Vol 10 No 1, p 37-43

UTILISATION OF SOME BROWSE PLANTS OF EASTERN SUDAN BY CAMEL AND GOAT

A.G. Abdel Rahim
Faculty of Veterinary Medicine, Assiut University, Assiut, EGYPT

ABSTRACT

The nutritive value and utilisation of the browse plants *Ziziphus spinachrista*, *Acacia senegal*, *Capparis decidua*, *Blepharis linearifolia*, *Maerua crassifolia* and *Sesamum indicum* were studied by using rumen-fistulated camels and goats. Most of the plant studied constituted an excellent forage with a relatively high crude protein values (10.62-24.8%) and water content (23.3-63.2%). The concentrations of range values obtained for macro-elements in this study (2.3-15.6, 12.4-128.6, 2.9 - 10.4 and 2.01 - 68.23 g/kg DM for Ca, Mg, K and Na, respectively) furnished an adequate supply for both camels and goats. Although the dry matter disappearance rates in most incubated samples were slightly higher in camels than goats, but generally they were low (4.5 - 23.8%) for most plants in both camels and goats. The study suggested that camel and goat rumen has no significant role in minerals digestion. It was believed that the nutritive values of browse plants may complement and supplement grasses especially in the dry season to meet livestock maintenance requirements.

Key words: Browse plants, camel, goat, Sudan, utilisation

Camels and goats can consume many different kinds of plants. Knoess (1976) noted the advantage of the camel over other livestock in the Awash valley of Ethiopia, in that it could utilise a wider variety of local plants, while Matharu (1966) indicated that Indian camel were able to consume many types of feeds sometimes considered unsuitable for other herbivore and could live on hard, thorny plants like acacia. Field (1979) reported that the average diet of camel in northern Kenya consists of 45.5% dwarf shrubs, 29.9% trees, 11.2% grasses and 10.2% other herbs. Maxwell-Darling (1938) and El-Shami *et al* (1989) also confirmed the wide variety of plants, that included trees, shrubs and grasses consumed by camels in northern Sudan. The feeding preferences of goats have been little studied, though they are observed to consume beside grasses, leaves, twigs, shoots and barks of shrubs and trees (Wilson, 1957).

It has been shown by Sarson and Salmon (1978) that browse alone can not ensure the maintenance requirements of cattle, but it can ensure maintenance of sheep without allowing production. In goats, however, maintenance and production can be assured on a pure browse diet. This may explain why only goats, camels and some wild herbivores can survive on the depleted range lands often found in arid zones, where browse constitutes most of the feed (Wardeh, 1990).

The present study is an attempt to study the utilisation of some browse plants of eastern Sudan consumed by camel and goats by the determination of the dry matter disappearance and release of minerals in the rumen using the nylon bag technique.

Materials and Methods

Collection, preparation and analysis of samples

The browse plants used are those which are either cut for feeding goats by farmers or those which are observed to be eaten by camel and goats. The plants were collected from the Butana area of the eastern Sudan between April and May (dry season). Their local and botanical names were identified (Table 1). The parts eaten (leaves in the case of trees and shrubs and leaves and stem in the case of herbs and grasses) were analysed in this study.

SEND REPRINT REQUEST TO A.G. ABDEL RAHIM

Table 1. Some browse plants of the Butana area of Eastern Sudan.

Botanical Nomeclature	Local Name	Type
Ziziphus spinachrista	Sidder	Tree
Acacia senegal	Hashap	Tree
Capparis decidua	Tunduls	Shrub
Bleharis lineariifloia	Siha	Shrub
Maerua crassifolia	Sereh	Grass
Sesamum indicum	Sesame	Grass

The samples were weighed and oven-dried at 100°C to constant weight. The proximate components (crude protein -CP, crude fibre-CF, ether extract-EE and ash) were determined by the AOAC methods (1965). The nitrogen-free extract-NFE (%) is calculated as follows:

NFE (%) = 100-% ash-% CF-% EE-%CP. NFE is no longer used as an entity in calculating diets, but until sufficient energy data becomes available for browse plants, there is some advantage in having NFE for calculating total digestible nutrients (TDN), that in turn, is used for calculating digestible energy (DE). For the determination of minerals, samples were asked in a muffle furnance at 450°C overnight. Minerals were extracted using atomic absorption spectro-photometer.

Animals and diets

Two adult male camels and three goats were used throughout the experiment. Each animal was fitted with a wide-bore fore-stomach (rumen) fistula wide enough to introduce nylon bags in the rumen.

Camels and goats were housed separately in the University of Khartoum Farm. Animals were allowed to browse freely on trees and shrubs and graze on grasses around the area from morning till mid-day and they were then housed in pens with free access to hay and water.

Determination of dry matter disappearance in the forestomach

Browse plants samples were tested for dry matter digestibility with camels and goats using the nylon bag technique of Orsokov *et al* (1986). Dried plant samples were ground, weighed into nylon bags and incubated for 6, 12, 16, 24, 48 and 72 hours in the forestomach of camels and goats. Dry matter loss from the nylon bag during these incubation periods serves as an indicator for digestibility.

All chemicals were of analar grade supplied by Sigma (Sigma Chemical Company Ltd., Fancy Road, Poole, Dorset, England).

Statistical analysis of the results (mean and standard deviation - SD) was carried out according to Snedecor and Cochran (1967).

Results and Discussion

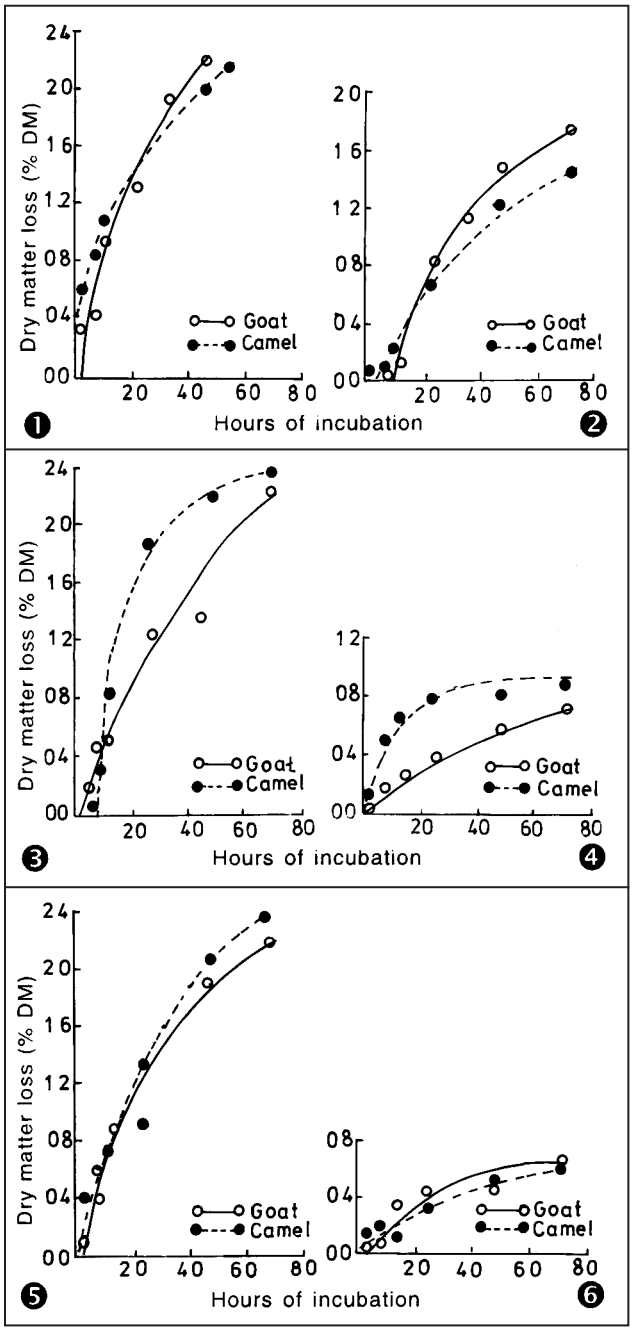
The results of the chemical analysis of browse plants investigated in this study are summarised in table 2. The DM ranged between 36.8-76.7% with a mean value of 55.56 ± 0.75. Mean values with percentages with ranges (%) of 14.37 ± 2.27 (10.62-24.8), 36.8 ± 5.72 (30.5 - 45.0), 1.18 ± 0.56 (0.52 - 1.85), 9.7 ± 0.57 (5.4 - 14.5) and 41.74 ± 3.6 (35.69 - 45.68) were obtained for CP, CF, EE, Ash and NFE, respectively. Mean values (g/kg DM) with wide range (g/kg DM) variations were obtained for the macro elements Ca, Mg, K and Na concentrations (Table 2). Figures 1-6 show the mean dry matter disappearance (DMD) from 0-72 hours in camel and goat for the different

Table 2. The chemical composition of some browse plants of the Butana area of Eastern Sudan.

Chemical component	Concentration (Mean ± SD)
Dry Matter (DM%)	55.56 ± 0.75 (36.8-76.71)
Crude Protein (CP%)	14.37 ± 2.27 (10.62-24.8)
Crude fibre (CF%)	36.8 ± 5.72 (30.5-45.0)
Ether Extrad (EE%)	1.18 ± 0.56 (0.52-1.85)
Ash (%)	9.7 ± 0.57 (5.4-14.5)
Nitrogen, Free Etract (NFE%)	41.74 ± 3.60 (35.69-45.68)
Ca (g/kg DM)	8.62 ± 0.06 (2.3-15.6)
Mg (g/kg DM)	41.27 ± 3.01 (12.4-128.6)
K (g/kg DM)	6.91 ± 0.02 (2.9-10.4)
Na (g/kg DM)	20.15 ± 0.14 (2.01-68.23)

Values in parentheses indicate range values.

Ziziphus spinachrista, Acacia senegal, Capparis deciduas, Blepharis linearifolia, Maerua crassifolia and *Sesamum indicum* were used.



Figs 1-6. Mean dry matter disappearance rate of *Ziziphus spinachrista* (1); *Acacia senegal* (2); *Sesamum iudicum* (3); *Maerua crossifolia* (4); *Blepharis linearifolia* (5); *Capparis decidua* (6) incubated in the rumen of camel and goat.

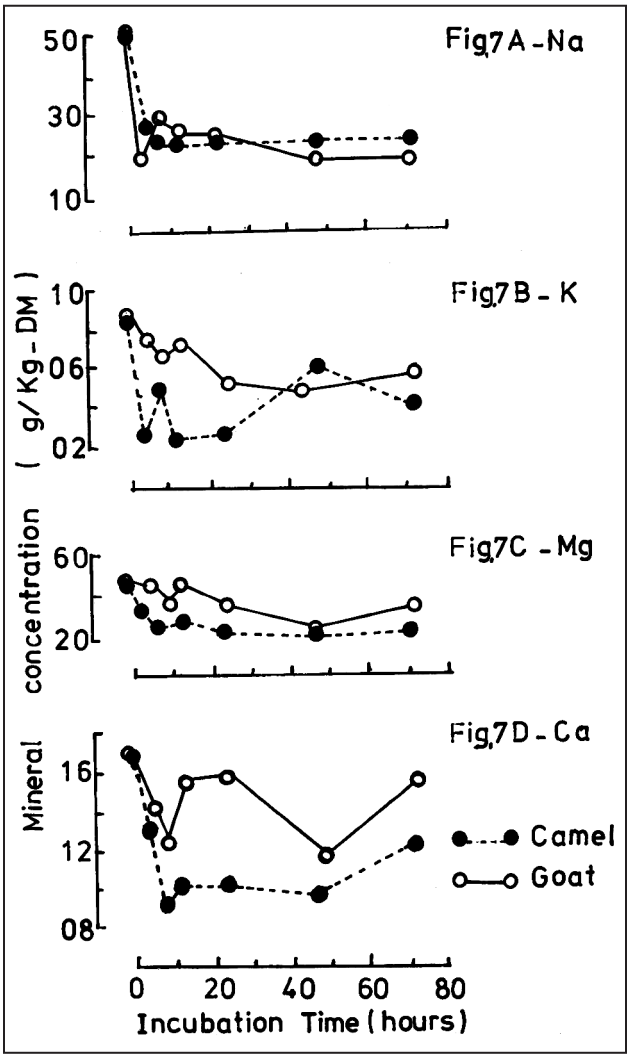


Fig 7. The concentration of Na (a), K (b), Mg (c) and Ca (d) of *Acacia senegal* after incubation in the rumen of camel and goat for 6, 12, 24, 48 and 72 hours.

browse plants studied. Figures 7-12 show the concentration of Na, K, Mg and Ca of the various plants investigated after incubation in the rumen of camels and goats for a period up to 72 hours.

Various ranges of chemical composition of the different plant species are shown in Table 2. These variations are expected to affect their nutritive values as was shown by Le Hoaerous (1980a). Concentrations (10.62-24.8% DM) in this study which agree with the values reported by Dougall *et al* (1964) may probably satisfy goat needs when compared with the recommendations of the ARC (1965). The crude fibre concentration range reported in this study (30.5-45.0% CF) is relatively low than the values reported by Le Houaerou (1980a) and the range values (51.9-69.0% CF) reported by El-Shami *et al* (1989).

The high protein and low fibre contents of browse plants may be an advantage to camels

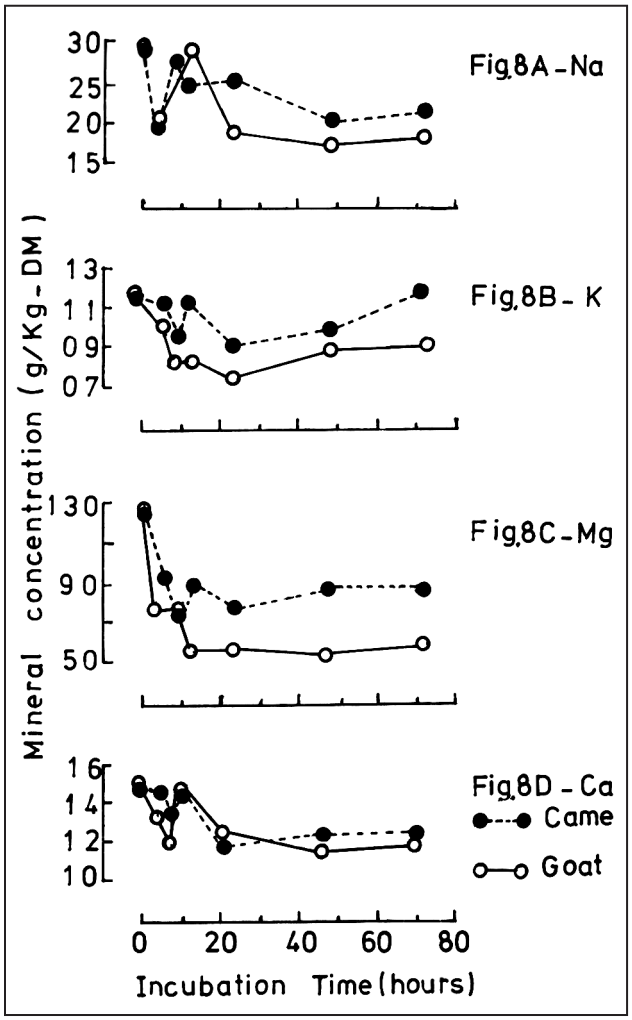


Fig 8. The concentration of Na (a), K (b), Mg (c) and Ca (d) of *Ziziphus spinachrista* after incubation in the rumen of camel and goat for 6, 12, 24, 48 and 72 hours.

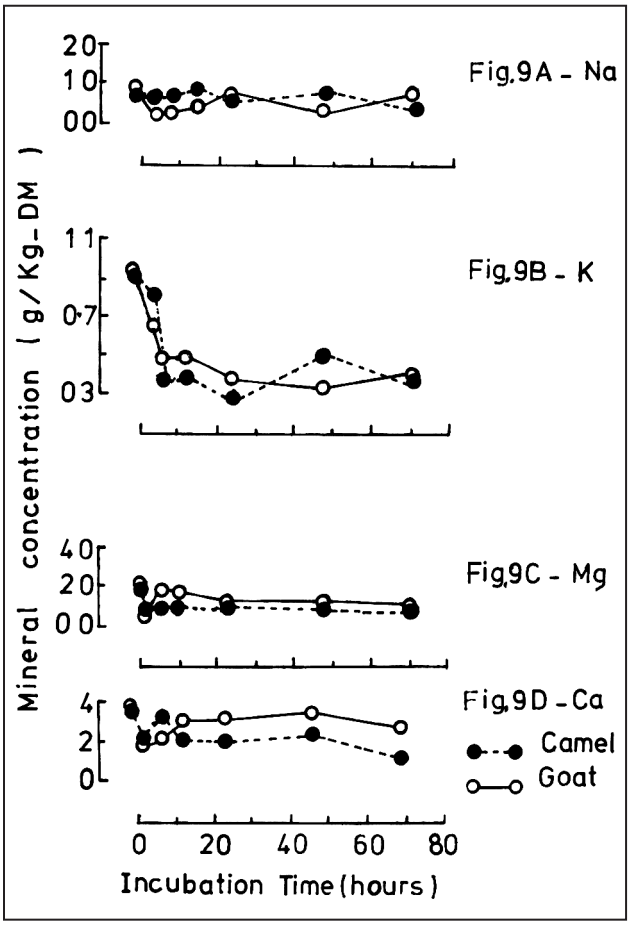


Fig 9. The concentration of Na (a), K (b), Mg (c) and Ca (d) of *Capparis decidua* after incubation in the rumen of camel and goat for 6, 12, 24, 48 and 72 hours.

and goats specially during the dry season when the nutritive values of arid zones grasses were reported to be low due to a decrease in protein and increase in fibre content (Oyeruga, 1957 and Van Soest, 1982). The mineral concentrations of the browse plants analysed in this study are generally adequate for goats when compared with the data recommended by the ARC (1965) and the values projected by Boudet (1975) for ruminants. However, the concentrations of Ca, Mg, K and Na reported in this study for browse plants of the Butana area of eastern Sudan are markedly higher than those reported by Le Houerous (1980a) for browse of tropical west Africa.

The dry matter disappearance rates (DMD) reported in this study (7.5-23.8%) were low, even samples were incubated for 72 hours. These values agree with the results obtained by Schwartz (1992) for a variety of browse plants eaten by free-ranging sheep, goats and camels in eastern Africa and Wilson and Harrington (1980) for Australian browse. The low DMD reported in this study may be attributed to factors such as lignin, phenolic compounds and silica that inhibit the degradation of cell wall (Bichards, 1976; Danny, 1982; Ramplrez and Lara, 1998 and Romero *et al*, 2000). Thicker cell walls of browse plants grown at high temperature may also be a contributory factor in lowering digestibility (Le Houreou, 1980a). It was observed that the DMD curves of

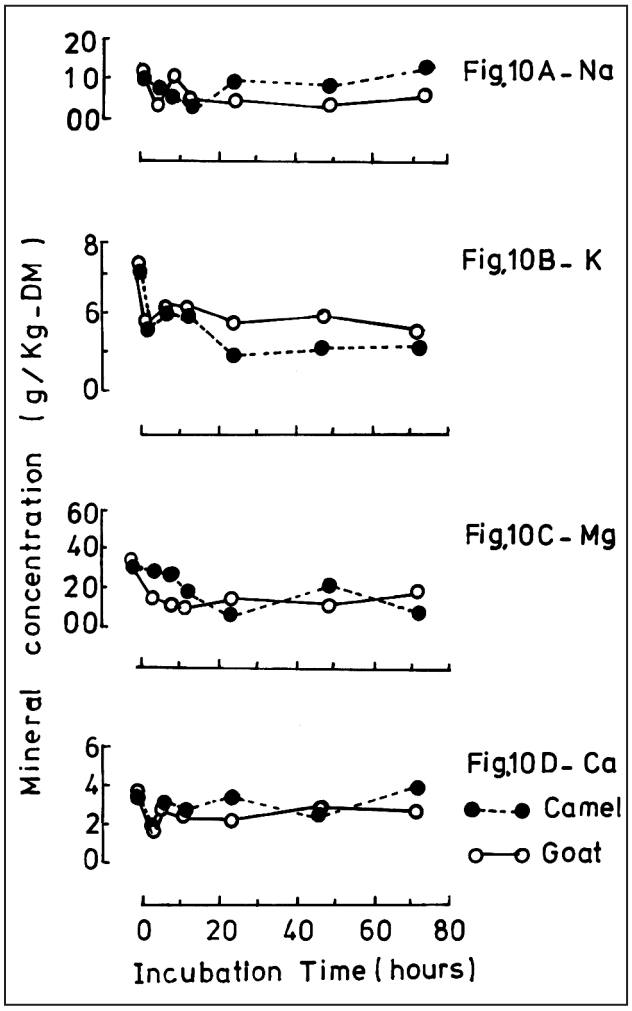


Fig 10. The concentration of Na (a), K (b), Mg (c) and Ca (d) of *Maerua crassifolia* after incubation in the rumen of camel and goat for 6, 12, 24, 48 and 72 hours.

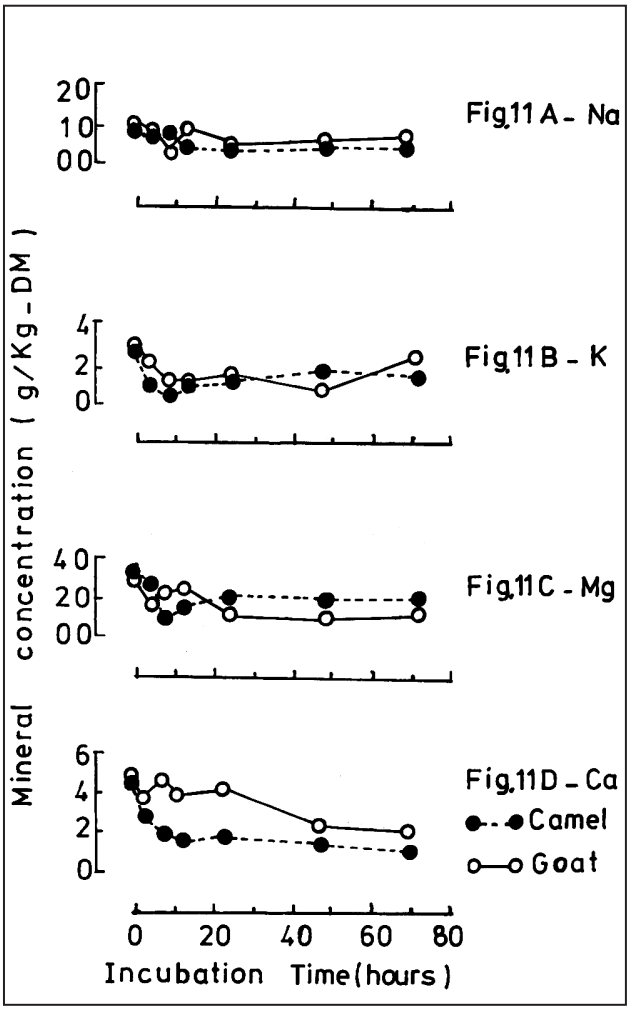


Fig 11. The concentration of Na (a), K (b), Mg (c) and Ca (d) of *Acacia senegal* after incubation in the rumen of camel and goat for 6, 12, 24, 48 and 72 hours.

camels were slightly higher than those of goats (Figs 2-6). This may be attributed to differences in the anatomical structure of camel and goat stomach (Engelhardt *et al*, 1988) with different microbial populations (Eadie, 1962).

One of the objectives of the present study is the determination of the rumen role in minerals digestion. Small differences were illustrated in the concentrations of Ca, Mg, K and Na after incubation of various samples in camel and goat rumen for 72 hours (Figs 7-12). However, most of the curves tended to plateau at on stage for the two species. There are at least two possibilities for explaining mineral losses in the rumen after incubation: firstly, may be due to rumen digestion in which the rumen microorganisms attack various organic complexes and thus release minerals making them available for absorption by the animal or utilisation by the micro-organisms. Another explanation for the loss of minerals may be due to the solubility of minerals in rumen liquor. However, the results obtained in this study strongly support the last explanation and it agrees with the findings of El-Shami *et al* (1990) who estimated the loss in minerals for various browse plants incubated in camel and goat rumen.

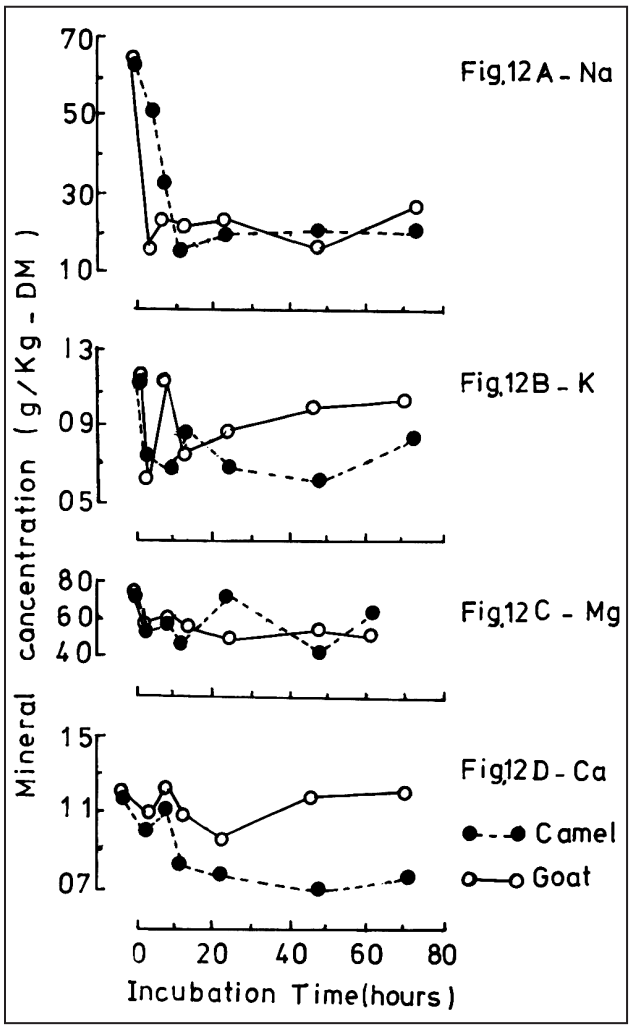


Fig 12. The concentration of Na (a), K (b), Mg (c) and Ca (d) of *Blepharis lineariifolia* after incubation in the rumen of camel and goat for 6, 12, 24, 48 and 72 hours.

References

Agricultural Research Council (1965). The Nutrient Requirements of Farm Livestock. No. 2 Ruminant. Technical reviews and summaries. Henry Burt and Son Ltd., Kepston, Befford, London, England.

Association of Official Agricultural Chemists (1965). Methods of Analysis. 10th Edn. Washington D.C., U.S.A.

Bichards GN (1976). Search for factor other than liginshielding in protection of cell wall polysaccharides from digestion in the rumen. In: Carbohydrates Research in Plant and Animal. Ouwhogesch, Wogeningen, The Netherlands. pp 129-135.

Boudet G (1975). Problems poses par "estimation de la capacite de charge dun. Paturage naturel tropical". Coll. Sur L'evaluation *et al* cartographie des paturages tropicaux africans. CIPEA, Addis Abeba. pp 269-276.

Danny EA (1982). Rumen microbial degradation of cell walls. In: Proceedings of Dietary Fibre in Human and Animal Nutrition Symposium. Massy University, Planerston, New Zealand.

Dougall HW, Drysdole UM and Glouer PE (1964). The chemical composition of Kenya browse and pasture herbage. East Africa Wildlife Journal 2:86-121.

Eadie JM (1962). The relationship between certain rumen ciliate protozoa. Journal of General Microbiology 29:579-548.

El-Shami, El-Ginaid M, Idris OF, Abdel Rahim AG and Mousa HM (1989). Chemical composition of eastern Sudan browse plants. The Sudan Journal of Veterinary Research 8:59-65.

El-Shami, El-Ginaid M, Idris OF and Abdl Rahim AG (1990). A comparative study on the utilisation of some browse plants by camels and goats in eastern Sudan. The Sudan Journal of Veterinary Research 9:29-35.

Engelhardt WV, Lechner-Doll M, Heller R, Schwartz T, Rutagwenda T and Schuttka W (1988). Physiology of the forestomach in camelids with particular reference to adaptation to extreme dietary conditions. A comparative approach. Proceedings Seminaire sur la Digestion, la Nutrition *et al*, Alimentation du Dromedaire Ouargla, Algeria.

Field CR (1979). Ecology and management of camels, sheep and goats in northern Kenya. UNEP/MAB/IPAL. United Nations Environmental Programme/Mand and Biosphere Integrated Project in Arid Lands, Mimeo, Nairobi, Kenya. p 18.

Knoess KH (1976). Assignment report on Animal Production in the middle Awash Valley. Rome, FAO. p 57.

Le Houerou HN (1980). Chemical composition and nutritive value of browse in tropical west Africa. In: Browse in Africa. Ed. Le Houerous HN. International Livestock Centre for Africa, Addis Ababa, Ethiopia. pp 261-289.

Matharu BS (1966). Animal Management: Camel care. Indian Farming. pp 19-22.

Maxwell-Darling RC (1938). The food of the camel of the Red Sea and Northern Kordafan. Sudan Notes and Records 21:189-198.

Oroskov BE, Del FD and Hovel FM (1986). The use of Nylon bag technique for the evaluation of feed stuffs. Tropical Animal Production 2:195-213.

Oyeruga VA (1957). The composition and agricultural value of some grass species in Nigeria. Journal of Experimental Africa 25:237-243.

Ramplrez RG and Lara JA (1998). Influence of native shrubs Acaia rigidula, Cercidium macrum and Acacia farnesiona on digestibility and nitrogen utilization by sheep. Small Ruminant Research 28:39-46.

Romero MJ, Mardid J, Herndez F and Cerln JJ (2000). Digestibility and voluntary intake of vine leaves (*Vitis vinifera L.*) by sheep. Small Ruminant Research 38:191-195.

Sarson M and Salmon P (1978). Role des arbres et arbustes fourrager dans lamenagement paturages Naturels en Afique du Nord. Mimeo. Supporting Papter, Item No.10. 8th World Forestry Congress, Jakarta.

Schwartz HJ (1992). Common range forage species preferred by camels and their nutritional value. In: The one-humped camel in eastern Africa. Eds. Schwartz HJ and Dioli M. Verlag Josef Margraf Scientific Books, Berlin, Germany. pp 268-276.

Snedecor GW and Cochran EG (1967). Statistical Methods. 6th Edn. Ames, Iowa State University Press.

Wardeh MF (1990). Camel feeds and grazing behaviour, Symposium. Animal Science Divisions in the Arab Universities. Workshop on Development of Camel Production. ACSAD/AS/P104, March 4-7.

Wilson AD and Harrington NA (1980). Nutritive value of Australian browse plants. In: Browse in Africa. Ed. Le Houerou HN. International Livestock Centre for Africa. Addis Ababa, Ethiopia. pp 291-297.

Wilson PH (1957). Studies on the browsing and reproduction behaviour of east African dwarf goat. East Africa Agriculture Research 23:138-147.

Van Soest PJ (1982). Nutritional Ecology of the Ruminants. O and B. Books Inc., 1215 NW Kline Place, Corvallis, Oregon, 97330, USA.

FORM - IV

1. Place of Publication	: (See Rule 8) : Camel Publishing House, 67, Gandhi Nagar West, Near Lalgarh Palace, Bikaner-334003, India.
2. Periodicity of its publication	: Biannual
3. Printer's Name (Whether citizen of India) Address	: Smt.Leela Devi : Yes : Gahlot Kutir, Nagani Road, Bikaner (Raj.)
4. Publisher's Name (Whether citizen of India) Address	: Smt. Leela Devi : Yes : Gahlot Kutir, Nagani Road, Bikaner (Raj.)
5. Editor's Name (Whether citizen of India) Address	: Dr.T.K.Gahlot : Yes : Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Bikaner 334 001 (India).
6. Names and address of individual who own the newspaper and partners or share holders holding more than one per cent of total csapital.	: Dr.T.K.Gahlot 67, Gandhi Nagar West, Near Lalgarh Palace, Bikaner -334 001 (India)

I, Smt.Leela Devi hereby declare that the particulars given above are true to the best of my knowledge and belief.

Dated : 22.08.2003

Sd/-
Signature of Publisher