

Full Length Research Paper

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

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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 (Muhammed, 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°04N5°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 twelve (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 *Cacia 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 3.75 min/day and 5.08 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.

Browse species	Hausa name	Feeding time (minutes/day)		
		Dry season	Wet season	t-values
<i>Indigofera oblongifolia</i>	Birgu	40.00	53.75	-1.41
<i>Ziziphus mauritania</i>	Magarya	46.66	27.08	-5.04
<i>Maerua crassifolia</i>	Jirga	11.16	0.99	-5.61
<i>Bauhinia rufescens</i>	Kargo	22.60	46.66	-7.05
<i>Boscia angustifolia</i>	Anza	22.91	62.50	-8.11
<i>Phyllanthus pentandrus</i>	Geza	46.66	52.08	-0.92
<i>Faidherbia albida</i>	Gawo	15.42	0.99	9.17
<i>Acacia sieberiana</i>	Farar kaya	26.67	0.11	-12.34
<i>Cacia arerah</i>	Marga	9.58	0.99	-5.35
<i>Balanite aegyptiaca</i>	Aduwa	24.58	0.92	-8.83
<i>Leptadania hastata</i>	Yadiya	20.50	87.33	-8.03
<i>Guiera senegalensis</i>	Sabara	25.78	56.67	-4.67
<i>Acacia nilotica</i>	Bagaruwa	45.95	48.33	6.12
<i>Selerocarpa birrea</i>	Danya	30.32	47.92	7.44
<i>Pelgularia tomentosa</i>	Patakka	15.15	17.50	4.37

Table 2. Effect of camel age on forage preference.

Browse species	Hausa name	Feeding time (minutes/day)		
		Young	Adult	t-values
<i>Indigofera oblongifolia</i>	Birgu	65.21	28.75	-.056
<i>Ziziphus mauritania</i>	Magarya	33.75	54.17	- 0.84
<i>Maerua crassifolia</i>	Jirga	5.42	13.75	0.16
<i>Bauhinia rufescens</i>	Kargo	34.58	27.08	-0.92
<i>Boscia angustifolia</i>	Anza	48.33	37.08	-0.45
<i>Phyllanthus pentandrus</i>	Geza	54.17	40.58	0.48
<i>Faidherbi aalbida</i>	Gawo	5.08	8.33	0.43
<i>Acacia sieberiana</i>	Farar kaya	15.42	18.41	-0.57
<i>Cacia arerah</i>	Malga	5.42	15.42	0.15
<i>Balanite aegyptiaca</i>	Aduwa	8.75	15.75	-0.49
<i>Leptadania hastata</i>	Yadiya	48.58	37.50	-0.49
<i>Guiera senegalensis</i>	Sabara	39.17	35.42	0.55
<i>Acacia nilotica</i>	Bagaruwa	17.58	26.58	0.70
<i>Selerocarpa birrea</i>	Danya	3.75	45.83	0.59
<i>Pelgularia tomentosa</i>	Patakka	13.75	3.75	0.21

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)

Table 3. Effect of sex on forage preference.

Browse species	Hausa name	Feeding time (minutes/day)		t-values
		Male	Female	
<i>Indigofera oblongifolia</i>	Birgu	44.17	49.58	-.054
<i>Ziziphus Mauritania</i>	Magarya	34.58	39.17	-0.82
<i>Maerua crassifolia</i>	Jirga	10.00	9.17	0.16
<i>Bauhinia rufescens</i>	Kargo	34.50	27.08	-0.94
<i>Boscia angustifolia</i>	Anza	45.00	40.12	0.47
<i>Phyllanthus pentandrus</i>	Geza	50.83	47.92	0.48
<i>Faidherbia albida</i>	Gawo	7.08	8.33	0.34
<i>Acacia sieberiana</i>	Farar kaya	15.42	11.25	0.55
<i>Cacia arerah</i>	Malga	5.42	4.12	0.15
<i>Balanite aegyptiaca</i>	Aduwa	13.83	10.75	-0.49
<i>Leptadania hastata</i>	Yadiya	42.75	45.58	-0.49
<i>Guiera senegalensis</i>	Sabara	39.17	37.50	0.53
<i>Acacia nilotica</i>	Bagaruwa	24.58	23.45	0.70
<i>Selerocarpa birrea</i>	Danya	21.25	26.67	0.61
<i>Pulgularia tomentosa</i>	Patakka	6.25	11.25	0.21

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 indicus* 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 possess 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

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

- Bleich VC, Bowyer RT, Wehausen JD (1997). Sexual Segregation in Mountain Sheep: Resources or Predation? *Wildlife Monogr.* 134:1-50.
- Chimsa YY, Mummed M, Kurtu Y (2013). Forage Preference Of Camel Calves (*Camelus Dromedarius*) In Eastern Ethiopia. *J. Anim. Plant Sci.* 23(5):1236-1241.
- Clutton TH, Albon SD, Guinness FE (1986). Great expectations: dominance, breeding success and offspring sex ratios in red deer. *Anim. Behav.* 34:460-471.
- Dereje M, Uden P (2005). The Browsing Dromedary Camel I. Behaviour, Plant Preference and Quality of Forage Selected. *Anim. Feed Sci. Technol.* 121:297-308.
- Guevara JC, Stasi CR, Estevez OR (1996). Seasonal Specific Selectivity by Cattle on Rangeland in Monte Desert of Mendoza, Argentina. *J. Arid Environ.* 34:125-132.
- Illius AW, Gordon IJ (1992). Modelling the nutritional ecology of ungulate herbivores: evolution of body size and competitive interactions. *Oecologia* 89:428-434.
- Iason GR, Duck CD, Clutton-Brock TH (1986). Grazing and reproductive success of red deer: the effect of local enrichment by gull colonies. *J. Anim. Ecol.* 55:507-515.
- Kalla DJU, Zahraddeen D, Yerima J (2008). Reproductive Performance of One Humped Camel at the Komodugu-Yobe River Basin, Nigeria. *WBC/ICAR Satellite Meeting on Camelid Reproduction* pp. 77-81.
- Kassily FN (2002). Forage Quality and Camel Feeding Patterns in Central Baringo, Kenya. *Livest. Production Sci.* 78:175-182.
- Main M, Weckerly F, Vernon C (1996). Sexual segregation in ungulates: new directions for research. *J. Mammal.* 77:449-461.
- Mengli Z, Walters DW, Jin Y (2006). Bactrian Camel Foraging Behaviour in Haloxylon ammodendron Desert of inner Mongolia. *Appl. Anim. Behav.* 99:330-343.
- Mohammed I, Hoffmann I (2006). Management of Drought Camels (*Camelus dromedarius*) in Crop-livestock Production System in North West – Nigeria. *Livest. Res. Rural Dev.* 17:12.
- Muhammed A (2013). Place of Biodiversity in Ecosystems' Efficiency In Nigeria. *British J. Earth Sci. Res.* 1(1):10-17.
- Mukasa-Mugerwa E (1981). The Camel (*Camelus dromedaries*): A Bibliographical Review. *ILCA Monograph 5*. International Livestock Centre for Africa, Addis Ababa, Ethiopia <http://www.ilri.org/InfoServ/Webpub/Fulldocs/Monono5/Toc.htm>
- Njidda AA, Olatunji EA, Raji AY (2012). Semi arid browse forages: Their antinutritive substances and *in sacco* neutral detergent fibre and organic matter degradability. *J. Agric. Vet. Sci.* 1(6):31-36.
- Ouedraogo-Kone S, Kabore-Zoungrana CY, Ledin I (2006). Important Characteristics of Some Browse Species in an Agrosilvopastoral System in West Africa. *Agroforestry Syst.* 74:213-221.
- Rutagwenda T (1985). The control of important camel diseases in the integrated Project of Arid Lands Study area. Camel disease and Productivity in the arid lands of Northern Kenya. Integrated Project in the Arid Lands (IPAL) technical Report No. E-7, Germany pp. 9-70.
- Schwartz HJ (1992). Common range forage species preferred by Camels and their nutritive value. In *The One-Humped Camel in Eastern Africa: A pictorial guide to diseases, health care and management*. Verlag Josef Margraf, Germany.
- Smith OB, Idowu OA, Odunlami O (1991). Comparative Rumen Degradability of Forages, Browse, Crop Residues and Agricultural by-products. *Livest. Res. Rural Dev.* 3(2):1011-1017.
- Towhidi A. (2007). Nutritive value of some herbage for dromedary Camel in Iran. *Pak. J. Biol. Sci.* 10(1):167-170.
- Umaru MA, Bello A (2013). Reproduction in the One Humped Camel (*Camelus dromedarius*) in Semi Arid Nigeria. *S. J.* 2(1):1-7.
- Van Soest PJ (1994). *Nutritional Ecology of Ruminants*. Cornell University Press Ltd 476 p.
- Villaret JC, Bon R (1995). Social and spatial segregation in alpine ibex (*Capra ibex*) in Bargy, French Alps. *Ethol.* 101:291-300.
- Wei D (1979). Chinese camels and their productivities. In *Proc. Workshop on Camels and their Productivities 18-20 December, Khartoum, Sudan*.
- Zhao M, Walter WD, Guodong H, Jin Y (2006). Bactrian camel Foraging Behaviour in Haloxy Ammodendron Desert of Inner Mongolia. *Appl. Anim. Behav. Sci.* 99:330-343.