9 (T₁), organic matter (OM) (58.8 in T₄ to 65.3 in T₁). The digestibility of crude protein, NDF and ADF did not differ significantly among the groups. The results indicated that chaya fodder meal can replace up to 75% of the conventional mixture without affecting the DM intake or digestibility of nutrients in growing goats.

Key words: Chaya fodder meal, *Cnidoscolus aconitifolius*, Nonconventional feed resources

Chaya (*Cnidoacolus aconitifolius*) is a perennial shrub, which was domesticated by the Mayan people about 2500 years ago in the Yucatan peninsula of Central America. Also known as 'tree spinach', its leaves are eaten as a vegetable by the indigenous Maya people who grow it in the backyard (Martin 1978, Peregrine 1983). It is classified as underutilized vegetable plant (NAS 1975, Williams and Haq 2002). Chaya is drought tolerant and disease resistant, and gives copious amount of foliage during summer months. It was introduced in India in 2006 at Indian Grassland and Fodder Research Institute to test its feasibility for use as a fodder plant. Feed cost constitutes over 60% of the cost of animal production in India. Moreover, there is also an acute shortage of feed and fodder in the country. It was estimated that by 2010, the deficit of green and dry fodder is expected to reach 63% (666 mt) and 23% (138 mt), respectively (IGFRI 2007). Providing the livestock keepers a cheap source of quality fodder will benefit both the producers as well as consumers. The objective of this study was to test digestibility of nutrients upon inclusion of Chaya in the diet replacing conventional concentrate mixture in growing goats.

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MATERIALS AND METHODS

The experiment was carried out at the Indian Grassland and Fodder Research Institute, Jhansi from April to May 2009. Growing male indigenous Bundelkhandi goats (24) were taken for this experiment. The average age of the animals were 157.8±5.2 days with an average body weight of 19.19±0.88 kg. The animals were grouped into 4 groups of 6 animals each and they were randomly assigned to 1 of the 4 dietary treatments (T₁, T₂, T₃ and T₄) in a randomized block design (RBD). The diets were formulated using chaya fodder meal, mustard cake, barley grain, wheat bran and oat hay. The animals were offered one of the diets containing concentrate mixture @ 2% of their body weight and *ad lib.* oat hay. The diets of the goats were formulated to achieve a targeted growth rate of 100 g/d as per the ICAR (1998). The concentrate mixture in T₁ contained crushed barley grain, mustard cake, wheat bran, mineral mixture and salt so as to have about 20% CP. In T₂, 50% of the concentrate mixture contained chaya fodder meal, in T₃, 75% chaya meal and in T₄, 97% chaya meal. The relative proportions of different ingredients and the chemical composition of concentrate mixture in the 4 treatment groups have been given in Table 1. After a preliminary feeding of 21 days in-group, digestibility trial for 6 days was conducted by putting animals individually

into metabolic cages. During preliminary feeding, the animals were offered water *ad lib.* but while in metabolic age they were offered water thrice a day. The concentrate mixture was offered to the animals at 9:00 AM. After 4 h at 1:00 PM, oat hay was offered to the animals. During the trial, daily recording of feed intake, and quantitative collection of faeces voided during 24 h basis was done.

Preparation of chaya fodder meal

Plantation of chaya has been established at the central research farm of IGRI where over 1 000 plants are growing. Chaya fodder was harvested every 70–90 days depending on the growth of the plant by cutting at 50 cm from the ground. The new shoots emerged quickly during summer months but in winter its emergence was delayed. The fodder containing leaves and succulent stems were chopped by hand chaff-cutter with two blades, dried in the sun and stored in gunny bags. Initially when the dried hay of chaya was fed to the animals, all the leaves were eaten and the dried stem part was left behind. Therefore, the chaya hay containing dried leaf and stem were made into meal with the help of a hammer mill in the Post Harvest Technology Division of the Institute to avoid selective consumption.

Samples of feeds, residues and faeces were analyzed for proximate principles (AOAC 1996). The statistical analysis was carried out as per Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

The chemical composition of the concentrate mixture in the 4 treatment groups is presented in Table 1. The crude protein content in the concentrate mixture was 20% of DM in the four treatment groups. Analysis of chaya fodder meal revealed that it is a good source of nutrients containing 20.52% CP, 26.85% ADF, 29.94% NDF, 6.21% lignin, 3.61% ether extract, 10.94% ash and 89.06% organic matter. The CP content of chaya is similar to other leguminous fodder such as Lucerne (20.0%) and cowpea (20.2%) (Ranjan 1977). Oat hay fed to the goats contained 8.7% CP and was similar to the value reported by Meena *et al.* (2004).

Table 1. Composition and chemical analysis of concentrate mixture in different treatment groups

Item	Concentrate mixture				Oat hay
	T ₁	T ₂	T ₃	T ₄	
<i>Ingredients,% of DM</i>					
Chaya fodder meal	0	50	75	97	
Mustard cake	35	17	8	0	
Barley grain (ground)	37	18	8	0	
Wheat bran	25	12	6	0	
Mineral mixture	2	2	2	2	
Salt	1	1	1	1	
	100	100	100	100	
<i>% of dry matter</i>					
CP	20.09	20.00	19.96	19.9	8.70
ADF	13.71	20.07	23.28	26.04	36.40
NDF	28.75	28.88	29.05	29.94	57.00
Lignin	4.78	5.42	5.75	6.02	6.50
Ether extract	3.78	3.64	3.57	3.57	2.15
Ash	5.24	8.01	9.41	10.61	8.60
NFC*	42.14	39.48	38.00	35.98	23.55
Organic matter	91.76	88.99	87.59	86.39	91.40

*NFC = 100 – (NDF + CP + ether extract + ash).

The DM intake (g/d or % b wt.) amongst groups was similar, suggesting that the inclusion of chaya fodder meal did not affect the palatability of diet (Table 2). The average dry matter intake in the 4 treatment groups ranged from 0.52 to 0.62 kg/d per goat. The DM intake of goats was similar to that reported by Datta and Singh (2009) who reported a similar range of (535 to 554 g/d) DM intake in Barbari, Jamunapari and Marwari goats. The DM intake (g/kg W^{0.75}) in different treatment groups was 56.7 to 68.7 and DM intake as kg/100 kg b.wt. ranged from 2.71 to 3.30. These values were similar to that reported by Sharma and Vaishnava (2004).

The apparent digestibility coefficient of DM, OM, CP, NDF and ADF did not differ significantly between the groups indicating that chaya fodder meal could be included in the diet of ruminants, in place of oil seed cakes. The DM digestibility (%) in different treatments ranged from 57.29

Table 2. Feed intake and digestibility of nutrients

Parameters	T ₁	T ₂	T ₃	T ₄
<i>Av. body weight (kg)</i>	19.1±1.86	18.78±1.39	19.7±2.69	19.18±1.72
Total dry matter intake (g/d)	559±0.08	619±0.07	611±0.08	524±0.05
DM intake (kg/100 kg b.w.)	2.93±0.17	3.30±0.17	3.10±0.16	2.71±0.06
W ^{0.75}	9.14±0.66	9.02±0.50	9.35±0.95	9.17±0.62
DM intake (g/kg W ^{0.75} /d)	61.29±4.84	68.73±4.44	65.23±3.30	56.74±2.08
<i>Digestibility coefficients (%) of nutrients</i>				
DM	63.95±0.72	61.09±2.43	60.87±1.83	57.29±1.54
OM	65.33±0.59	62.48±2.12	62.24±1.39	58.83±1.28
CP	66.25±1.25	67.78±1.74	64.23±1.27	65.05±1.05
NDF	52.09±1.54	51.53±1.16	52.41±3.01	53.52±1.86
ADF	41.99±1.00	42.52±1.51	42.27±2.03	41.86±2.90

to 63.95, OM 58.83 to 65.33, CP 65.05 to 67.78, NDF 51.53 to 53.52 and ADF 41.86 to 42.52. The values of digestibility of different nutrients were similar to diets of guinea grass and sesbania fed to goats (Ash 1990).

It was concluded that chaya fodder meal is a good source of nutrients and it can replace concentrate mixture in the diets of growing goats. Although replacement of 100% of concentrate mixture with chaya fodder meal did not differ significantly as compared to 50 and 75% replacement, there was a slight decline in the intake of dry matter and digestibility of nutrients. Hence, it is recommended that up to 75% of concentrate mixture can be replaced by chaya fodder meal in growing goats.

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