

FORAGE PREFERENCE OF CAMEL CALVES (*CAMELUS DROMEDARIUS*) IN EASTERN ETHIOPIA

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ABSTRACT

A study on forage preference of Camel calves from 6 to 12 months of age was conducted in eastern Ethiopia. Data were collected at an interval of 50 minutes for each calf for 15 consecutive days in dry and wet season. Based on the observation, calves commonly selected 13 plant species in the dry season and 15 plant species in the wet season. The top 10 plant species preferred by calves accounted for about 99% and 94% of the total browsed forage species during the dry and wet season, respectively. *Opuntia ficus-indicus* was the most frequently browsed forage species both in the wet (37%) and dry (41%) seasons. The second frequently browsed species in dry season were *Lantana camara* (15.09%) and *Becium* species (15.09%) and in wet season *Becium* species (13.08%). The crude protein (CP) content of mixed plant species browsed by the calves in the dry and wet season was 13.8 and 27.7 %, respectively. On average calves spent $79.51 \pm 14.83\%$ of their time on browsing during the dry and wet season in the present study. Relatively more time spent on browsing in wet season ($82.11 \pm 9.74\%$) compared to dry season ($76.91 \pm 19.92\%$). From the study it was concluded that number of commonly preferred forage species of calves were less than number reported for mature Camels. Calves selected for feed with lower CP content in dry season compared to wet season. Moreover, time spent browsing was relatively lower in dry season compared to wet season. It is therefore, recommended that further study will be suggested to know how much the requirement of the calves can be satisfied from the liquid milk suckled from the dams and solid feed available in the area in order to supplement the calves strategically.

Keywords: Camel calves; Forage preference; Time spent on browsing; Chemical composition of forage.

INTRODUCTION

The dromedary Camel (*Camelus dromedarius*) like any other herbivores animals grazing in arid rangelands are seasonally challenged with shortage of feed and scarcity of water, both in quantity and quality. However, they are known for their ability to survive and produce milk during dry and drought periods (Moaeenuddin *et al.*, 2004; Wernery, 2006). The foundation of a Camel herd is the calf. Calves form the replacement stock without which the herd cannot grow and neither would milk be available for the Camel keepers. However, rearing of Camel calves under traditional pastoral production systems is faced with several challenges that result in high death rates of the calves. The main cause of calf mortality in African Camels is supposed to be malnutrition because of competition between calf and farmer for milk (Yesihak and Bekele, 2004). Since milk is the major source of food for pastoral farmers, other alternate source of feed for the calves should be considered. Identifying forage preferred by Camel calves and its chemical composition is the first step toward developing sound supplementation program. *Opuntia* and *Acacia brevispica* was reported to be among the most preferred forage by adult and mature Camels in

eastern Ethiopia (Dereje and Uden, 2005). According to the report *Acacia brevispica* had the highest CP (210-230 g/kg DM) and *Opuntia had the highest* IVDMD ((0.61-0.65) in both seasons. It is obvious that calves are not tall enough to reach tall plant like *Acacia brevispica* which are rich source of CP for their feed source. Moreover, calves in age group 6-12 months of age didn't get enough amount of milk from their dams because of the reduction in productivity of the dams in latter stage of lactation and intensification of competition between calves and farmer for milk. Interview made to the farmers in the region indicated that calves death for unknown reason was one of the main problems in mid and late stage of lactation. It was therefore important to clear whether the death was associated with malnutrition as was reported by some other studies for some other region (Yesihak and Bekele, 2004). For the purpose identifying forage browsed by calves in these age group and determine chemical composition of these feeds is important so that strategic supplementation program will be implemented.

This study was, therefore, conducted with the aim to identify forage species preferred by Camel calves, time spent on browsing and determine the nutritive values of mainly preferred species that constitute the diet of the animals during the wet and dry season.

MATERIALS AND METHODS

Study Area: The study area is located between 9° 14'N latitude and 42° 14'E longitude at an altitude of 1300 – 1600 m above sea level. The climate condition is semi-arid with annual average rainfalls of 400 to 500 mm and average temperature of 17°C to 31 °C. Seasons of the year are classified into long rainy (July – September), short rainy (March – April), long dry (October – February) and short dry (May – June) season. The soils type is sandy-dry-loam with some alluvial nature in some areas. The vegetation cover mainly includes dwarf shrubs (such as *Indigofera* species), large shrubs and trees (such as *Acacia*, and *Boscia* species) and highly populated cacti.

The animals: Twenty Camel calves of both sexes between 6 and 12 months of age were used for the study. During the day time, calves browsed on communal range land. Calves were herded by children separately from mature animals. They browsed for about 8 hours a day (9:30 am - 5:30 pm) in both the dry and wet seasons. They were provided with water once a day. During the night, they were kept in night enclosure.

Data collection: Data was collected by observing browsing calves during browsing time (9:30 am - 5:30 pm). The observation was made for 15 days in the dry season (February 1-15, 2009) and wet season (July 3-18, 2009). Each camel was observed closely for about 50 minutes to identify forage species browsed. To identify representative species selected by the calves, samples of the 10-15 most preferred plants were identified, sample of feed hand picked and collected. The samples were collected from the entire browsing area with the aid of senior herdsman. Moreover, numbers of calves browsing were recorded during browsing hours of the days. Plants that were not identified at the field were preserved and taken to herbarium for identification by the Herbarium at University of Haramaya.

Feed sample preparation: The collected samples of each forage species were kept in a labeled cloth bag and taken to laboratory of University of Haramaya for chemical analyses. Samples of highly preferred forage were chopped and dried at 55°C for 72 hours. The dried samples were weighed and ground in a Wiley laboratory mill to pass through 1-mm mesh sieve. An equal amount of composite samples were taken from each plant of the ground materials and mixed in order to make a mixture of representative sample. The samples then stored in sealed plastic bottle for further chemical analysis.

Chemical analyses of feed samples: Samples of the most preferred forage species and a mixture of plant species from both dry and wet seasons were analyzed for DM, ash, and crude protein (CP), according to the procedure of AOAC (2000). The neutral detergent fiber

(NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) were analyzed according to the procedure described by Van Soest *et al.* (1991).

RESULTS AND DISCUSSION

Forage preference of Camel calves: Forage preference of Camel calves in the wet and dry season is presented in Table 1. In the current study, Camel calves selected 13 and 15 plant species in the dry and wet season, respectively. The top 10 plant species preferred by calves accounted for 99% and 94% of the total browsed plant species during the dry and wet season, respectively. The numbers of commonly preferred forage species by calves were less than the number of plants preferred commonly by mature Camel in the dry (21 species) and wet (30 species) season (Dereje and Uden, 2005). The high number of plant reported for mature Camel might be due to their experience and ability to browse diversified and taller plants species which might not be easily accessed by calves. Similar to the present finding, top plant species preferred by Camel compared to other ruminant was reported 100% (Woodward and Coppock 1995). The percent of time spent on browsing top preferred plant species by mature and adult Camel was 80% and 87% in wet and dry season, respectively (Dereje and Uden, 2005). The same authors reported that adult animals spent more time on walking, resting, rubbing against trees, dust bathing, sexual activities and ruminating compared to the young animals.

In this study it was found that *Opuntia ficus-indicus* was the most frequently browsed plant species in both the dry (41%) and wet (37%) seasons. *Lantana camara* and *Becium species* were the second frequently browsed plant species in the dry (15.09%) and wet (13.08%) seasons, respectively. The high preference of *Opuntia* by calves in the dry season might due to high water content and its succulent edible leaf with high crude protein and lower fiber content than any other species.

This plant species was reported to have higher IVDMD in both season (Dereje and Uden, 2005). The preference of this species in dry season was similarly reported for mature and adult camels. However, in contrast to the present finding, *Acacia brevispica* was reported as the most preferred plant species by young and adult Camels during wet season (Dereje and Uden, 2005).

In southern region of Ethiopia, *Grewia tembensis* was reported as the main preferred plant species by adult Camel in the wet season followed by *Ormocarpum mimosoides* and *Acacia etbaica* where as *Cadaba farinose* and *Capparis tomentosa* were most preferred herbaceous plant species in the dry season (Woodward and Coppock, 1995). *Boscia* species was reported to be among the important forages for Kenyan Camel (Infonet-biovision, 2012). Plant species preferred

Table 1. Forage species preferred by Camel calves during the dry and the wet season.

Scientific names	Vernacular name (Somali)	Preference (%)	Plant type
Wet season			
<i>Opuntia ficus-indicus</i>	Tin	36.92	Shrub
<i>Becium sp</i>	Digriyas	13.08	Shrub
<i>Vernonia cinerances</i>	Timilogi	8.46	Shrub
<i>Acacia brevispica</i>	Swed	8.46	Tree
<i>Grewia tembensis</i>	Dhabii	8.46	Tree
<i>Acacia Senegal</i>	Adaad	6.15	Shrub
<i>Commiphora Africana</i>	Kabaw	5.38	Tree
<i>Commiphora sp</i>	Dhulfaliid	4.60	Shrub/ Tree
<i>Lantana camara</i>	Bakkaargate	3.08	Shrub
<i>Dichrostachys cinerea</i>	Jirimi	1.54	Shrub/ Tree
<i>Plepharis sponisa</i>	Qudaatol	1.30	Herb
<i>Acacia sp</i>	Maroodimakaraan	1.30	Shrub
<i>Vepris glomerata</i>	Eriqudun	1.30	Shrub
<i>Calpurnia aurea</i>	Cekaa	1.30	Shrub
<i>Greuria ferruginea</i>	Futowedher	1.30	Shrub
Dry season			
<i>Opuntia ficus-indicus</i>	Tin	40.57	Shrub
<i>Lantana camara</i>	Bakkaargate	15.09	Shrub
<i>Becium sp</i>	Digriyas	15.09	Shrub
<i>Mixed grass sp</i>	Awus	7.55	Mixed
<i>Senecia sp</i>	Madriyas	5.66	Herb
<i>Vernonia cinerances</i>	Timilogi	5.66	Shrub
<i>Acacia Senegal</i>	Adaad	1.89	Shrub
<i>Acacia oerfata</i>	Wangayo	1.89	Shrub
<i>Acacia brevispica</i>	Swed	1.89	Herb
<i>Indigofera oblongifolia</i>	Gedirman	1.89	Shrub
<i>Carissa edulis</i>	Agamso	0.94	Shrub
<i>Maerua angolensis</i>	Jiika	0.94	Tree
<i>Vepris glomerata</i>	Eriqudun	0.94	Shrub

in third categories in dry season were mixed grass species *Senecia species* and *Veronia cinerances* (5.66-7.55%) where as in the wet season *Acacia brevispica* and *Grewia tembensis* (8.46%). *Grewia tembensis* which was primary preference of Camel in Southern region of Ethiopia (Woodward and Coppock, 1995) was categorized as the third preferred plant for Camel calves in this study. Plants preferred in the fourth category were *Acacia Senegal*, *Acacia oerfata*, *Acacia brevispica* and *Indigofera oblongifolia* in the dry season (1.89%) and *Acacia Senegal*, *Commiphora Africana*, *Commiphora species* and *Lantana camara* in wet season (3.08-6.15%). In present study, the second frequently browsed plant species during the dry season (*Lantana camara*) was among plants preferred in the fourth categories in the wet season. This indicated that the order of preference for plant species changes depending upon the availability or absence of feed resources. Camels widen their dietary acceptance range in the dry seasons to compensate the declining forage abundance by eating more grasses, litter, leaves, vines and lignified twigs (Iqbal and Khan, 2001). They usually prefer to browse on salty bushes which are

rich in water because salts present in such plants help meet the physiological requirement of the animal. *Acacia brevispica* which was reported by Woodward and Coppock (1995) as the primary and secondary preference for mature and adult camel in the wet and dry season, respectively, were in the third and fourth category of preference in this study. The difference in rank of preference for *Acacia brevispica* by calves and adult Camels might be associated to the height of the plant which might be easily accessed by the latter than the former groups of animals. In general animal factors (animal species, individuality, feed demand), behavioral factors (grazing, social and previous experience), sensory factors (sight, smell, touch and taste), physical environment (topography, slope, distance of plant from water source, distance of plants from track or shade), plant environment (soil type, soil fertility and plant community) and availability of plant species present (chemical and physical characteristics, and abundance) were reported as a major factor for plant selectivity by ranging animals (Arnold and Dudzinski, 1978).

Time spent on browsing during dry and wet season:

Time spent on browsing during the dry and wet season is shown in Table 2 and Figure 1. On average calves spent 79.51 ± 14.83 % of their time browsing in the present study. Similar to the present finding, suckling female calves was reported spent 77.3% of their total time for browsing in arid ranges of Tunisia (Khorchani *et al.*, 1992). However, the finding in present study was relatively higher than the report for adult, young stock and sucklers which range from 60.8 to 68.04% (Iqbal, 1999). The same study reported the time spent by adult in browsing/grazing was relatively higher which was followed by young stock and sucklers. In present study relatively more time spent on browsing in wet season ($82.11 \pm 9.74\%$) compared to dry season (76.91 ± 19.92 %). The variability of time spent on browsing was relatively higher in dry season compared to the wet season. Relatively more time spent on browsing from 15:00 to 17:00 hrs ($97.22 + 4.98\%$) which was followed by 9:20 to 12:20 hrs ($81.6 + 3.52\%$).

However, time spent on browsing from 12:20 to 15:20 hrs (62.05 ± 3.52 %) was less. Time spent on browsing in wet season was less variable (79.44 to 83.89%) thought out the day. The variability in time spent on browsing during dry season might be the relative higher temperature in warmer parts of the day (12:10 to 15:00 hrs) which might be the reason for reduced the activity of calves to browse. However, the relative cooler climate through out the day and relative availability and diversity of feed in wet season might favored the calves

to spent more time in browsing compared to the dry season. Camels browse and graze on natural range at any time of the day or night; however, during very hot weather they tend to avoid feeding during the heat of the day and they adopt positions which reduce heat gain and thus conserve energy (Qureshi, 1986).

Table 2. Time spent on browsing during dry and wet season (Mean % \pm S.D)

part of the day (hrs)	Mean (%)	S.D
Overall mean	79.51	14.83
Dry season		
Average	76.91	19.92
	**	
9:20- 12:20	81.60 ^b	3.52
12:20-15:20	62.05 ^c	3.52
15:20-17:20	97.22 ^a	4.98
Wet season		
Average	82.11	9.74
	Ns	
9:20- 12:20	83.89	2.29
12:20-15:20	79.44	2.29
3:20-17:20	83.89	3.24

Least squares mean in the same column with different letters differ significantly, S.D standard deviation, ns non-significant, ** $p < 0.001$

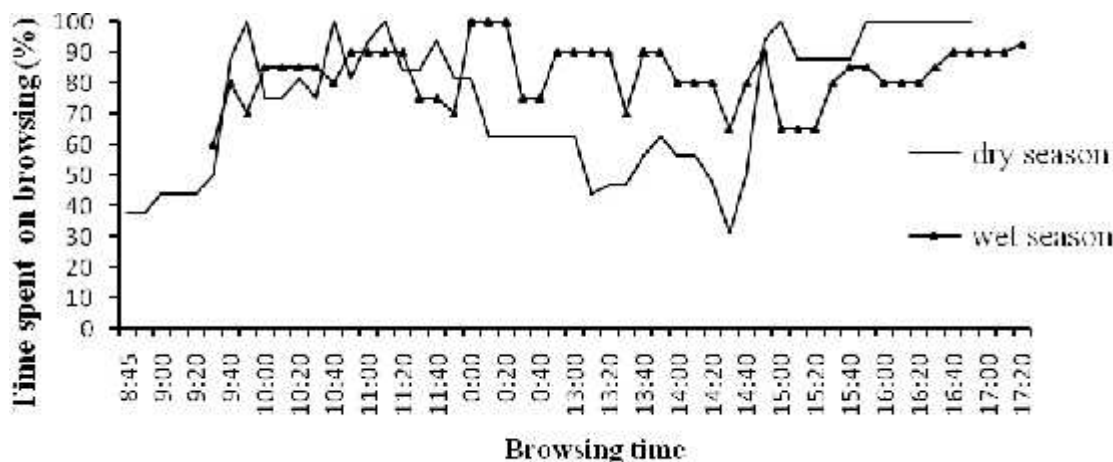


Figure 1. Time spent on browsing by calves during dry and wet season

Chemical composition of plant species preferred by calves:

The chemical composition of major forage and mixed plant species preferred by calves in dry and wet season is shown in Table 3. The mixed species of preferred plants had 13.8 and 27.7 % CP in the dry and wet season, respectively. The finding was comparable to the report by Elmi (1989) for major forage species in

Camel diet which was 14.9% and 27.4% in springy-winter and the wet season, respectively.

In the wet season, CP content of mixed plant species in the study area can be considered as a good source of protein since it contained over 250 g CP per kg DM (Chesworth, 1992). A reduction in CP content of herbaceous plant in the dry season was similarly reported

by some other researchers (Hashi and Cianci, 1985; Rutagwenda, 1985). Higher fiber and lignin contents of feed at the end of dry season and relatively higher crude protein contents in the end of wet season was reported by Towhidi (2007). Relatively highest CP content of plant species in the wet season compared to dry season might give better opportunity for calves to select for better quality forage in the former than the latter season. The ability of animals to identify nutritional differences

between feeds using taste, color or some other sensory factors (Schwartz, 1992c) enable them to select feed in similar quality from the same pasture they graze (Towhidi, 2007). Particularly, Camel prefers plants with high moisture and mineral content and the leaves of trees, shrubs and herbs/forbs to grass (Towhidi, 2007). Moreover, Camels usually take a variety of vegetation that presumably provides optimal nutrition (Khan, 1996; Ranjhan, 1997).

Table 3. Chemical compositions of major forage and mixed plant species preferred by calves in wet and dry season (%DM).

Season	Scientific name	DM%	Ash	OM	CP	NDF	ADF	ADL
Dry	<i>Opuntia ficus indicus</i>	90.13	16.41	90.13	14.20	27.35	21.80	2.3
	<i>Lantana Camara</i>	88.82	12.63	89.60	12.43	55.96	37.27	6.0
	Mixed plant species	90.49	8.07	90.49	13.83	51.61	37.02	7.76
Wet	<i>Opuntia ficus indicus</i>	87.58	17.80	88.82	15.06	33.96	24.92	1.74
	<i>Becium sp</i>	90.75	9.35	90.75	7.71	64.33	48.09	12.27
	Mixed plant Species	89.60	10.20	87.58	27.67	49.68	35.26	6.85

DM = dry matter; OM = organic matter; CP= crude protein; ASH = ash; NDF = neutral detergent fiber; ADF= acid detergent fiber; ADL = acid detergent lignin

Furthermore, the presence of high CP contents was reported as the base for preference of Camels for some plant species (Iqbal, 1999). In present study the CP content of *Opuntia* was 14.2% and 15.06% in the dry and wet season, respectively. The CP during the dry season was comparable to the reported by Dereje and Uden (2005) which was 13.3%. The CP content of *lantana camara* (12.43%) was lower than the content of *Opuntia*. This might be the reason for calves to prefer the latter species relatively more than the former. Moreover, the NDF, ADF, and ADL contents of *Opuntia* were relatively lower than *Lantana camara*. Lower NDF, ADF and ADL concentration of *Opuntia* in the dry season indicate its higher digestibility and intake. The NDF content of *Lantana camara* (55.96%) in the current study might limit nutritive value of the feed as it ranged in 55-60% of the DM of forage (Van Soest, 1967). This might classify *Lantana camara* as low quality feed in the dry season for the study area. NDF (51.61%) and ADF (37.02%) content of mixed plant species in the dry season in present study was relatively lower than the report by Elmi (1989) for major forage species in Camel diet which was 69.3% and 52.3%, respectively. This variation in chemical composition might be due to the difference in the composition of species of mixed forage, location, soil type and the climate (Chesworth, 1992). The OM (88.82%) and ash (17.80%) content of *Opuntia* species in wet season was comparable to the report by Dereje and Uden (2005) which was 84.5% and 15.5%, respectively. The NDF (64.33%) contents of *Becium* in this study was relatively higher than the critical value of 55-60% (Van Soest, 1967) that limits the intake and digestibility of

forage. The same forage species was reported to have low *in vitro* dry matter digestibility (IVDMD: 45%) and relatively high condensed tannin values (26.7%) of DM in the dry season (Dereje and Uden, 2005). The highest NDF contents of *Lantana Camara* and *Becium* species in the dry and wet seasons, respectively, may lower their nutritive quality and this may classify them as a low quality feeds since digestibility decrease with increasing NDF content and with increasing lignifications of the fiber (McDonald *et al.*, 1995). This two plant species are the second most important preferred species in dry season, even though lower in the digestibility. This indicated that calves selected these plants in the absence of good quality feed. It is therefore important to supplement calves in dry season as they have no chance to select for better feed like adult Camels.

Conclusions: Calves have relatively lower experience to browse diversified species and inability to browse for taller plant like adult Camel. The crud protein content of mixed plant species preferred by calves in dry season was relatively lower than the content in wet season. Moreover, calves relatively spent less time to brows during dry season compared to wet season. It is therefore, recommended that further study will be suggested to know how much the requirement of the calves can be satisfied from the liquid milk suckled from the dams and solid feed available in the area in order to supplement the calves strategically so that performance of the calves will not be hindered because of nutrition.

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