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Dromedary feeding behaviour in the Southern Steppe of Morocco

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SUMMARY - A study was conducted in the county of M'Hamid located South of Ouarzazate at about 200 km during January, April, June and October of 1990. The objective was to investigate the dromedary feeding behaviour. For each of the four sampling periods, observations during six consecutive days were made. Observations concerned temporal behaviour, diet botanical composition and diet ingestion. Diet botanical composition was assessed by means of the bite count technique. Simulated diets were composite from hand-plucked material similar to that ingested by the animal based on bite counts. Chemical analysis were done on the simulated diets. Grazing time (GT) of the dromedary varied among the different periods of the year ($P < 0.05$). The proportion of the time allocated to grazing decreased, 56%, 53%, 42% and 38% for January, April, June and October, respectively. Resting time increased with the advance in season ($P < 0.05$). The proportion of the resting in the total time for all activities varied from 18% in January to 34% in October. Distance walked averaged 27, 28, 30 and 25 km per day for January, April, June and October, respectively. Diet botanical composition was influenced by season ($P < 0.05$). Fodder trees (nanophanerophytes) and fodder shrubs (chameaphytes) composed nearly all the dromedary diet early and late in the season, i.e., 85% and 100% in January and October, respectively. At the mid season, the dromedary switched to the lower vegetation layer. Chamaephytic and herbaceous species contributions averaged 70%. Herbaceous species were an important component of the dromedary diet in April as result of the spring rain. During January and June, *Diplotaxi harra* was the only herbaceous specie ingested, i.e., 15.29% and 67.69% for January and June, respectively. Overall the dromedary included fewer species in its diet. Crude protein content averaged 12.60, 13.59, 19.63 and 10.94% in January, April, June and October, respectively. Diet crude protein remained high all year-long because of the larger proportion of the shrubs in the diet. The NDF content of the simulated diet was the lowest early and late in the season, probably because of the selectivity of leaves and twigs in the higher layer of vegetation (trees). Ingestion of ADF was similar to NDF. The ADL content of the dromedary diet decreased with advance in season. *In vitro* dry matter digestibility declined in April and June. Higher content of fodder trees and fodder shrubs seemed to be responsible for adequate level of digestibility of diet. The dromedary intake, expressed as kg of dry matter per animal averaged 3.23, 3.07, 3.22 and 2.47 for January, April, June and October, respectively.

Key words: Dromedary, grazing behaviour, intake.

RESUME - "Comportement alimentaire du dromadaire dans la steppe du sud du Maroc". La présente étude s'est déroulée durant les mois de Janvier, Avril, Juin et Octobre 1990 dans la région de M'hamid El Ghezlane dans la province de Ouarzazate. Elle s'est proposée comme objectif l'étude du comportement alimentaire du dromadaire. Les résultats indiquent que le dromadaire passe 47% de son temps à pâturer, soit une moyenne de 455 min. Cependant, le temps de pâturage varie avec l'époque

de l'année; 540, 515, 400 et 365 min respectivement pour les mois de Janvier, Avril, Juin et Octobre. La proportion de temps allouée à l'activité de repos a très peu varié avec les saisons; elle a été en moyenne de 25%. Les distances de déplacement, exprimées en km par jour, ont été de 27,3, 28,25, 30,25 et 24,7 respectivement pour les 4 mois investis. Les choix du dromadaire opérés au niveau de la végétation, ont été influencés par l'avancement de la saison. En Janvier et en Octobre, les contributions des espèces ligneuses ont atteints respectivement 85 et 100%. Parmi les espèces ligneuses, l'*Acacia radiana*, *Salsola sp.*, *Gaillonia reboudiana*, *Piganum sp.* et *Traganum sp.* ont été les recherchées. Les espèces herbacées ont été prélevées surtout en milieu de saison; 52% en Avril et 68% en Juin. La valeur nutritive du régime alimentaire du dromadaire a connu des variations. Le contenu protéique est resté adéquat le long de l'année ; 12,6, 13,59, 19,63 et 10,94 respectivement pour les mois de Janvier, Avril, Juin et Octobre. La teneur du régime alimentaire en constituants membranaires indique une faible teneur en NDF en début et fin de saison ainsi qu'une diminution de l'ADL avec l'avancement de la saison. La digestibilité du régime alimentaire a été faible surtout en Avril (39,1%) et Juin (38,9%). Les quantités ingérées par le dromadaire ont été en moyenne de 3,23, 3,07, 3,22 et 2,47, kg MS par animal pour les quatre mois d'étude.

Mots-clés : Dromadaire, comportement au pâturage, ingestibilité.

Introduction

The dromedary plays many roles in the moroccan desertic ecosystems, it produces meat and milk, draft and prevent extent of desertification. The state of our knowledge on the dromedary is limited for all aspects of production, breeding systems as well as its interaction with its environment. The objective of this study is to assess temporal behaviour, diet botanical composition and diet ingestion.

Methodology

Location of the study

The study was conducted in the county of M'Hamid, located south of Ouarzazate at about 200 km. The average annual precipitation is 70 mm with maximum of 40 days of rain. The temperature is comprised between 10°C for the coldest month (January) and 45°C for the hottest month (August).

Experimental design

The study was carried out during January, April, June and October 1990, in three different pastures of M'Hamid county. For each sampling period, observations concerning temporal behaviour, diet botanical composition and diet ingestion were made during six consecutive days.

Temporal behaviour

Animals were continuously observed throughout the day. The time and the activity (e.g., grazing, resting and walking) were recorded. Summation of the time allocated for each activity was done for each sampling day.

Diet botanical composition

Diet botanical composition was assessed by mean of the bite count technique. The number of bites given on each plant was counted during 10 minutes for each of the six animals identified. Observations were repeated twice in the morning and twice in the afternoon.

Diet ingestion

Qualitative diet ingestion

Simulated diets were composite out of hand-plucked material similar to that ingested by the animal based on bite counts. Simulated diets were analyzed for nitrogen (N) by the Kjeldahl method, ash, neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL) and *in vitro* dry matter digestibility. Crude protein was expressed as $N * 6.25$.

Quantitative ingestion

Total ingestion was calculated as the product of the rate of ingestion and the grazing time. The rate of ingestion (g per min) was calculated as the product of the rate of biting (bites per min) and the mass per bite (g).

In order to estimate density of bite (g per bite), an average of one hundred simulations were hand plucked. The amount of material removed per bite was determined from careful observation. Simulated material was bagged and oven dried at 50°C for 48 to 72 h and weighted.

Results and discussion

Temporal behaviour

Grazing time

Dromedary temporal behaviour is summarized in Table 1. Dromedary grazing time (GT) varied among the different periods of the year ($P < 0.05$). Expressed as proportion, the time allocated for grazing decreased (56%, 53%, 42% and 38% for January, April, June and October, respectively).

Early in the season, GT averaged 8.5 hours per day and was comparable to those reported by Coppock *et al.* (1986a) for the wet season in the Turkana and lower to those reported by Khorchani *et al.* (1992). Late in the season feeding time indicated a lower level (6 hours per day) in comparison to Coppock *et al.* (1986a). The dromedary grazing times in the Southern Steppe of Morocco were higher than those recorded for the other grazing animal species (Coppock *et al.*, 1986a; El Aich and Ritenhouse, 1988).

Table 1. Time allocated (hours) by the dromedary to the different activities in the Southern Steppe of Morocco

	Grazing	Resting	Walking
January	9.00 ^a	2.84 ^a	4.16 ^a
April	8.55 ^a	3.30 ^a	4.15 ^a
June	6.69 ^b	5.60 ^b	3.72 ^a
October	6.07 ^b	5.37 ^b	4.56 ^a

^{a, b} Means of the same activity followed by the same letter are not different at $P = 0.05$

Resting time

Resting time, reported in Table 1, increased with the advance in season ($P < 0.05$). The proportion of the resting in the total time for all activities varied from 18% in January to 34% in October.

Distance walked

Time allocated to walking remained constant ($P > 0.05$) and averaged 26% of the time budget. Distance walked averaged 27, 28, 30 and 25 km per day for January, April, June and October, respectively. Our results were higher than those reported by Coppock *et al.* (1986a).

Diet botanical composition

Diet botanical composition is reported in Table 2. Diet botanical composition was influenced by season. Fodder trees (nanophanerophytes) and fodder shrubs (chameaphytes) composed nearly all the dromedary diet early and late in the season, i.e., 85% and 100% in January and October, respectively.

Early and late in the season, the dromedary based its diet on higher layers of vegetation (naonophanerophyte). In January, two halophytic species (*Salsola* sp. and *Traganum* sp.) contributed for 80% of the dromedary diet. Late in the season, halophytic trees (*Salsola* sp., *Haloxylon scoparium*, *Tamaris* sp. and *Traganum* sp.) composed most of the dromedary diet (53%).

Table 2. Diet botanical composition (%) of the dromedary in the Southern Steppe

Plant species	January	April	June	October
Nanophanerophytes				
<i>Acacia radiana</i>		9.83	4.26	
<i>Galligonum comoson</i>	4.47		8.51	17.98
<i>Salsola</i> spp.	43.72	11.15		9.45
<i>Ziziphus lotus</i>		0.98		
<i>Haloxylon scoparium</i>		7.17		17.02
<i>Tamaris</i> spp.				10.23
<i>Traganum</i> spp.	36.52		13.97	16.08
Chamaephytes				
<i>Gaillonia reboudiana</i>		12.75		
<i>Piganum</i> sp.		6.17		
<i>Peunisteum dichotonum</i>				3.46
<i>Launea arborescence</i>				25.77
<i>Atriplex halimus</i>		9.89		
Herbaceous				
<i>Diploaxis harra</i>	15.29		67.69	
<i>Sinapis alba</i>		10.06		
<i>Resida</i> sp.		10.29		
<i>Fagonia cretica</i>		4.61		
<i>Echinaria capilata</i>		5.01		
<i>Sporalia plicata</i>		12.10		
Nanophanerophytes	84.71	29.12	32.31	70.77
Chamaephytes	0.00	28.81	0.00	29.23
Herbaceous	15.29	42.07	67.69	0.00

At the mid season, the dromedary switched to lower vegetation layers. Chamaephytic and herbaceous species contributions averaged 70%. Herbaceous species were an important component of the dromedary diet in April as result of the spring rain. During January and June, *Diploaxis harra* was the only herbaceous specie ingested; i.e., 15.29% and 67.69% for January and June, respectively. Overall the dromedary included fewer species in its diet.

Our results for the dromedary diet botanical composition were comparable to Coppock *et al.* (1986b) who reported an average diet diversity of 0.19 for camel.

Diet ingestion

Qualitative diet ingestion

Chemical content and *in vitro* dry matter digestibility expressed as % of dry matter, are reported in Table 3. Crude protein content averaged 12.60, 13.59, 19.63 and 10.94 in January, April, June and October, respectively. Diet crude protein remained high all year-long because of the larger proportion of shrubs in the diet.

Table 3. Diet chemical composition (% of DM) of the dromedary in the Southern Steppe

	January	April	June	October
Crude protein	12.60	13.59	19.63	10.94
NDF	33.11	38.24	42.34	33.82
ADF	25.39	30.57	31.22	26.25
ADL	11.82	10.88	7.30	8.19
IVDMD	51.78	39.11	38.92	43.16

The NDF content of the simulated diet was the lowest early and late in the season, probably because of the selection of leaves and twigs in the highest layer of vegetation (trees). Ingestion of ADF was similar to NDF. The ADL content of the dromedary diet decreased as the season advances.

In vitro dry matter digestibility declined in April and June (Table 3). Higher content of fodder trees and fodder shrubs seemed to be responsible for adequate level of digestibility of diet.

Similar conclusions were reported in the Turkana (Kenya) by Coppock *et al.* (1986c) who found that crude protein varied between 23% in the wet and 13% in the dry season. The same authors indicated that IVDMD varied between 52% in the wet season and 27% in the dry season.

Quantitative diet ingestion

The dromedary intake, expressed as kg of dry matter per animal, averaged 10.58, 13.56, 12.00 and 10.89 for January, April, June and October, respectively. Our results were comparable to those reported by Gauthiers and Dagg (1981) and Khorchani *et al.* (1992).

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