Relative forage preference by camel (*Camelus dromedarius*) as influenced by season, sex and age in the Sahel zone of north western Nigeria

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A study on effect of age, sex and seasonal variation in forage preference of camel was conducted in the Sudano-Sahelian zone of north western Nigeria. A total number of 12 camels were used in the study. Data were collected at an interval of 5 min for each category of animal for 3 consecutive days in dry and rainy seasons using scan sampling method. Based on the observation, the number of plants preferred in this study by young camel calves was less than that preferred by matured camel. Matured animals consume mostly diversified, thorny and taller plant species which might not be easily accessed by the camel calves. *Leptadania hastata* was found to be the most preferred forage during the rainy season, while *Ziziphus mauritiana* was the preferred forage during dry season with mean feeding time of 87.33 and 46.66 min/day, respectively; while the least preferred forage during the rainy and dry seasons were *Acacia sieberiana* and *Bauhinia rufescens* with mean feeding time of 0.11 and 15.00 min/day, respectively. Browse species found in the study area are extremely important as feed for camels.

**Key words:** Camel, preference, forage, grazing.

**INTRODUCTION**

The camels in tropical Africa are raised on natural pastures which decline both in quality and quantity from the rainy season to the dry season (Smith et al., 1991). The marked fluctuations in seasonal weights and irregular growth of animals are as a result of changes in their nutritional status. Subsistence farmers could not afford to feed supplementations in order to illuminate dry season growth checks; they solely rely on crop residues and some browses to supplement the grazing during the dry season (Mohammed and Hoffman, 2006). Most of these forages are potential feed resources which degrade readily in the rumen (Njidda, 2012). The common
challenges camel herders face in keeping their animals is
the declining feed resources both in quality and quantity
as a result of drought and in this context, fodder trees
and shrubs emerge as key resources allowing the herds
to endure up to the end of the dry season. The Sudano-
Sahelian zone of north western Nigeria is identified to
have a diverse forage species that can support livestock
production (Muhamed, 2013). Large population of
camel herds from neighboring countries are seen
migrating into this part of the country in search of feed
(Umaru and Bello, 2013; Kalla et al., 2008). However,
there is inadequate information on the usefulness of
these forages as feed resources for camel. The selective
livestock grazing has diverse and far reaching implications
for herdsmen, resource managers and researchers.
Knowledge of specific species grazed provides insight
into various facets of diet quality, stocking rate, livestock
distribution and effect of defoliation on the subsequent
well-being of forage plants. Most studies on camel feed
preference (Kassily, 2002; Ouedraogo-Kone et al., 2006;
Mengli, 2006) failed to address the effect of sex, age and
seasonal variations in the camel feed preference. This
paper was therefore designed with main objective of
investigating the forage utilization and preference in the
zone to enable us improve and fully exploit the potentials
of the available forages and effectively understand
the camel ecology and effective rangeland management
and to further enable us develop a reticulated camel
production system in northern Nigeria.

MATERIALS AND METHODS

Study area

The forage preference study was conducted in Ilela Local
Government Area of Sokoto State, North Western Nigeria. The
State covers a land area of 25,973 square kilometers with a
population of 4,244,399 million. It lies to the north west of Nigeria
on 13°04'51"N 14E and shares a common boundary with Niger
Republic to the North, Katsina State to the East, Kwara State to the
South and Benin Republic to the West. It has an average
temperature of 28.3°C and is one of the hottest cities in the country;
however, the maximum day time temperature is generally under
40°C most of the year. The highest recorded temperature is 47°C
which is also the highest recorded temperature in the country. The
mean annual rainfall ranges between 500 and 1300 mm.

Forage preference sampling

Scan sampling method was used to determine the forages preferred
in both rainy and dry seasons as described by Guevara et al.
(1996), Zhao et al. (2006) and Chimsa et al. (2013). In this
technique, animals were closely followed (3 to 5 m) and monitored
during feeding to ensure accurate identification of the plant
consumed at an interval of 5 min. The time spent by the camel on
each forage is thus recorded in minutes/day. A total number of
discerned three (12) camels were used in the study. The observations
were made on four categories of camel (adult, young, male and female)
for three consecutive days, both in the morning and in the
afternoon. Morning observations were recorded between 9.00 am
and 12.00 pm and afternoon observations were made between 2.00
pm to 5.00 pm.

Experimental design and statistical analysis

The study was laid down in a completely randomized block design
and all data generated were analyzed using the GLM procedure of
GenStat 10.

RESULTS

Seasonal variation in forage preference by the camels

Seasonal variation in camel forage preference is presented in Table 1. There was significant (P<0.05)
difference in the forages preferred in both dry and rainy
season. During the wet season, camels showed high
preference for Leptadania hastata with a mean feeding
time of 87.33 min/day followed by Boscia angustifolia
62.50 min/day. The least preferred forages during the wet
season were Cacis arerah, Faidherbia albida and Maerua
crassifolia with a mean feeding time of 0.99 min/day
each. In the dry season, camels showed high preference
for Z. mauritania and P. pentandrus 46.66 min/day each.
The only forage that was not affected by the season was
Bauhinia rufescens with an average feeding time of 46.66
min/day in wet season and 22.91 min/day in dry seasons,
respectively.

Effect of age on forage preference by the camels

Age had significantly (P<0.05) affected preference of the
forages (Table 2). Young calves had high preference for
I. oblongifolia with a mean feeding time of 65.21 min/day
followed by P. pentandrus 54.17 min/day. The least
preferred forages by camel calves were S. birrea, F.
albida with an average feeding time of 5.08 min/day
and 3.75 min/day. Adult camels showed high preference for
Z. mauritania and S. birrea with a mean feeding time of
54.17 and 45.83 min/day. The least foraged species by
the adult animal includes P. tomentosa 3.75 min/day and
M. crassifolia 13.75 min/day.

Effect of sex on forage preference by the camels

There was significant (P<0.05) difference in diet selection
between male and female camels (Table 3). Male animals
showed high preference for P. pentandrus, 50.83 min/day
followed by B. angustifolia, 45.00 min/day, while the
female camels preferred I. oblongifolia 49.58 min/day.
Consumption of C. arerah, Guiera senegalensis and P.
tomentosa were not significant (P>0.05) between the two
sexes.
### Table 1. Effect of season on camel forage preference.

<table>
<thead>
<tr>
<th>Browse species</th>
<th>Hausa name</th>
<th>Feeding time (minutes/day)</th>
<th>Dry season</th>
<th>Wet season</th>
<th>t-values</th>
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<td>-7.05</td>
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<td>9.17</td>
</tr>
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<td>26.67</td>
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<td></td>
<td>15.15</td>
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</table>

### Table 2. Effect of camel age on forage preference.

<table>
<thead>
<tr>
<th>Browse species</th>
<th>Hausa name</th>
<th>Feeding time (minutes/day)</th>
<th>Young</th>
<th>Adult</th>
<th>t-values</th>
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<td>-0.92</td>
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<td>0.15</td>
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<tr>
<td>Balanite aegyptiaca</td>
<td>Aduwa</td>
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<td>15.75</td>
<td>-0.49</td>
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<td>Leptadania hastata</td>
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<td>48.58</td>
<td>37.50</td>
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<tr>
<td>Guiera senegalensis</td>
<td>Sabara</td>
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<td>0.55</td>
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<td>Bagaruwa</td>
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<td>Pelgularia tomentosa</td>
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<td>13.75</td>
<td>3.75</td>
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</tr>
</tbody>
</table>

**DISCUSSION**

Feed choice according to Guevara et al. (1996) by animal is a highly sophisticated process, developed through evolution, to maximize the efficiency of energy use in food harvesting. Both animal and forage attributes affect diet selection. Animal attributes include species, class of animal, productive function, prior conditioning and experience. Forage factors affecting diet selection according to Dereje and Uden (2005) include chemical composition and physical characteristics of the feed. In this study, it was observed that these had significant impact on the dietary selection of forages consumed. Camels showed high preference for grass/legumes such as *L. hastata* and *B. angustifolia* and shift their dietary preference to mainly thorny plants, tree branches and twigs during the dry season. This confirms the reports that the dromedary camel shows a feeding preference of annual and ephemeral plants and only when these dry off do shrubs and trees forages begins to dominate its diet (Mukasa-Mugerwa, 1981; Schwartz et al., 1992; Kassily, 2002; Chimsa et al., 2013). Wei (1979)
reported that camels can survive in a natural and semi wild conditions of roaming and grazing in the range throughout the year feeding on coarse, thorny plants and those forages with unfavorable flavors. This study further confirms the report of Schwartz et al. (1992) that deep rooted trees and large evergreen bushes are usually the only reliable sources of forages for camels during drought and dry season.

The number of plants preferred in this study by young camel calves was less than that preferred by matured camel. The calves exhibited preference for mostly annual plants especially during the wet season as they become more available. This variation in the preference between young and adult camels might not be unconnected with their ability and experience to browse the diversified plants by the adult which are inaccessible by the calves. Dereje and Uden (2005) also reported that the percentage time spent by camel browsing preferred plants species by matured and young calves were 80 and 87% during wet and dry season. This study showed that body size and/or age had influenced dietary preference of camel significantly. Camel calves showed high preference for shrubs/legumes which constitute their chief dietary component while adult and matured camels feed mostly on thorny and taller plants. Some authors (Ouedraogo-Kone, 2006; Chimsa et al., 2013) reported that the adult camels spent more time walking, resting and rubbing against trees and sexual activities as compared to the young animals.

In the present study, it was also found that *I. oblongifolia* was the most frequently preferred plant species by the camel calves, while *Z. mauritania* is the most preferred forage by the matured camels. This great variation might be due to high water content and succulent edible leaves with high CP and low fiber content than any other species. Rutagwenga (1985), Kassily (2002) and Towhidi (2007) reported that these species have high CP and low fiber. However, in contrast to this study, Chimsa et al. (2013) reported that *Opuntia ficus indica* was the most preferred forage by the camel calves. This variation indicated that the order of preference for plant species changes and depends upon location, rangeland composition and availability of feed resources.

The dietary preference of forages by male and female camels also differed in this study. Male animals showed high preference for *P. pentandrus*, while the female showed preference for *I. oblongifolia*. A number of differences between the sexes in both species’ composition of a diet and its quality have been reported in ungulate species. Main et al. (1996) reported that in ungulates, sexes segregate because sexual differences and body size lead to different energy requirements and hence food selection. This variation between the male and female is also attributed to their body size. Many studies (Illius and Gordon, 1992; Van Soest, 1994) reported that there is a variation in terms of their metabolic rate which is invariably related to body weight, decreasing with increasing body weight, while rumen volume and gut capacity remain a constant fraction of body weight. Similarly, Van Soest (1994) also reported that larger ruminants possesses larger rumen and have slower passage rate of food than smaller ones and this may assume that within a species, males are more efficient in utilizing energy than the females. The females therefore, need to compensate for this digestive inferiority by either increasing foraging efficiency or by selecting higher quality forage (high nitrogen levels) than that.

### Table 3. Effect of sex on forage preference.

<table>
<thead>
<tr>
<th>Browse species</th>
<th>Hausa name</th>
<th>Feeding time (minutes/day)</th>
<th>t-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
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<td>39.17</td>
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<td>Jirga</td>
<td>10.00</td>
<td>9.17</td>
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<td><em>Bauhinia rufescens</em></td>
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<td>Anza</td>
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<td><em>Pulgarria tomentosa</em></td>
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<td>6.25</td>
<td>11.25</td>
</tr>
</tbody>
</table>
which is consumed by males. In addition, energy expenditure and transfer of nutrients through lactation increase selectivity in reproducing females for food sources rich in nitrogen, sodium or calcium (Clutton-Brock et al., 1986b; Iason et al., 1986). Sexually dimorphic males and females may, therefore, select different plant species or habitats with differing plant and nutrient availability and hence segregate in space (Main et al., 1996). Males and females often use different habitat types, but also overlap in habitat use (Villaret and Bon, 1995). In contrast to this study, Bleich et al. (1997) found no difference between the sexes in either habitat choice or ingested plant quality.

Conclusion

In general, animal factors (animal species, sex, age and feed demand), behavioral factors (grazing, social and previous experience) and availability of plant species present (chemical and physical characteristics, and abundance) were reported as major factors for plant selectivity by foraging camel on natural range. Further studies on the relationship between forage quality and intake in camel should be investigated.

Conflict of interests

The authors have not declared any conflict of interests.

REFERENCES


