

Assessment of Food and Feeding Habit of Giraffe (*Giraffa camelopardalis*) in Sumu Wildlife Park of Ganjuwa Local Government Area of Bauchi State, Nigeria.

¹Kwaga, B.T., ¹Gwallameji, L.B., ¹Ali, A. and ²Khobe, D.

¹ Department of Forestry and Wildlife Management, Modibbo Adama University of Tech., Yola.

² Department of Animal Science, Adamawa State University, Mubi.

Correspondence Author's GSM/email: Nos. 08027995044, 08072547283. divinetizhe@yahoo.com

Abstract: The study assessed the food and feeding habit of giraffes in Sumu Wildlife Park of Ganjuwa Local Government Area of Bauchi State, Nigeria. The forage (woody plants) mostly preferred by the species and time used in consuming each food have not been ascertained despite the giraffe's population in the study area hence, the need for this study which assessed the food and feeding habit of giraffe in the study area. The entire area was sub-divided into four (4) plots of one hectare each randomly selected across the study area. Data on the plant species eaten by giraffes were obtained through total counting of all individuals within the 1 hectare plots. Woody plant species mostly preferred by giraffes were obtained by ocular method measuring time spent (5 to 10 minutes and 30minutes to 1 hour) browsing each species. Data on the nutritive content (water, crude protein, crude fibre, nitrogen free extract, fats and ash) of the preferred woody plant species was gathered through laboratory analysis of the plants parts following Association of Analytical Chemist (AOAC) methods. Data collected were subjected to descriptive statistics (Tables of frequency, percentages, mean). The result obtained indicated that 17, 17, 19 and 17 different woody individuals were identified to have been eaten by giraffes in the 4 plots. *Acacia sayel* is the dominant species (24.24%, 27.59%, 27.63% and 24.06%) while *Ziziphus spina-christi* is the least (0.75%, 1.38%, 1.32% and 0.75%) in the 4 plots selected. 7 woody plant species were identified as the most preferred forage by the giraffes in the area. *Acacia sayel* formed the majority (33.17%) while *Combretum apiculatum* is the lowest (4.67%). Results of the nutrient value of the preferred species consumed by giraffes showed that *Acacia sieberiana* had the highest (62.10%) mean water content value and *Combretum imberbe* had the lowest (50.20%) mean value. *Acacia sieberiana* had the highest (30.60%) mean value of crude protein while *Combretum molle* had the lowest (10.30%). *Combretum imberbe* had the highest (27.60%) crude fibre and *Acacia nilotica* had the least (13.70%) mean value. *Acacia nilotica* had the highest (32.20%) nitrogen free extract (NFE) and *Acacia sieberiana* had the least 18.70% mean value. (62.10%). *Combretum molle* had the highest (5.40%) mean fat value and *Combretum apiculatum* had the least (2.60%) mean value. *Acacia nilotica* had the highest (1.10%) mean ash and *Acacia senegal* the lowest (0.40%). Further research on the status of all the available forage plants and establishment of the species plantations are recommended.

[Kwaga, B.T., Gwallameji, L.B., Ali, A. and Khobe, D. **Assessment of Food and Feeding Habit of Giraffe (*Giraffa camelopardalis*) in Sumu Wildlife Park of Ganjuwa Local Government Area of Bauchi State, Nigeria.** *Rep Opinion* 2017;9(7):36-43]. ISSN 1553-9873 (print); ISSN 2375-7205 (online). <http://www.sciencepub.net/report>. 7. doi: [10.7537/marsroj090717.07](https://doi.org/10.7537/marsroj090717.07).

Key words: Giraffe forage, feeding, preferred food

Introduction

The name "giraffe" has its earliest known origins in the Arabic word *zarafa*, perhaps from some African language. The name is translated as "fast-walker". The word possibly was derived from the animal's Somali name *geri*. The Italian form *giraffa* arose in the year 1590s. The modern English form developed around 1600 from the French *giraffe*. The species name *camelopardalis* is from Latin (camel-like) (Pellow, 2001). The giraffe belongs to animal Kingdom, Phylum-Chordata, Class-Mamalia, Order-Artiodactyla, Suborder- Ruminantia, Family-Giraffidae, Genus-Okapi and *Giraffa*, Species-*camelopardalis*, Subpecies- *angolensis* (Angolan Giraffe), *antiquorum* (Kordofan Giraffe) and

camelopardalis (Nubian Giraffe) among others. (Mitchell and Skinner, 2003).

The giraffe's scattered range extends from Chad in the north to South Africa in the south and from Niger in the west to Somalia in the east. Giraffes usually inhabit savannas, grasslands, and open woodlands. Their primary food source is acacia leaves, which they browse at heights most other herbivores cannot reach. Giraffes are preyed on by lions, and calves are also targeted by leopards, spotted hyenas, and wild dogs, (Badlangana *et al*, 2009). Adult giraffes do not have strong social bonds, though they do gather in loose aggregations if they happen to be moving in the same general direction. Males establish social hierarchies through "necking", which are combat bouts where the neck is used as a weapon.

Dominant males gain mating access to females, which bear the sole responsibility for raising the young. While some ancient giraffes such as *Sivatherium* had massive bodies, others such as *Giraffokeryx*, *Palaeotragus* (possible ancestor of the okapi), *Samotherium*, and *Bohlinia* were more elongated. (Badlangana *et al.*, 2009).

Giraffes are usually found in groups, the composition of these groups tends to be open and ever-changing. They have few strong social bonds, and aggregation usually change members every few hours. For research purposes, a “group” has been defined as “a collection of individuals (up to 32 or above) that are less than a kilometer apart and moving in the same general direction (Vander and Prins, 2000). stated that the number of giraffes in a group can range up to 32 individuals.

Giraffa Camelopardalis is one of the tallest land animals with an average height of up to 5.5m (males), 4-4.5m (females) and an average life body weight of about 800kg to 1,800kg. Neck elongated, with a short, erect mane, shoulders much higher than croup but limbs of nearly equal length. It has a tail, hock with long black terminal tuft and horns: the pair is up to 13.5cm, borne by both sexes, the ends knobbed and hairless in adult males, thin and tufted in females and young; a median, lumpy horn and 4 or smaller bumps in males only. Color is usually brown to dark chestnut (and sometimes black), broken up into patches and blotches by a network of light-colored hair, the pattern individually unique; males darken with age. Scant glands: possible a pod -crane glands on eyelids, nose, adult males have a pungent odor (Williams, 2011). Aided by its 45mm tongue and a modified atlas-axis joint that enables the head to tilt to the vertical, a giraffe can feeding on crowns of small trees. Matured bulls can reach up to 5.8m, nearly a meter higher than cows. Where a choice exists between high and low browse, there is a clear ecological separation between the sexes, the bulls browsing the high while females concentrate regenerating trees and shrubs below 2m. The sexes of distant giraffes can usually be predicted by whether the animals are feeding high or bending low. Differences in feeding ecology as well as lower vulnerability to predators (based on size and absence of parental responsibility) allow males to enter taller and denser woodland more readily than females, leading also to measure spatial separation of the sexes, (Richard,1992).

In many zoos and wildlife parks, giraffe serve as an attraction. Giraffes have been killed for their meat and hide. The thick skin has been made in to bucket, resin, whips, strops for harness, and some time for musical instruments, (Brown *et al.* 2007).

Food and feeding habits of giraffe especially in the arid regions have not been assessed to certain

extent in the study area. The nature of feeding and species of woody plants consumed and their densities have not been adequately documented. Equally, the feeds (woody plants) mostly preferred by the species and at what time have not serious attention despite the giraffe’s population in the study area, (Baltimore, 1999), hence the need for this study which assessed the food and feeding habit of giraffe in the study area.

Methodology

Study Area

The study area is Sumu Wildlife Park which has an area of 8km² and situated at Kafin-madaki of Ganjuwa Local Government Area of Bauchi State. It lies between the latitudes 10^o.68’N and 10^o.41’N and longitudes 9^o.76’E and 8^o.45E (Figure 1) (Bauchi State Government House Diary BSGD, 2014). The area has a tropical climatic condition with an annual rainfall ranging from 1021mm to 2410mm. The driest month is December with zero rainfall. Heaviest rainfall is recorded in August and the warmest month of the year is April. The annual temperature ranged between 24.6^oC to 35.3^oC with an average temperature of 30.3^oC. The dominant woody plant species of the study area include; *Acacia seyel*, *Acacia senegleansis*, *Acacia tortilis*, *Ziziphus mauritiana*, *Anona senegleansis*, *Combretum mole*, *Ziziphus mauritiana*, *Ziziphus spina-christi*, *Balanites aegyptiaca* among others. The fauna resources include Giraffes (*Giraffa camelopardalis*), Eland (*Taurotragus oryx*), Kudu (*Tragelaphuss trepsiceros*), Impala (*Aepyceros melampus*) and Zebra (*Equus quagga*).

Study Design and Data Collection

The study design followed the method of Akosim *et al.* (2007). The entire park was divided into four (4) sites (north, east, south and west) and one plot of one hectare each was randomly selected from each site for the purpose of data collection. Direct observation of the types of forage species (woody plants) eaten by giraffe was assessed in the morning (7-10am) and evening (3-6pm) in each of the selected plot. Total count of the Woody plants eaten by the giraffes was done following Sutherland (1999) and Akosim *et al.* (2007) methods. Data on the forage mostly preferred by the giraffe was obtained following the time spent grazing/browsing each species among the individuals.

Statistical Analysis of Data.

Time spent grazing/browsing was measured between 5-10 minutes, 30 minutes to 1 hour on a species preference as outlined by Mitchell and Skinner (2004). The forage mostly preferred by the giraffe were subjected to laboratory analysis following the Association of Analytical Chemists (AOAC-1990) methods. The following chemical /nutrient properties:

water, crude protein, Crude fibre, Nitrogen Free Extract (NFE), fat and Ash were determined as

outlined by Okwu and Ndu (2006).

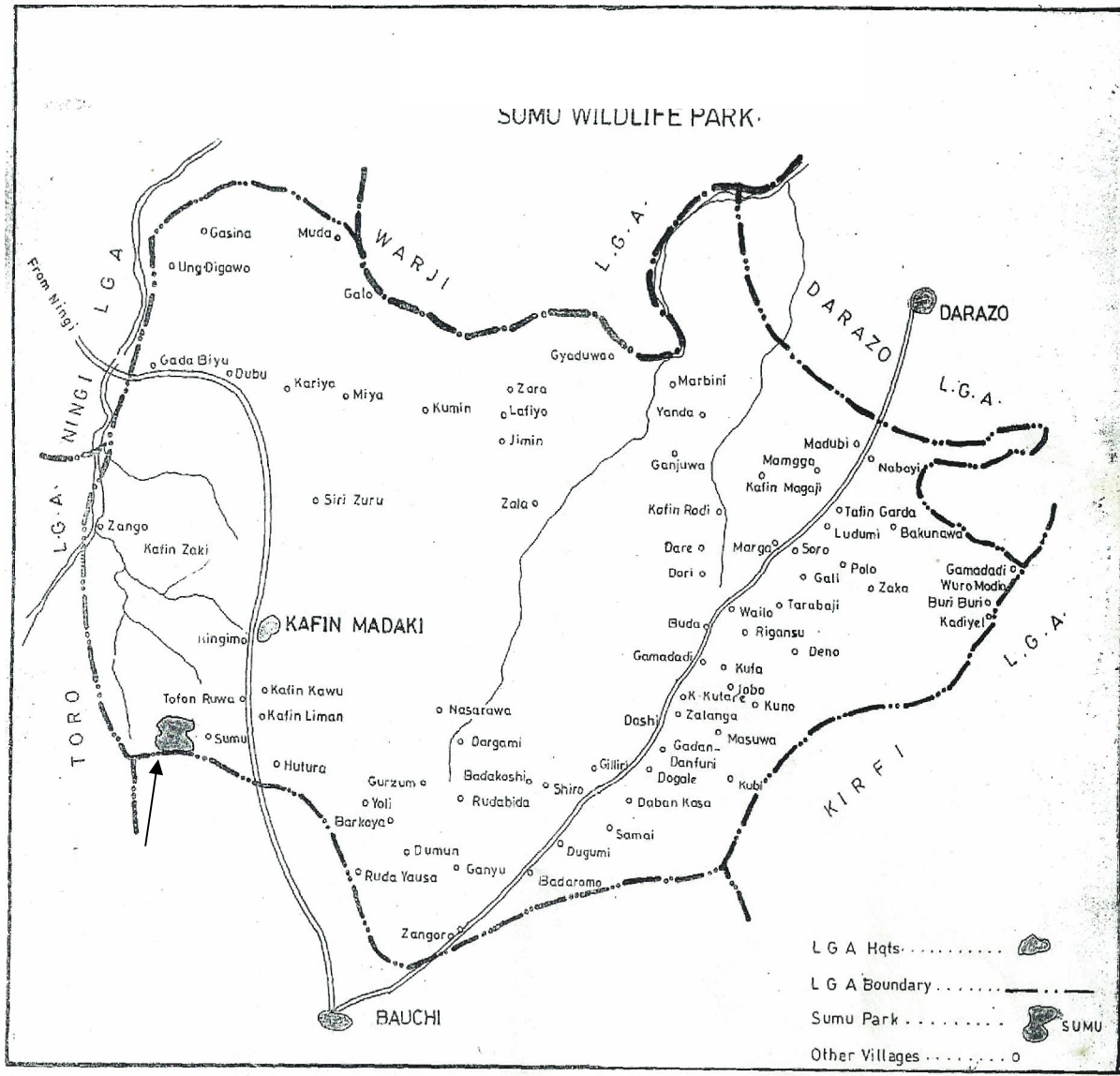


Figure 1: Map of Ganjuwa L.G.A. showing the Study Area (Sumu Wildlife Park)
 Source: Bauchi State Government Diary (2013)

Results and Discussion

The result of the forage plant species eaten by the giraffes in the study area (northern part) is shown in Table 1. It has indicated a total number of 132 different individuals belonging to 17 species. The result also showed that *Acacia sayel* is the predominant woody species with frequency of 32 individuals (24.24%) in the study area while *Ziziphus*

spina-christi is the least species with a frequency of 1 individual (0.75%). From the table, the giraffe feed mostly on leaves, twigs, pods and thorns. The result of this study agrees with the finding of Brown *et al.* (2007) and Henderson and Naish (2010) who reported that giraffes are picky browsers eating twigs, leaves and other parts of species of acacia and combretum that are inaccessible to other browsers.

Table 1: Forage Plant Species (woody plants) Consumed by Giraffes in the Study Area (plot 1- northern part).

Forage plant species	Frequency	Percentage	Parts consumed
<i>Acacia seyel</i>	32	24.24	Leaves, pods, thorns
<i>Acacia senegalensis</i>	26	19.70	Leaves, twigs, pods, thorns
<i>Acacia nilotica</i>	16	12.12	Leaves, twigs, thorns
<i>Acacia sieberiana</i>	14	10.61	Leaves, twigs, thorns
<i>Acacia albida</i>	5	3.79	Leaves, twigs, thorns
<i>Acacia polyacantha</i>	7	5.30	Leaves, twigs, thorns
<i>Anonna senegalensis</i>	3	2.28	Leaves, fruits, seeds
<i>Combretum imberbe</i>	5	3.79	Leaves
<i>Combretum apiculatum</i>	2	1.51	Leaves
<i>Combretum glaucescens</i>	3	2.28	Leaves, fruits
<i>Combretum molle</i>	4	3.03	Leaves, fruits
<i>Ziziphus mauritania</i>	2	1.51	Leaves, fruits, seeds
<i>Ziziphus spina-christi</i>	1	0.75	Leaves, flowers, seeds
<i>Balanites aegyptiaca</i>	3	2.28	Leaves, thorns, seeds
<i>Mimosa pudica</i>	4	3.03	Leaves, flowers, pods, thorns
<i>Terminalia glaucescens</i>	3	2.28	Leaves, seeds
<i>Terminalia albida</i>	2	1.51	Leaves, seeds
Total	132	100	

Source: Field Survey, 2014.

The result of the woody plant species mostly preferred by the giraffes in the eastern part of the study area is shown in Table 2. It has indicated a total number of 145 individuals belonging to 17 different forage plant species. The result indicated that *Acacia seyel* as the predominant species (40 individuals) (27.59%) in the study area while *Terminalia albida* is

the least (2 individuals) (1.38% in the study). From the table, the giraffe feed mostly on leaves and twigs. The finding of the study agrees with the finding of Sauer (2003) who reported that the leaves of acacia and combretum species are mostly selected as food item by giraffes.

Table 2: Forage Plant Species (woody plants) Consumed by Giraffes in the Study Area (plot 2- eastern part).

Forage plant species	Frequency	Percentage	Parts consumed
<i>Acacia seyel</i>	40	27.59	Leaves, pods, thorns
<i>Acacia senegalensis</i>	25	17.24	Leaves, twigs, pods, thorns
<i>Acacia nilotica</i>	6	4.14	Leaves, twigs, thorns
<i>Acacia sieberiana</i>	16	11.03	Leaves, twigs, thorns
<i>Acacia albida</i>	3	2.07	Leaves, twigs, thorns
<i>Acacia polyacantha</i>	3	2.07	Leaves, twigs, thorns
<i>Anonna senegalensis</i>	5	3.45	Leaves, fruits, seeds
<i>Combretum imberbe</i>	8	5.52	Leaves
<i>Combretum apiculatum</i>	6	4.14	Leaves
<i>Combretum glaucescens</i>	6	4.14	Leaves, fruits
<i>Combretum molle</i>	10	6.89	Leaves, fruits
<i>Ziziphus mauritania</i>	3	2.27	Leaves, fruits, seeds
<i>Ziziphus spina-christi</i>	2	1.38	Leaves, flowers, seeds
<i>Balanites aegyptiaca</i>	4	2.75	Leaves, thorns, seeds
<i>Mimosa pudica</i>	3	2.07	Leaves, flowers, pods, thorns
<i>Terminalia mantaly</i>	3	2.07	Leaves, seeds
<i>Terminalia albida</i>	2	1.38	Leaves, seeds
Total	145	100	

Source: Field Survey, 2014.

The result of the woody plant species mostly preferred by the giraffes in the southern part of the study area is shown in Table 3. It has indicated a total number of 152 individuals belonging to 19 different forage plant species. The result indicated that *Acacia seyel* as the predominant species (42 individuals) (27.63%) in the study area while *Ziziphus spina-christi*

is the least (2 individuals) (1.32% in the study. From the table, the giraffe feed mostly on leaves, thorns and twigs. The finding of the study agrees with the finding of Sauer (2003) who reported that the leaves of acacia and combretum species are mostly selected as food item by giraffes.

Table 3: Forage Plant Species (woody plants) Consumed by Giraffes in the Study Area (plot 3- southern part).

Forage plant species	Frequency	Percentage	Parts consumed
<i>Acacia seyel</i>	42	27.63	Leaves, pods, thorns
<i>Acacia senegalensis</i>	21	13.82	Leaves, twigs, pods, thorns
<i>Acacia nilotica</i>	8	5.26	Leaves, twigs, thorns
<i>Acacia sieberiana</i>	16	10.53	Leaves, twigs, thorns
<i>Acacia albida</i>	7	4.61	Leaves, twigs, thorns
<i>Acacia polyacantha</i>	8	5.26	Leaves, twigs, thorns
<i>Anonna senegalensis</i>	3	1.97	Leaves, fruits, seeds
<i>Combretum imberbe</i>	4	2.63	Leaves
<i>Combretum apiculatum</i>	5	3.29	Leaves
<i>Combretum glaucescens</i>	3	1.97	Leaves, fruits
<i>Combretum molle</i>	7	4.61	Leaves, fruits
<i>Ziziphus mauritania</i>	3	1.97	Leaves, fruits, seeds
<i>Ziziphus spina-christi</i>	2	1.32	Leaves, flowers, seeds
<i>Balanites aegyptiaca</i>	5	3.29	Leaves, thorns, seeds
<i>Mimosa pudica</i>	5	3.29	Leaves, flowers, pods, thorns
<i>Adansonia digitata</i>	3	1.97	Leaves, pods, seeds
<i>Piliostigma thoningii</i>	4	2.63	Leaves, pods
<i>Detarium microcarpum</i>	3	1.97	Leaves, pods
<i>Annogeissus leiocarpus</i>	3	1.97	Leaves
Total	152	100	

Source: Field Survey, 2014.

The result of the woody plant species mostly preferred by the giraffes in the western part of the study area is shown in Table 4. It has indicated a total number of 133 individuals belonging to 17 different forage plant species. The result indicated that *Acacia seyel* as the predominant species (32 individuals) (24.06%) in the study area while *Ziziphus spina-christi* is the least (1 individual) (0.75%) in the study. From

the table, the giraffe feed mostly on leaves, thorns and twigs. The finding of the study agrees with the finding of Henderson and Naish (2010) who reported that giraffes are picky browsers and strived to reach the leaves of tall trees/shrubs with the aid of their long necks, thus having added advantage over other browsers.

Table 4: Forage Plant Species (woody plants) Consumed by Giraffes in the Study Area (plot 4- western part).

Forage plant species	Frequency	Percentage	Parts consumed
<i>Acacia seyel</i>	32	24.06	Leaves, pods, thorns
<i>Acacia senegalensis</i>	26	19.55	Leaves, twigs, pods, thorns
<i>Acacia nilotica</i>	14	10.53	Leaves, twigs, thorns
<i>Acacia sieberiana</i>	14	10.53	Leaves, twigs, thorns
<i>Acacia albida</i>	5	3.76	Leaves, twigs, thorns
<i>Acacia polyacantha</i>	7	5.26	Leaves, twigs, thorns
<i>Anonna senegalensis</i>	3	2.25	Leaves, fruits, seeds
<i>Combretum imberbe</i>	5	3.76	Leaves
<i>Combretum apiculatum</i>	2	1.50	Leaves
<i>Combretum glaucescens</i>	3	2.25	Leaves, fruits
<i>Combretum molle</i>	4	3.01	Leaves, fruits

<i>Ziziphus mauritania</i>	2	1.50	Leaves, fruits, seeds
<i>Ziziphus spina-christi</i>	1	0.75	Leaves, flowers, seeds
<i>Balanites aegyptiaca</i>	3	2.25	Leaves, thorns, seeds
<i>Mimosa pudica</i>	4	3.01	Leaves, flowers, pods, thorns
<i>Terminalia glaucescens</i>	3	2.25	Leaves, pods, seeds
<i>Terminalia albida</i>	5	3.76	Leaves, pods
Total	133	100	

Source: Field Survey, 2014.

The result of the cumulative frequency of individual forage consumed by giraffes in the study area is shown in Table 5. It has indicated a total number of 562 individuals belonging to 17 different forage plant species. The result indicated that *Acacia sayel* as the predominant species (135 individuals) (24.02%) in the study area while *Ziziphus mucronata* is the least (4 individuals) (0.71%) in the study. From

the table, the giraffe feed mostly on leaves, thorns, pods, seeds and twigs. The finding of the study agrees with the finding of Henderson and Naish (2010), who reported that giraffes are picky browsers and strived to reach the leaves of tall trees/shrubs with the aid of their long necks, thus having added advantage over other browsers.

Table 5: The Cumulative Frequency and Percentage of Forage Species (Woody Plant) Consumed by Giraffes in the Study Area

Forage species	Frequency	Percentage	Parts consumed
<i>Acacia sayel</i>	135	24.46	Leaves//pods/thorns
<i>Acacia senegal</i>	87	15.76	Leaves/twigs/pods/ thorns
<i>Acacia nilotica</i>	37	6.70	Leaves/seeds/ thorns
<i>Acacia siberiana</i>	73	13.22	Leaves/twigs/ thorns
<i>Acacia albida</i>	23	4.17	Leaves/twigs/ thorns
<i>Acacia polyacantha</i>	26	4.71	Leaves/twigs/ thorns
<i>Anona senegalensis</i>	18	3.26	Leaves/fruits / thorns
<i>Combretum imberbe</i>	24	4.35	Leaves
<i>Combretum apiculatum</i>	19	3.44	Leaves
<i>Combretum gasolensis</i>	11	1.99	Leaves
<i>Combretum molle</i>	32	5.80	Leaves
<i>Ziziphus mauritania</i>	13	2.36	Leaves/Seeds
<i>Ziziphus spina – Christi</i>	9	1.63	Leaves/flowers/seeds
<i>Balanite egyptica</i>	20	3.62	Leaves/flower
<i>Mimosa pudica</i>	25	4.53	Leaves/flowers/pods/ thorns
Total	552	100%	

Source: Field Survey, 2014

The result of plant species mostly preferred by giraffes in the study area is presented in Table 6. The result indicated that *Acacia sayel* had the highest 135

individuals (33.17%) while *Combretum apiculatum* has the lowest (19 individuals) (4.67%).

Table 6: Woody Plant Species Mostly Preferred by the Giraffes in the Study Area

Plant species	Frequency	Percentage	Parts mostly consumed
<i>Acacia sayel</i>	135	33.17	Leaves/twigs/buds
<i>Acacia senegal</i>	87	21.38	Leaves/twigs/buds
<i>Acacia nilotica</i>	37	9.09	Leaves/seeds
<i>Acacia siberiana</i>	73	17.94	Leaves/twigs
<i>Combretum imberbe</i>	24	5.89	Leaves
<i>Combretum apiculatum</i>	19	4.67	Leaves
<i>Combretum molle</i>	32	7.86	Leaves
Total	407	100	

Source; Field Survey, 2014

Table 7: The Chemical Analysis of the Plant Species Preferred by the Giraffes

Plant Species	Nutritional Contents %					
	Water Content	Crude Protein	Crude fibre	NFE	Fat	Ash
<i>Acacia sayel</i>	62.0	29.6	17.3	20.9	4.9	0.8
<i>Acacia senegal</i>	61.0	28.6	16.2	19.8	3.8	0.4
<i>Acacia nilotica</i>	52.0	12.9	13.7	32.2	5.1	1.1
<i>Acacia siberiana</i>	62.1	30.6	14.8	18.7	3.9	0.6
<i>Combretum imberbe</i>	50.2	12.5	27.6	18.9	3.7	0.7
<i>Combretum apiculatum</i>	52.9	11.1	22.1	29.6	2.6	0.9
<i>Combretum molle</i>	51.3	10.3	23.0	28.9	5.4	1.0

Source; Field Survey, 2014

The result of nutritive analysis of forage species preferred by giraffes in the study area is shown in Table 7. The result indicated that *Acacia sieberiana* had the highest mean water content (62.1%) while *Combretum imberbe* had the lowest (50.2%). For the crude protein, *Acacia sieberiana* had the highest mean (30.6%) while *Combretum molle* had the least mean value (10.3%). For crude fibre, *Combretum imberbe* had the highest mean value (27.6%) and *Acacia nilotica* had the least mean value (13.7%). For Nitrogen Free Extract (NFE), *Acacia nilotica* has the highest value (32.2%) while *Acacia sieberiana* has the least (18.7%) value. As for fats, *Combretum molle* had the highest (5.4%) value with *Combretum apiculatum* having the least (2.6%) value. The result also showed that *Acacia nilotica* had the highest (1.1%) ash content value while *Acacia Senegal* had the lowest (0.4%) value. The finding of this study is in strong agreement with Sauer (2003), who reported that *Acacia species* have high crude protein, nitrogen free extract and ash than other woody plant species except *Combretum imberbe*. Sauer (2003) equally observed that in general, *Combretum species* have higher crude fibre than species of woody plants.

Conclusion

The study assessed the food and feeding habit of giraffe in Sumu wildlife park of Ganjuwa Local Government Area of Bauchi State, Nigeria. From the results obtained, it could be concluded that the study provided to some extent a baseline information on the various parts (leaves, twigs, fruits, pods, thorns and seeds) of plants consumed and the time spent feeding on each part. It could be noted that there are abundant forage plant species utilized by giraffes in the study area. Research on nutrient status of all the forage plant species consumed by giraffes as well as artificial cultivation of the forage species preferred by the giraffe is encouraged.

References

1. Association of Official Analytical Chemist AOAC (1990). Official Method of Analysis. Washington, D. C.
2. Akosim, C., Kwaga, B.T., Amadi, D.C.A. and Inah, E.I. (2007). Ecological Potentials of Beekeeping in Adamawa State, Nigeria. *International Journal of Agricultural Science, Sciences, Environment and Technology (ASSET)*. University of Agriculture, Abeokuta, Nigeria (67-76).
3. Badlangana, L.N, Adams, J.W, Manger, P.R. (2009). "The Giraffe (*Giraffe camelopardalis*) cervical vertebra column: A Heuristic example in understanding evolutionary processes? *Zoological Journal of the Linnean Society* 155 (3): 736-57.
4. Baltimore M (1999) Walker's Mammals of the World Okapi and Giraffe vol. 2, 6 Edition. The John's Hopkins University press pp 1080-1089.
5. Bauchi State Government Diary (2014).
6. Brown, D.M; Brenneman R.A; Koepfli, K-P; Poolinger, J.P; Mila, B; Georgiadis, N.J; Louis Jr, E.E; Grether, G.F; Jacobs, D.K; and Wayne R.K. (2007). "Extensive population Genetic Structure in the Giraffe" *BMC Biology* 5 (1): 57.
7. Henderson, D.M; Naish, D. (2010). "Predicting the buoyancy, equilibrium and potential swimming ability of giraffe by computational analysis" *Journal of Theoretical Biology* 265 (2): 151-59.
8. Mitchell, G, Skinner, J.D. (2003). On the Origin, Evolution and Phylogeny of Giraffes *Giraffe camelopardalis*" *Transactions of the Royal Society of South Africa* 58(1): 51-73.
9. Mitchell, G, Skinner, J.D. (2004). "Giraffe Thermoregulation: a Review" *Transactions of the Royal Society of South Africa: Proceeding of*

- a Colloquium on Adaptations in Desert Fauna and Flora* 59(2): 49-57.
10. Okwu, C. and Ndu, B. D. (2006). Physicochemical and Vitamin Content of Indigenous species of South Eastern Nigeria. Department of Chemical Sciences, Michael Opara University of Agriculture, Umudeke. Bland Food Press Doble Dorset.
 11. Pellow, R.A. (2001). Giraffe and Okapi. In MacDonald, D. *The Encyclopedia of Mammals* (2nd ed). Oxford University Press. Pp. 520-27.
 12. Richard, D. E. (1992). *The Behaviour Guide to African Mammals (including Hoofed Mammals, Canivores, Primates)* Oxford University Press, London.
 13. Sauer, J. J. C. (2003). Seasonal Changes in Food Selection by Giraffe in Relation to Changes in Chemical Composition of the Leaves selected, *South African Journal of Animal Science* 13, 40-43.
 14. Sutherland, W. J. (1999). *Ecological Census Techniques: A Handbook*, Cambridge University Press, United Kingdom (UK) Pp. 260-278.
 15. Vander, J. H.P. and Prins, H.H.T. (2000). "Movement and Group Structure of Giraffe (*Giraffa camelopardalis*) in Lake Manyara National park, Tanzania" *Journal of Zoology* 251 (1):15-21.
 16. Williams, E. (2011). *Giraffe*. Reaction Books. University Press, United Kingdom (UK) Pp. 160-178.

7/13/2017