In-vitro Fermentation Study of Some Grasses Utilized by Camels in Arid Ecosystem

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Introduction

Camel, the ship of desert feeds on a variety of feeds and fodders of grasses, crop residues and shrubs/bushes. The various types of feeds and fodders are the source of nutrient supply upon which depends the production performance of the animal. It is, thus, essential to create the data base of feeds and fodders and their nutrient contents for the formulation of balanced ration for the animals. The analysis of proximate components and detergent fibre components are generally done to get idea about the nutrient availability to the animal. I*n vivo* evaluation provides the real picture of feeds and fodders to about their production potential but *in vivo* methods are quite expensive in terms of cost of the, animals, feeds and fodders, labor input, sophisticated laboratory and animal housing infrastructure and also the time. A wide range of grass species can be studied using *in vitro* gas production techniques and this method is inexpensive, efficient and widely used. Little information is documented on their potential digestibility of grass species and the correlation with their nutrient constituents. Therefore, this study was undertaken with the aim of providing information on grass species commonly found in arid zone of Rajasthan. The specific objectives were to characterize the grass species in terms of chemical composition and related attributes and to compare *in vitro* gas production of various tropical grass species.

Materials and Methods

Samples of 6 grasses namely Anjan, Dhaman, Doob, Ganthia, Grammna and Sewan at milk stage were collected from the campus and agriculture farm are of NRCC. Proximate analysis and detergent fibre components of were estimated as per the standard methods of AOAC, (2005) and Van Soest *et al.*, (1991). About 200 mg of air dried milled (1.0 mm) were weighed in 100 ml fermentation bottles in triplicate. The rumen liquor was collected anaerobically with the help of stomach tube from 3 years old camel calf maintained on *ad-.libitum* roughage ration of guar (*Cymposis tetragonoloba*) phlagati. The strained rumen liquor was brought to the laboratory in in pre-warmed and carbon dioxide pre-gassed thermos flask. A culture medium containing macro- and micro-minerals solutions, resazurine and a bicarbonate buffer solution was prepared as described by (Menke and Steingass, 1988). The medium was kept at 39 ºC and saturated with CO_2. Rumen fluid was then diluted into the medium in the proportion 1:2 (v/v). About 30 ml of buffer solution mixed with rumen liquor was dispensed in each fermentation bottle. The bottles were placed in the incubator (Kühner SHAKER Switzerland) at 39^0C, with continuous rotation to bottles containing the rumen fluid. The volume of gas produced in each bottle was recorded after 24 h after inoculation time. The contents of the fermentation bottle were filtered through pre- weighed goose crucibles G1, dried, weighed and ashed for estimation of *in-vitro* DM and OM digestibility. Total Digestible Organic matter (TDOM), Metabolizable energy (ME) and partition facto (PF) were calculated as per equations given by Menke and Steingass (1988). The filtrate was collected for estimation of VFA, total nitrogen and ammonia nitrogen by standard methods. And the data were subjected to statistical analysis.

Results and Discussion

The chemical analysis of 6 grasses collected at the milk stage (Table 1) indicated that crude protein values of ranged between 10.12 to 18.09, minimum in case of Sewan (10.12) and maximum in case of Grammna grass (18.09), ether extract contents varied between 1.76 to 3.39 , minimum in case of Sewan (1.76) and maximum in case of Grammna grass (3.39), crude fibre contents varied between 22.49 to 33.81, minimum in case of Grammna and maximum in case of Sewan grass, total ash ranged between 8.65 to 14.64, minimum in case of Sewan grass and maximum in case of Ganthia grass, neutral detergent fibre contents ranged between 57.62 to 75.58, minimum in case of Ganthia grass (57.62) and maximum in case of Sewan grass (75.58). The acid detergent fibre contents ranged between 26.43 to 39.50, minimum in case of Ganthia grass (26.43) and maximum in case of Sewan grass (39.50). The chemical compositions of some of the grasses were comparable to those reported in ICAR (2014). Kalla *et al.*, (2013) also reported that feedstuffs containing higher CP had lower CF values.

Table 1: Chemical analysis (on %DM basis) report of some grasses.

Grass	CP	EE	CF	TA	NFE	NDF	ADF
Anjan (*Cenchrus ciliaris*)	13.70	2.75	27.47	14.56	41.52	61.77	28.33
Dhaman (*Cenchrus setigerus*)	11.08	2.35	30.58	9.29	46.70	63.10	36.39
Doob (*Cynodon dactylon*)	15.75	3.31	23.28	10.16	47.50	67.26	36.61
Ganthia (*Dactyloctenium aegyptium*)	15.76	2.45	22.73	14.64	44.42	57.62	26.43
Grammna (*Panicum antidotale*)	18.09	3.39	22.49	11.68	44.35	60.05	28.26
Sewan (*Lasiurus sindicus*)	10.12	1.76	33.81	8.65	45.66	75.58	39.50

In-vitro study revealed (Table 2) that gas production (ml/ 0.2 g DM) varied between 19.0 to 28.67 ml in 6 grasses. Gas production was lower (P < 0.05) in case of Sewan grass (19.0 ml) and maximum in case of Dhaman grass (28.67 ml). However, gas production was comparable among Anjan, Doob, Ganthia and Grammna grasses. The % IVDMD ranged between 24.09 to 47.13. It was significantly (P < 0.05) lower in case of Ganthia grass (24.09) and higher in case of Dhaman grass (47.13). The IVDMD of was statistically similar among Sewan, Ganthia and Doob grasses which differ (P< 0.05) from other grasses. The IVDMD of Anjan, Dhaman and Grammna grasses differed significantly (P < 0.05) from each other but also from other grasses. The yield of SCFAs ranged between 4.33 to 5.85 mmol/100 ml, the minimum value in case of Sewan grass and maximum value in case of Grammna grass. The SCFAs from Sewan grass, Ganthia and Doob grasses were comparable but differed (P (< 0.05) from other grasses. Anjan, Dhaman, Doob and Ganthia showed similarity and differed (P< 0.05) from other 2 grasses. Total nitrogen contents varied between 12.48 in case of Sewan grass to 18.67 in Ganthia and Grammna grasses. Total-nitrogen contents of Sewan grass were minimum, and differed significantly (P< 0.05) from all other grasses. The total-N of Dhaman and Doob were similar. Ammonia nitrogen levels ranged between 7.67 to 12.15 mg/100 ml, minimum in case of Sewan grass and maximum in case of Grammna grass. Ammonia-N of Sewan grass was significantly (P< 0.05) lower and different from other grasses. Dhaman and Doob grasses exhibited similarity between them but significant P < 0.05) difference with other grasses. Calorific value in terms of ME (MJ/Kg DM) was minimum (P<0.05) in Sewan grass and maximum in Dhaman grass. Partition factor (PF) ratio of digestible organic matter and gas volumes a valuable tool for predicting the efficiency of microbial production was observed to be significantly (P<0.05) lowest in case of Ganthia grass and maximum in Grammna grass**.** The lower mean value of IVDMD of grasses can be attributed to their high fibre contents. Kalla *et al.,* (2013) concluded that dry matter degradability of various feedstuffs is influenced mainly by the protein and fibre contents and those feedstuffs with high crude protein contents with low crude fibre values showed higher degradability and vice-versa. The cell wall components based on detergent extraction is a good indicator for predicting nutritional worth of fibrous feed resources as voluntary DM intake and DM/OM digestibility are dependent on NDF and ADF. In the present study Doob and Sewan with high fibre fractions showed low IVDMD values.

Table 2: *In- vitro* fermentation of some camel grasses.

Grass	Gas production (ml)	IVDMD (%)	SCFAs mmol / 100 ml	Total-N mg / 100 ml	NH3-N mg / 100 ml	MBP (mg)	ME (MJ/kg DM)	Partition factor
Anjan (*Cenchrus ciliaris*)	$25.33^{b} \pm 0.67$	$42.91^{c} \pm 2.05$	$5.32^{bc} \pm 0.19$	$20.18^{d} \pm 0.42$	$10.57^{c} \pm 0.10$	$25.61^{d} \pm 2.11$	$5.66^{b} \pm 0.28$	$3.53^{c} \pm 0.21$
Dhaman (*Cenchrus setigerus*)	$28.67^{c} \pm 0.67$	$47.13^{d} \pm 0.55$	$5.35^{bc} \pm 0.08$	$17.15^{b} \pm 0.70$	$9.05^{b} \pm 0.11$	$30.35^{de} \pm 2.53$	$6.29^{e} \pm 0.09$	$3.40^{c} \pm 0.13$
Doob (*Cynodon dactylon*)	$21.33^{b} \pm 1.33$	$24.73^{a} \pm 2.40$	$5.13^{abc} \pm 0.03$	$17.62^{b} \pm 0.51$	$8.97^{b} \pm 0.01$	$6.74^{b} \pm 2.32$	$5.33^{b} \pm 0.05$	$2.61^{b} \pm 0.14$
Ganthia (*Dactyloctenium aegyptium*)	$24.00^{b} \pm 0.58$	$24.09^{a} \pm 1.34$	$4.58^{ab} \pm 0.14$	$18.67^{c} \pm 0.12$	$10.77^{c} \pm 0.24$	0^{a}	$5.92^{cd} \pm 0.08$	$1.63^{a} \pm 0.03$
Grammna (*Panicum antidotale*)	$25.00^{b} \pm 1.53$	$39.16^{b} \pm 1.19$	$5.85^{c} \pm 0.26$	$18.67^{c} \pm 0.31$	$12.15^{d} \pm 0.24$	$35.43^{e} \pm 0.95$	$6.01^{de} \pm 0.04$	$3.93^{d} \pm 0.02$
Sewan (*Lasiurus sindicus*)	$19.00^{a} \pm 1.53$	$26.63^{a} \pm 1.00$	$4.33^{a} \pm 0.13$	$12.48^{a} \pm 0.42$	$7.67^{a} \pm 0.14$	$15.61^{c} \pm 5.14$	$4.92^{a} \pm 0.21$	$2.80^{b} \pm 0.02$

Different superscripts in a column differ significantly P (< 0.05)

Conclusion

Based on the chemical composition and in vitro digestibility data it can be inferred that Anjan, Dhaman and Grammna grasses can be fruitfully exploited for feeding and incorporation utilization in the diet of camel

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