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Nutritive Value of Some Herbages for Dromedary Camel in Iran

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Abstract: To prepare standard tables of chemical composition of feedstuffs and to determine digestibility and palatability of different plant species in dromedary camel, this research was carried out by considering the most consuming herbages of Iranian desert rages. The plant species were included *Atriplex lentiformis*, *Alhagi persarum*, *Seidlitzia rosmarinus*, *Saueda fruticosa*, *Haloxylon ammodendron*, *Tamarix kotschyi*, *Hammada salicornica*, *Salsola yazdiana*, *Salsola tomentosa*, *Tamarix aphylla* and *Artemisia sieberi*. Thirty samples of the browsing parts were collected from the rangelands of Yazd province in autumn. Chemical composition of samples including Dry Matter (DM), Crude Protein (CP), Crude Fiber (CF), Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), Ether Extract (EE), Total Ash (TA), macro elements (Ca, P, Mg, K), micro elements (Fe, Mg, Cu, Zn)and gross energy (GE) were analyzed. The *in vitro* digestibility was determined by camel rumen liquor in Tilley and Terry method. Palatability of the plants were measured by three mature camels in cafeteria trials. The camels voluntarily fed 11 plant species during one hour for six days. Data were analyzed by GLM method in SAS software. The highest CP (18.3%) and the lowest NDF (40.4%) and ADF (35.4%) were related to *Tamarix aphylla*. The lowest CP (5.5%) and the highest NDF (72.8%) and ADF (59.6%) were related to *Artemisia sieberi*. The highest organic matter digestibility in dry matter was related to *Haloxylon ammodendron*. The results also indicated that *Atriplex lentiformis*, *Alhagi persarum*, *Seidlitzia rosmarinus*, *Saueda fruticosa*, *Haloxylon ammodendron*, *Salsola tomentosa*, *Hammada salicornica*, *Tamarix kotschyi*, *Salsola yazdiana*, *Tamarix aphylla* and *Artemisia sieberi* were more pleasure feed, respectively. It was not observed any correlation between %DOMD and chemical composition. Moreover, There was not a consistent relationship between the palatability of herbages with %DOMD or chemical composition.

Key words: Chemical composition, digestibility, palatability, herbage, camel

INTRODUCTION

To determine the nutritive value of feedstuffs for camel, the first step is to analyse chemical composition of different species plants which preferred by camels and then, to measure digestibility and palatability. Chemical composition of many feedstuffs have been obtained from different ecosystems in the Arab region in Asia and Africa (Wardeh *et al*., 1990). In India, nutritive value of different tree leaves and green lucerene fodder for camels in north semi-arid zone were determined (Bhagwat *et al*., 2001). They suggested that tree leaves were palatable to camel and can serve as good and nutritive fodder for camel.

In Iran, Javan (2001) has reported the digestibility some arid rangelands plants by bovine rumen liquor. The determination of *in vivo* digestibility of wheat straw imply that camel apparently digested poor quality roughages more than cattle and sheep (Hedi and Khamais, 1990; Cianci *et al*., 2004). Therefore, It is required to measure the *in vitro* digestibility of herbages by camel rumen liquor.

It has been documented which there is a reverse relationship between digestibility and palatability of forages with NDF content (Lascano *et al*., 2003; Bagg, 2003). While there is a positive correlation between preferred rating of herbages and nitrogen and mineral concentration in sheep (Reid *et al*., 1992). There are no data from dromedary camel.

However, little information is known about the nutritive value of range herbage consumed by camel in arid and semi-arid zone of Iran. The objectives of the current study were to determine 1) the chemical composition, gross energy of the most consuming plant species including *Atriplex lentiformis*, *Alhagi persarum*, *Seidlitzia rosmarinus*, *Saueda fruticosa*, *Haloxylon ammodendron*, *Tamarix kotschyi*, *Hammada salicornica*, *Salsola yazdiana*, *Salsola tomentosa*, *Tamarix*

*aphylla*and *Artemisia sieberi*, 2) *in vitro* digestibility of the plants by camel rumen liquor 3) the possible relationship between the palatability (preferred rating) with digestibility or chemical composition of the herbages in dromedary camel.

MATERIALS AND METHODS

The plants samples were collected in autumn 2002 based on stratified random sampling from the rangelands of Yazd province in Iran. Thirty samples from the browsing parts prepared, pooled and dried at room temperature and milled. Chemical composition of samples including dry matter (DM), crude fiber (CF), Neutral detergent fiber (NDF), acid detergent fiber (ADF), ether extract (EE), total ash (TA), macro elements (Ca, P, Mg, K)and microelements (Fe, Mn, Cu, Zn)and gross energy (GE) were analyzed by standard methods (AOAC, 1990; Wiseman and Cole, 1990; Undersander *et al*., 1993) in Animal Science Research Institute, Karaj.

To determine the digestibility of the plants, four mature male camel were fitted with fistula in the rumen under anesthesia. The *in vitro* digestibility was measured in duplicate by camel rumen liquor and pepsin in Tilley and Terry 1963 method. Percentage of dry matter digestibility (%DMD), organic matter digestibility (%OMD), organic matter digestibility in dry matter (%DOMD) were calculated.

The palatability of plants were determined by three mature camels in cafeteria trials. The camels were placed in individual pen and offered simultaneously the choice of 11 fresh plant species. The plant samples were collected from the browsing parts from the rangelands. No apparent stress or anxiety was observed from individual penning of the camels. Camels were fed each morning for one hour during six consecutive days. Each feed was weighed and offered in three separates containers. Sufficient feed was placed in each container so that feed would not be depleted. Feed remaining from the previous feeding was weighed to determined amount consumed and the containers were refilled. The location of the containers in the pen was randomizes at each feeding. To compare the preferred rating based on a defined standard, a sample of each collected samples were dried at room temperature for one month.

Data from feed preference trials were analyzed by GLM method in SAS software (1996). The means were compared by duncan's test.

RESULTS AND DISCUSSION

The results of Table 1 showed that highest CP (18.3%)and the lowest NDF (40.4%) and ADF (35.4%) were related to *Tamarix aphylla*. The lowest CP (5.5%)and the highest NDF (72.8%) and ADF (59.6%) were related to *Artemisia sieberi*.

Little information is known about the digestibility of herbages in camel. The digestibility of CP and CF of tree leaves and green lucerene fodder were measured (Bhagwat *et al*., 2001). *In situ* DM and fiber degradation in camel and *in vitro* gas production of four grasses irrigated with sea water have been reported (Alhadrami *et al*., 1998; Abdel-Gawad and Alhadrami, 1998).

Present data are the first report about the *in vitro* digestibility of the some Iranian herbages which obtained by camel rumen liquor. The highest and the lowest %DOMD were related to *Haloxylon ammondendron* and *Artemisia siberi*, respectively (Table 2). We will be able to calculate metabolizable energy of the plants based on MEF = 0.15% DOMD as MEF is metabolizable energy of forage (Orskov, 1984).

% DOMD of *Haloxylon ammondendron* (57.9%), *Seidlitzia rosmarinus* (20.6) and *Hammada salicornica* (48.7) have measured with bovine rumen liquor by Javan (2001). The different result apparently is caused the kind of animal's liquor or phytogenic stage of the plants.

Lower fiber (NDF and ADF) is associated with higher digestibility and higher dry matter intake in sheep (Lascano *et al*., 2003). There was no correlation between our data in dromedary camel. Previous studies have been shown NDF indigestibility increased nonlinearly as

Table 1: Chemical composition and gross energy of different plant species based on dry matter

Scientific name of plants	DM (%)	CP (%)	CF (%)	NDF (%)	ADF (%)	TA (%)	EE (%)	GE (cal/g)	Ca (%)	P (%)	Mg (%)	K (%)	Fe (mg kg^{-1})	Mn (mg kg^{-1})	Cu (mg kg^{-1})	Zn (mg kg^{-1})
Alhagi persarum	92.4	9.9	41.8	59.0	51	7.5	0.30	4168.2	1.50	0.27	0.36	1.55	325	16.0	8.5	120
Artemisia siberi	92.3	5.5	48.4	72.8	59.6	5.5	1.35	4593.2	1.59	0.25	0.18	1.31	200	22.6	13.7	212
Atriplex lentiformis	92.9	8.7	38.2	64.8	46.6	12.3	0.20	4001.5	0.82	0.22	0.26	2.00	50	22.5	7.3	190
Haloxylon ammondendron	92.0	10.0	28.2	45.6	37.2	19.9	0.50	3525.7	1.19	0.05	0.61	0.95	250	40.7	8.8	167
Hammada salicornica	92.3	11.7	42.8	51.6	42.6	14.3	0.35	3573.6	2.33	0.20	0.80	1.02	530	29.0	10.5	225
Salsola tomentosa	93.2	13.3	41.6	60.0	39.8	19.5	0.40	3118.9	1.13	0.22	0.24	1.11	305	57.6	11.3	107
Salsola yazdiana	93.0	7.3	42.2	71.4	52.4	17.3	0.30	3912.1	1.17	0.05	0.80	2.20	537	48.5	10.7	150
Seidlitzia rosmarinus	93.3	9.5	23.2	32.2	26.4	26.3	0.15	3066.0	1.23	0.20	0.67	2.30	450	55.4	9.3	147
Sueda fruticosa	90.2	13.5	34.2	51.0	39.2	21.1	0.30	3129.3	3.15	0.50	1.09	1.11	722	37.0	9.9	115
Tamarix aphylla	93.5	18.3	28.4	40.4	35.4	16.4	0.30	3554.9	1.54	0.10	1.23	0.50	380	20.4	9.2	157
Tamarix kotschi	91.8	7.2	33.0	49.6	45.2	14.7	0.40	3948.5	1.85	0.80	1.25	1.90	250	31.9	9.6	192

Table 2: *In vitro* digestibility of different plant species

Scientific name of plants	DMD (%)	OMD (%)	DOMD (%)
Atriplex lentiformis	57.94	49.87	40.44
Alhagi persarum	43.57	39.03	34.66
Seidlitzia rosmarinus	61.43	46.26	32.43
Sueda fruticosa	82.83	68.62	33.83
Haloxylon ammondendron	71.57	63.61	45.36
Salsola tomentosa	45.16	36.90	29.81
Hammada salicornica	60.32	51.12	42.31
Tamarix kotschi	37.75	32.55	29.13
Salsola yazdiana	26.92	23.16	21.61
Tamarix aphylla	42.81	38.28	34.41
Artemisia siberi	23.63	19.71	18.53

Table 3: Mean±SD intake of different plant species as air-dried or fresh

Scientific name of plants	Air-dried	Fresh
Atriplex lentiformis	4.01 ± 0.44^{a}	$7.72\pm0.85^{a*}$
Alhagi persarum	3.26 ± 0.26^{b}	8.57 ± 0.68^{a}
Seidlitzia rosmarinus	1.91 ± 0.72^{c}	2.80 ± 0.30^{b}
Sueda fruticosa	1.45 ± 0.15^{cde}	2.85 ± 1.06^{b}
Haloxylon ammondendron	1.27 ± 0.69^{cdef}	1.57 ± 0.85^{c}
Salsola tomentosa	1.10 ± 0.18^{defg}	1.53 ± 0.25^{c}
Hammada salicornica	0.83 ± 0.26^{efg}	0.92 ± 0.28^{cd}
Tamarix kotschi	0.77 ± 0.14^{efg}	1.27 ± 0.23^{c}
Salsola yazdiana	0.57 ± 0.04^{g}	0.73 ± 0.06^{cd}
Tamarix aphylla	0.55 ± 0.02^{g}	0.82 ± 0.30^{cd}
Artemisia siberi	0.44 ± 0.06^{g}	0.62 ± 0.08^{cd}

* The values which did not have a common letter (s) are significantly different ($p<0.05$)

the lignin concentration of the NDF increased (Jung *et al*., 1997; Traxler *et al*.,1998). However, we did not measure lignin concentration or indigestible NDF in this experiment.

The results indicated that species of plant had a significant effect ($p<0.01$) on intake. Mean intake of *Atriplex* lentiformis was significantly ($p<0.05$) greater than the other plant species based on air-dried. As fresh, relative intake of *Atriplex lentiformis* and *Alhagi persarum* was not significantly different, but their intake were significantly ($p<0.05$) more than the other plant species. Relative intake was greater ($p<0.01$) for fresh *Seidlitzia rosmarinus* and fresh *Sueda fruticosa* and air-dried *Seidlitzia rosmarinus* than for the others plant species (Table 3).

Considering to results, we could divided the plants to three groups: 1) most palatable including *Atriplex lentiformis* and *Alhagi persarum*; 2) palatable including *Seidlitzia rosmarinus*, *Sueda fruticosa, Haloxylon ammondendron* and *Salsola tomentosa*; 3) less palatable or undesirable including *Hammada salicornica*, *Tamarix kotschi*, *Salsola yazdiana*, *Tamarix aphylla and Artemisia siberi.*

In the current study, there was not any consistent relationship of plants palatability to measured chemical composition or digestibility. In camel, there was a little information about herbage preference and grazing behavior of camel (Wardeh, 1990). In that study, it was not reported any relationship between palatability to chemical composition or digestibility. In cattle, Increased NDF indigestibility will result in higher energy values and perhaps more importantly, increased forage intake. Relatively small improvements in fiber digestibility can significantly increase dry matter intake (Bagg, 2003). In sheep, the palatability was associated with lower NDF and a greater concentration of nitrogen content and generally greater concentration of minerals (K, Ca, Mg, S, Fe) (Reid *et al*., 1992; Lascano *et al*., 2003). It has been suggested that sheep were able to select a diet meeting their CP requirements and avoid, at least to a certain extent, excess of protein intake (Reid *et al*., 1966; Kyriazakis and Oldham, 1993).

It has been shown that the animal needs to be aware of the nutritional differences between the feeds which differ in taste, colour or some other sensory discriminating factor. Social interactions between animals also can have influences on food selection (Forbes and Kyriazakis, 1995). It must be considering that the presence of a toxin in one food can markedly reduce the animal's preference for that food. For example, Ralphs *et al*. (1990) indicated that the presence of a toxin alkaloid swainsonine in locoweed resulted in the ewes did not select it if the other feeds were offered. However, We did not measured toxins in the plants.

Diet selection theory is extremely complex and has been reviewed for grazing and browsing livestock, for example, Malechek and Balph (1987) and Milne (1991). In this study, specific points of interest were whether palatability or preference ratings were related to chemical composition and (or) nutritional characteristics of the herbages.

Forbes and Kyriazakis (1995) have suggested that preferred foods, or the preferred ratio of two or more foods, are tuned to provide a diet which promotes maximum metabolic comfort. Hence, it is reasonable to presume that the camels selected a combination of feeds/plants which provided animal's metabolic requirements and, no based on the chemical composition.

IMPLICATION

This is the first report on the *in vitro* digestibility by camel rumen liquor and the palatability of some herbages in Iran. There were no consistent patterns between the palatability with chemical composition or the digestibility of the plants. For further study, it is suggested to investigate the relationship between the other contents of plants, for example lignin, toxin etc., with the palatability.

REFERENCES

Abdel-Gawad, M..H. and G.A. Alhadrami, 1998. *In situ* DM and fiber degradation in camel and *in vitro* gas production of two grasses irrigated with sea water. 2. Spartina grass (*Spartina alterniflora)*. Proceedings of the 3d Annual Meeting for Animal Production Under Arid Condition. U.A.E. Abstract, 35.

Alhadrami, G.A., M.H. Abdel-Gawad and A. Jumma, 1998. *In situ* DM and fiber degradation in camel and *in vitro* gas production of two grasses irrigated with sea water. 1. Sporobolus grass (*Sporobolus virginicus)*. Proceedings of the Third Annual Meeting for Animal Production Under Arid Condition. U.A.E. Abstract, 5.

Association of Official Analytical Chemists (AOAC), 1990. Official Methods of analysis. 15th Edn., USA. pp: 1289.

Bagg, J., 2003. Fiber Digestibility. Proceedings of Forage Focus Conference. Canada. Abstract, 9.

Bhagwat, S.R., M.B. Pande and D. Dongre, 2001. Nutritive value of different tree leaves and green lucerene fodder for camels in north semi-arid zone of Gujarat. Proceedings of the Sixth Annual Conference for Animal Production under Arid Condition. UAE Abstract, 50.

Cianci, D., L. Goio, A.M. Hashi, S. Pastorelli, M. Kamoun, G.B. Liponiand and M. Orlandi, 2004. Feed intake and digestibility in camels fed wheat straw and meadow hay. J. Camel Sci., 1: 52-56.

Forbes, J.M. and I. Kyriazakis, 1995. Food preference in farm animal: Why don' they always choose wisely? Proceedings of the Nutrition Society, 54: 429-440.

Hedi, A. and K. Khemais, 1990. Intake, digestion and feeding behaviour of the one-humped camel stall-fed straw-based diets. Livestock Research for Rural Develop., 2: 1-5.

Javan, A.A., 2001. Chemical composition and digestibility of five plants consumed by dromedary camel. The final report of research project. Research Center of Natural Resources and Animal Sciences os Sistan and Balouchestan.

Jung, H.G., D.R. Mertens and A.J. Payne, 1997. Correlation of acid detergent lignin and klason lignin with digestibility of forage dry matter and neutral detergent fiber. J. Dairy Sci., 80: 1622-1628.

Kyriazakis, I. and J.D. Oldham, 1993. Diet selection in sheep: The ability of growing lambs to select a diet that meets their crude protein (nitrogen * 6.25) requirements. Br. J. Nut., 69: 617-629.

Lascano, C., P. Avila and J. Stewart, 2003. Intake, digestibility and nitrogen utilixation by sheep fed provenances of *Calliandra calothrsus* Meissner with different tannin structure. Archivos Latinoamericanos de Producción Animal, 11: 1-8.

Malechek, J.C. and D.F. Balph, 1987. Diet Selection by Grazing and Browsing Livestock. In: Hacker, J.B. and J.H. Ternouth (Eds.), The Nutrition and Herbivores. Academic Press. North Ryde, Australia, pp: 121-132.

Milne, J.A., 1991. Diet selection by grazing animals. Proceedings of Nutr. Soc., 50: 77-84.

Orskov, E.R.E., 1984. Energy allowance and feeding systems for ruminants. Ministry of Agriculture Fisheries and Food.

Ralph, M.H., K.E. Panter and L.F. James, 1990. Feed preferences and habituation of sheep poisoned by locoweed. J. Anim. Sci., 68: 1354-1362.

Reid, R.L., G.A. Jungand and S.J. Murray, 1966. Nitrogen fertilization in relation to the palatability and nutritive value of orchardgrass. J. Anim. Sci., 25: 636-642.

Reid, R.L., G.A. Jung and J.R. Puoli, J.M. Cox-Ganser and L.L. Scott, 1992. Nutritive quality and palatability of switchgrass hays for sheep: Effect of cultivar, nitrogen fertilizationand time of adaptation. J. Anim. Sci., 70: 3877-3888.

Statistical Analysis System, 1996. SAS user's Guide: Statistics, version 6.12. Institute Inc., Cary, NC.

Tilley, J.M.A. and R.A. Terry, 1963. A two stage technique for the *in vitro* digestion of forage crop. J. Br. Grassland Soc., 18: 104-109.

Traxler, M.J., D.G. Fox, P.J. Van Soest, A.N. Pell, C.E. Lascano, D.P. Lanna, J.E. Moore, R.P. Lana, M. Velez and A. Flores, 1998. Predicting forage indigestible NDF from lignin concentration. J. Anim. Sci., 76: 169-1480.

Undersander, D., D.R. Mertens and N. Thiex, 1993. Forage Analyses Procedures. National Forage Testing Association Proceedings. Omaha, Ne, pp: 95-103.

Wardeh, F., M. Dawa and M.M. Ould Al-Mustafa, 1990. The nutritive value of plant species eater by camels (*Camelus dromedaries*). Proceedings of the International Conference on Camel Production and Improvement. Tobruk. Libya.

Wardeh, M.F., 1990. Camel Feeds and grazing behaviour. Symposium of Animal Science Divisions in the Arab Universities and Workshop on Development of camel Production. United Arab Emirates. Acsad/ASP., pp: 104.

Wiseman, J. and D.J.A. Cole, 1990. Feedstuff Evaluation. Cambridge University Press. London, pp: 456.