

Feeding preferences of one-humped camels (*Camelus dromedarius*) on a semi-arid thorn bush savannah in East Africa – adaptive advantages in view of increasing aridity of the environment

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Abstract: The East African lowlands face increasing drought risk and decreasing rainfall for the last four decades leading to declining productivity of rangelands and pastoral herds. Regional camel herds have increased in numbers during the same time and have spread southwards into Tanzania. Their remarkable feed preferences and harvesting capacity for woody vegetation has facilitated this biological success.

Keywords: Camel, feed preferences, semi-arid pastures, woody vegetation, drought risk

Introduction: During the past 40 years, there has been an increasing frequency of droughts in East Africa, and more pronounced in the past two decades, a decrease in annual rainfall. NASA data indicate a decline by 15 % since the late 1980s (NASA 2008). As a result, pastoral livestock production encounters higher risks and lower productivity mainly in the Ethiopian lowlands, Somalia, Kenya and Northern Tanzania. During the same time camel numbers have been increasing in the area (FAO 2011), camel herds have been spreading southwards into Northern Tanzania, and traditional cattle keepers like the Samburu and Maasai pastoralists have successfully embraced camel production. Revisiting data collected by the authors in the early 1990s showed that camels owe this positive development to a large extent to their superior harvesting ability and their specific feed preferences, which allow them to select high-quality diets on degraded and drought affected rangelands where cattle and small ruminants are under intense nutritional stress.

Materials and Methods: A comparative study of feed preferences of camels, cattle, sheep, goats and donkeys was carried on a semi-arid thorn bush savannah in Isiolo District, Kenya, approximately 250 km north of the equator. Only the results for camels are reported here. The study area included annual grassland, dwarf shrub land and semi-deciduous *Acacia* spec. dominated thorn bush of medium density; the annual rainfall was approximately 500 mm in a bimodal pattern. The study comprised of three principal components. Direct feeding observations were carried out using six adult male castrated dromedaries within a freely ranging herd of close to 100 animals. Each of the six animals was observed for two 10-minute intervals during the morning grazing period. Feeding time per forage species was recorded to the nearest five seconds, feeding stations were counted. Height of feeding above ground was also recorded. The observations were repeated every two weeks for 32 months amounting to a total of 768 10-minute records. Parallel to this activity samples of five dominant forage species for each of the 64 observation events were taken for chemical analysis. The approximate nutritive value of the ingested diet was calculated. Larger samples were taken to be processed for measuring in-vivo digestibility with the “nylon bag” technique. The latter measurements were carried out within one month of the sample collection using four other camels fitted with fore-stomach fistulas. The animals were regularly herded with the aforementioned herd on the same pastures. Data processing and descriptive statistics were done with the STATISTICA 6.5 software.

In a separate but related activity, a botanical inventory of the study pastures was established listing close to 350 plant species and containing information on spatial and seasonal occurrence as well as ground cover and density of the most valuable forage species (Schwartz and Schultka, 1995). This information was used to calculate relative dietary preferences in form of a selectivity index for individual forage plant species and taxonomic groups.

Results: The dromedaries fed regularly on 74 plant species out of the total inventory. During a single observation event any individual animal would utilise between 3 and 12 different species, the group of six would utilise between 10 and 25. Overall 44.2 % of the total observation time was spent feeding. The animals showed a distinct absolute preference for bushes, trees and dwarf

shrubs with 37.9 %, 29.2 % and 27.6 % respectively of the total feeding time observed. Grasses, forbs and others together accounted for only 5.3 %. Average feeding height above ground was 1.6 m; maximum feeding height was 3.6 m.

The five most preferred forage species represented 32.4 % of the total intake time. All were woody species, two dwarf shrubs, one large bush, and two trees. One dwarf shrub and one tree are semi-deciduous legumes, the large bush and one tree are evergreen and fleshy leaved, the remaining dwarf shrub is semi-deciduous.

Table 1: Observed feeding time by species and selected mean quality parameters for the five most preferred forage species

Plant name	% feed time	NDF %	ADF %	ADL %	CP %	DMDR* 24	DMDR 48
<i>Cadaba farinosa</i>	7,6	28.4	18.5	8.9	27.0	81.7	79.9
<i>Indigofera spinosa</i>	6,7	49.7	38.1	9.6	13.7	36.9	42.4
<i>Vernonia cinerascens</i>	6,4	44.2	30.0	9.0	18.5	49.5	53.0
<i>Maerua crassifolia</i>	6,0	28.3	16.9	5.4	22.7	67.1	72.2
<i>Acacia tortilis</i>	5,7	35.9	25.0	8.1	18.9	57.3	63.5

*DMDR = Dry matter disappearance rate

Calculation of preferences relative to the supply on the pasture (selectivity index) showed high positive values (0.94 to 0.98) for the five most preferred species, indicating that the displayed preference was not a function of abundant supply.

Discussion: The results show that feed preference was related to forage quality, in particular to protein content and digestibility, as the five most preferred species were also the five most nutritious of all species recorded in the camels' diet. Several factors contribute to this. Camels prefer woody plants which are usually much deeper rooted than the herb layer and have better access to soil water reserves. Therefore they often bear green foliage even in the dry season or highly nutritious flowers or fruits like most of the *Acacia* specs. Many of the larger woody species are evergreen and the foliage is of high quality throughout the seasons. Among the woody species a larger number are legumes, which are particularly rich in protein. Of all pastoral livestock, camels are best suited to exploit the woody vegetation. The ability to feed up to heights of 3.5 m or more above ground gives them a substantial niche without competition from other domestic livestock. The prehensile lips allow camels to harvest selectively small feed items such as *Acacia* leaves from between large thorns; the positioning of the canine teeth and the canine shaped premolars allow sideways leaf-stripping which is an efficient harvesting technique for larger and fleshy leaves of evergreen trees and bushes.

Due to their feed preferences and harvesting ability camels are efficient users of rangelands with a drought affected or degraded herblayer or those suffering from bush encroachment. Consequently they are less prone to drought related nutritional stress and related reduced productivity and/or increased mortality. Pastoralists traditionally keeping cattle like the Samburu of Kenya and the Waarush group of Maasai in Tanzania have, in the recent past, adopted and still are adopting camels to replace the drought susceptible cattle with favourable results, retaining the traditional multiple use character of production of milk, blood, meat and transport capacity.

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