AN INVESTIGATION OF THE BEHAVIOUR OF PREGNANT AND LACTATING BABOONS (*Papio Anubis*) IN GASHAKA GUMTI NATIONAL PARK, NIGERIA.

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ABSTRACT

This study was designed to investigate the behaviour of pregnant and lactating baboons, which could affect the social system. Using the one-minute and fifteen-minute fixed-point focal sampling technique, each focal animal was followed and behavioural patterns were observed and recorded for a period of six months. The behavioural patterns observed included social, feeding, reproductive, post-partum, movement, and roosting behaviours. However, there was a significant difference ($p<0.05$) in the behaviour of females within and between states in the same group and between the two troops. The percentage groups spread away from pregnant and lactating females were found to be increasing with a corresponding increase in the distance-intervals. Pregnant and lactating females were found to be associating mostly with adult females and infants in the presence of an alpha male or a contesting male. Group interaction under some activity budgets with pregnant and lactating females at various distance intervals was significant ($p<0.05$) within =1m but there was no significant difference ($p>0.05$) in the group interaction with the focal animals at distance-intervals =1m to =5m, =5m to =10m, and =10. The results of suckling behaviour indicate that infants spent more time suckling at Kwano site (52%) than infants at Gashaka site (48%). However, infants at Gashaka site suckle more frequently (4 times/day) than Kwano (2 times/day). The findings of this study indicate that individual and group behavioural patterns, group spread of members of the troop from focal animals, association of focal animals with individuals of the troop and group interaction under various activity budgets with the focal animals were functions of individual or group behavioural patterns while suckling bouts of infants at the two sites was a function of availability of quality and abundant food. It is therefore, recommended that further studies on the two troops at the two sites be carried out with the females when they are neither pregnant nor lactating.

Keywords: *Baboon, behavioural pattern, pregnant and lactating, Gashaka Gumti National Park.*

INTRODUCTION

Many non-human primates bear an uncanny resemblance to humans. Throughout history, they have been singled out from their fellow mammals, eliciting amusement, curiosity, and on occasions, heated debate (Warren, 2004). Meanwhile the rapid growth of human populations has resulted in the loss and disturbance of wild primate habitats (Chapman and Peres, 2001; Cowlishaw and Dunbar, 2000; Oates, 1999). These changes in wild primates habitats have led several primate species into modifying their behavioural ecology. In order to survive, some of these primates have to depend on human crops to compensate for loss of their wild fruits. As a result, they are viewed by man as pests for fighting for their natural right.

Furthermore, how free-living baboon groups spend time is an approximate representation of the way in which they relate to their social and ecological environment (Dunbar, 1988). Access to environmental resources and avoidance of hazard dictate the movements and activities of baboon troops, while geographic, habitat disturbance and seasonal

variations in resource availability accounts for much of the variation in behaviour of individuals or the troop.

Baboon's foraging strategies can be shown to combine high degrees of flexibility and breadth with selectivity. In the wild, baboons forage on a wide variety of food ranging from fruits, leaves to subterranean items and flesh. Baboons also crop-raid as a form of food-enhancement. They steal crops from people's fields and this greatly improves nutrition because crops have high concentration of protein, calories, and is low in toxins when compared to wild foods (Whiten *et al*., 1991). Previous studies have shown that feeding baboons/monkeys/apes on crops has several behavioural effects such as decreased foraging time, increased resting time, increased social time and increased aggression (William *et al*., 1999, Warren, 2004).

In Gashaka Gumti National Park (GGNP) there are severe crop pest problems from a range of mammals, such as warthog, duikers, cane rat, and birds and insects (Dunn, 1993), with baboons among the worst offenders (Warren, 2004). The baboons in GGNP harbour a representative population of crop raiders suspected to be affected behaviourally by human-induced changes in their environment. Pregnancy and lactation are the most nutritionally stressful phases for baboons. Therefore, effects should be most pronounced at this time. This study was an attempt to observe behavioural effects of crop raiding on pregnant and lactating baboons at GGNP. The study focused on two troops of previously habituated (to human observers) baboons, one in the Kwano area (living in the wild) and one close to Gashaka village.

Although there have been some behavioural studies on the two troops of baboons, research into the behaviour of the pregnant and lactating females in these troops has never been a focus of any particular study. The dearth of information about the behaviour of pregnant and lactating females has made it difficult to understand their role in population dynamics of the troops as they serve as the limiting resource in reproductive output. Consequently, the development of a management plan for the conservation of baboons' flourishing population in the park is impaired.

The objective of this study was to determine the behavioural effects of crop-raiding on pregnant and lactating baboons at Gashaka Gumti National Park, Nigeria.

MATERIALS AND METHODS

The study Area

Location

Gashaka Gumti National Park (GGNP) covers an area of approximately 6670 square kilometers. It is the largest National Park in Nigeria, located in the North Eastern part of the country, and represents an area of significant national and international conservation priority. From the edge of the plateau in Taraba state, GGNP stretches northwards along the international border with Cameroon and into Adamawa State as far as the small town of Toungo . Geographically the area lies between $6^{0}55^{1}$ latitude and $8^{0}05^{1}$ longitude North, and between $11^{0}11^{1}$ latitude and $12^{0}13^{1}$ longitude East (Fig.1). Despite being located in what may be classified politically and culturally as a Northern state, in ecological terms, GGNP bears many similarities with Nigeria's

southern regions. This study was located in Kwano forest (Aprox. 07 ^{0} 19 -11 ^{1} 35 ^{0} E ^{1}) at the foot of the hill of Chabbal Tale which is about three hours walk (13km) from a second study site in Gashaka village in the Southern part of the park. Kwano forest lies at an altitude of about 500-800m.

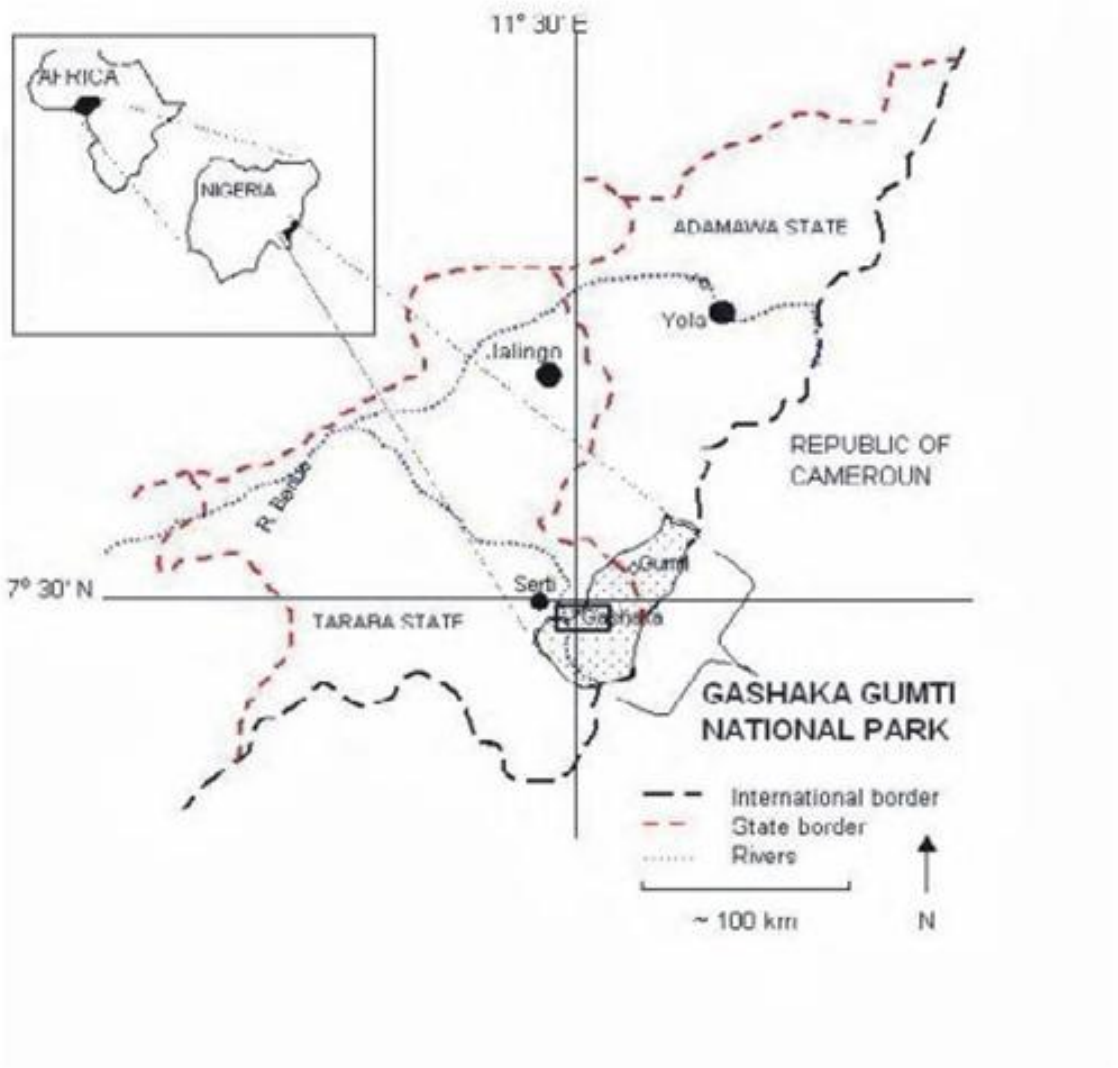

Fig. 1: Map showing the location of Gashaka Gumti National Park (Source: Warren, 2004).

Climate and Season

The Gashaka Gumti climate is broadly characteristic of the Guinea savanna zone. However, the climate of GGNP differs from most other central habitats because of its prolonged and marked dry season. It is not unusual to have no rain at all for up to three months. Typically, the rainy season begins in March or early April and ends in mid-November. Rainfall ranges from 1200 mm in the North to nearly 3000 mm in the South of the park (Dunn, 1993). The high rainfall is aided by the mountains of the area since humidity from the Atlantic is forced up into higher elevations, cools down and condenses to rain-bearing clouds. This, in turn, allows the growth of moist forests.

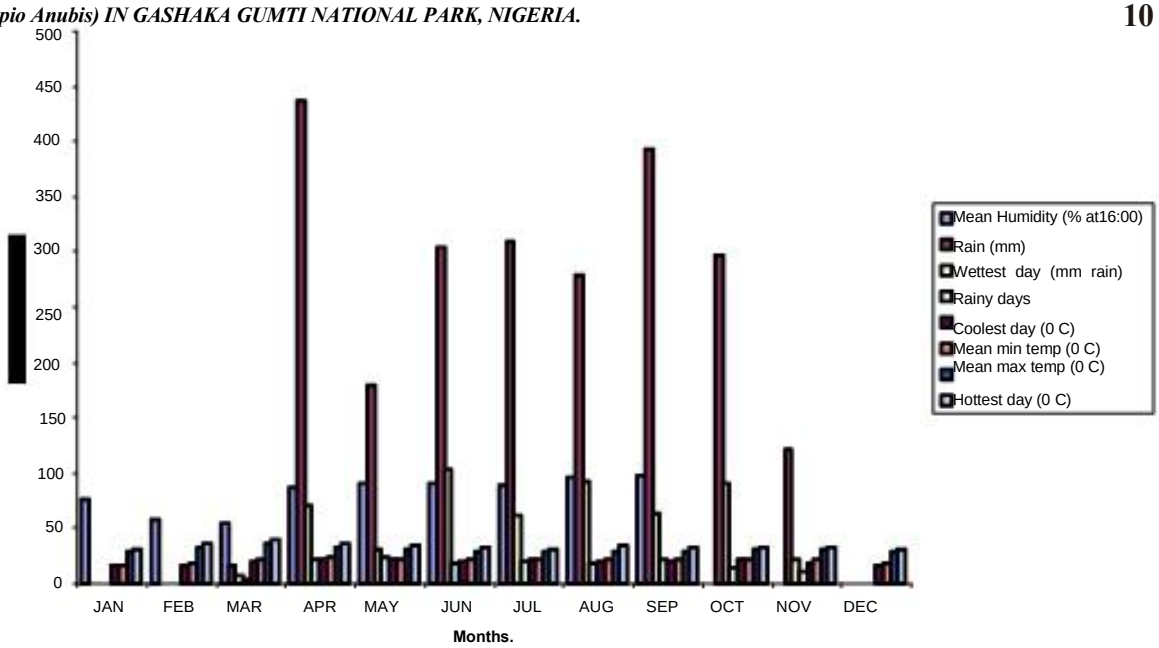

Figure 2: Chart showing the summary of Kwano weather during the study period

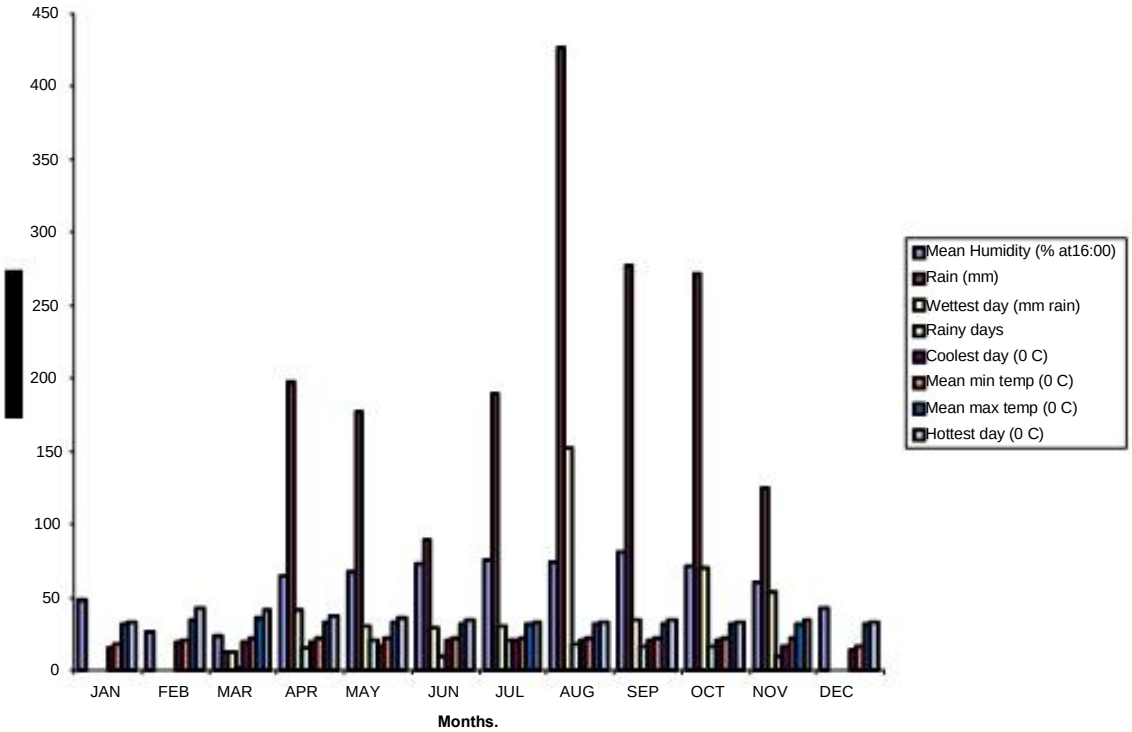

Fig 3: Chart showing the summary Gashaka weather during the study period

Study Design

Data was collected for six months, on twenty days per month. Data collection was done either in the morning from 06:00 to 12:00 hours or in the evening from 12:00 to 18:00 hours in alternate manner. Observations were made on two troops of baboons, which had already been habituated to human observers. One troop is located in Kwano forest, which are wild foraging (WF) and has a total of 26 individuals, while the other troop is located near Gashaka village, which are crop raiders with a total of 17 individuals. All male and female adults and most sub adults and infants were known to the researchers by name. Pregnant females were identified using past knowledge of their sexual swellings which, involved three stages (S_1, S_2, S_3) and the colour of their buttocks, which changes to faint pink during pregnancy.

Plate 2: The sexual swellings of Ymke during cycling

Plate 3: Amina during pregnancy
Source (field data)

Plate 4: Mamawutsiya during pregnancy

DATA COLLECTION TECHNIQUES

The time fixed-point focal sampling method as described by Paul and Patrick (1990), was used in determining the following: Behavioural patterns of pregnant and lactating females; behavioural patterns within states (pregnancy and lactation) and between the two groups; the group spread from pregnant and lactating females; the association of pregnant and lactating females with individuals of each group; and the group interaction with pregnant and lactating females at different activity budgets. For the determination of the suckling behaviour of infants, lactating females were followed and the suckling length (in minute) and bouts were recorded.

The time fixed-point focal sampling method involved following the focal animals and making observations on the selected behavioural parameters. The observations were recorded at fixed time intervals. Generally, behavioural patterns and group spread parameters were observed and recorded using one-minute focal sampling

technique while measurement of group association with focal dyads were taken using fifteen-minute focal sampling interval and included scan sampling. The collection of data on suckling behaviour involved following lactating females and observations were done only when infants were seen suckling. Each behavioural observation lasts for 45 minutes with a minimum of 15 minutes in between observations.

Descriptive analysis, student t-test and analysis of variance were used to analyse the data collected.

RESULTS

Determination of the behavioural patterns of pregnant and lactating females at Kwano and Gashaka troops.

The results of behavioural patterns of pregnant and lactating females at Kwano and Gashaka are presented in Table 1. The results indicate that pregnant and lactating females in both troops display social, feeding, reproductive, post-patum, movement and roosting behaviours. Observed social behaviours include playing, yawning, kissing, embracing , grooming , chasing and aggression, while feeding behaviours include browsing, grazing, hunting, crop-raiding and drinking. Reproductive behaviours observed include cycling, grooming, presenting, copulation, hierarchical mating and consort, while those of post-patum behaviour were follower and infant exchange. Others include movement in trees, grassland, forest floor and riverbanks, as well as roosting on trees and forest floor.

Table 1. Behavioural patterns of pregnant and lactating baboons at GGNP

Types of Behaviour	Characteristics
Social Behaviour	Playing
	Grooming
	Chasing
	Aggression
	Yawning
	Kissing
	Embracing
Feeding Behaviour	Browsing
	Grazing
	Hunting
	Crop-raiding
	Drinking
Reproductive Behaviour	Cycling
	Presenting
	Copulating
	Hierarchical mating

	Clutch size
	Consort
Post partum Behaviour	Follower
	Infant exchange
Movement Behaviour	Movement on tree, in grassland, in forest floor and in river bank.
Roosting Behaviour	Roosting in tree, in forest floor and in grassland.

Examination of the behavioural patterns within and between states (Pregnancy and lactation) and between the two groups.

Tables 2-6 show the results of the comparison of behavioural patterns within and between states (pregnancy and lactation) and between the two troops (Kwano and Gashaka). The results show that there was significant difference (P=0.05) within states (Table 2 and 3) in the same group, and between the two groups (Table 4). Similarly, significant differences (P=0.05) were found between states (Table 5) in the same group and between groups (Table 6).

Table 2. Comparison of the behavioural patterns between pregnant and between lactating females in Kwano troop

Pregnant females	Mean values	**Lactating females**	mean values
Adama	105.22 [a]	Tojali	159.2 [a]
Amina	45.67 [b]	Lami	64.22

Means with different superscripts are significantly different (P=0.05).

Table 3. Comparison of the behavioural patterns between pregnant and between lactating females in Gashaka troop

Pregnant females	Mean values	**Lactating females**	mean values
Mamawusiya	170.0	Straight tail	123.64 [a]
		Maman Kane	126.36 [b]

Means with different superscripts are significantly different (P=0.05).

Table 4. Comparison of the behavioural patterns between pregnant females and between lactating females in Kwano and Gashaka troops

Pregnant females	Mean values	**Lactating females**	mean values
Kwano troop	129.2[a]	Kwano troop	120.13[a]
Gashaka troop	170.0[b]	Gashaka troop	107.85[b]

Means with different superscripts are significantly different (P=0.05).

Table 5 Comparison of behavioural patterns between pregnant and lactating females in Kwano and Gashaka troops.

Kwano	Mean values	**Gashaka**	mean values
Pregnant females	129.2[a]	Pregnant females	170.[a]
Lactating females	120.13[b]	lactating females	107.85[b]

Means with different superscripts are significantly different (P=0.05).

Table 6. Comparison of behavioural patterns between pregnant and lactating females in Kwano and Gashaka and between lactating and pregnant females in Kwano and Gashaka troops.

States/sites	Mean values	**States/Sites**	mean values
Pregnancy/Kwano	129.2[a]	Lactation/Kwano	120.13[a]
Lactation/Gashaka	107.85[b]	Pregnancy/Gashaka	170.0[b]

Means with different superscripts are significantly different (P=0.05).

Determination of group population at distances =1m to =10m away from pregnant and lactating females.

The results of group counts at various distances (=1m to =10m) from pregnant and lactating females are presented in Tables 7 to 10. Results in Table 7 and 8 indicate that percentages of group count away from pregnant and lactating females at both sites increased with increase in distance. At Kwano site (Table 7), the percentage counts within 1m distances from the focal animals ranged from 4% to 9%, while at 10m and above the percentage group counts ranged from 42% to 57%. Similarly, at Gashaka site (Table 8), percentage group counts within 1m-distance ranged from 6% to 8%, while at 10m distances and above, the group count ranged from 46% to 51%. Comparison of percentage group counts at distance-intervals between pregnant females (Table 9) of both sites showed a range of 6% to 49% at Kwano site and 7% to 51% at Gashaka site. Similarly, the percentage of the group counts at distance-intervals from lactating females at Kwano and Gashaka sites were in the range of 9% to 43% and 7% to 49% respectively (Table 10).

Table 7. Percentage of the group population at distance-intervals from pregnant and lactating females at Kwano site.

Focal animals					
Distance-Intervals	Adama (P)	Lami (L)	Amina (P)	Tojali (L)	Ymke (P)
≤1m	5	9	5	9	4
5m	18	21	20	22	14
10m	29	28	27	26	25
10m	48	42	48	43	57
Totals	100	100	100	100	100

Table 8. Percentage of the group population at distance -intervals from pregnant and lactating females at Gashaka site.

	Distance-intervals				
Focal animals	1m	5m	10m	10m	**Totals**
Straight tail (L)	6	20	23	51	100
Mamawusiya (P)	7	18	24	51	100
Maman Kane (L)	8	19	27	46	100

Table 9. Percentage of the group population at distance -intervals from pregnant females at Kwano and Gahsaka sites.

	Distance-intervals				
Sites	1m	5m	10m	10m	**Totals**
Kwano	6	18	27	49	100
Gashaka	7	18	28	51	100

Table 10. Percentage of the group population at distance -intervals from lactating females at Kwano and Gashaka sites.

	Distance-intervals				
Sites	1m	5m	10m	10m	**Totals**
Kwano	9	22	26	43	100
Gashaka	7	19	25	49	100

Determination of the association of pregnant and lactating females with individuals of each group.

Figures 5 and 6 show the results of the nearest neighbours to both pregnant and lactating females at both sites. At Kwano site (Figure 5) and for pregnant females (Adama, Amina and Ymke), Tojali (17%) and juvenile males (16%) were observed to be the closest individuals to Adama, while Amina had the juvenile males (11%) and Sanda (9%) as her nearest neighbours. The nearest neighbours to Ymke were Lami (23%), Sanda (13%) and Dogo (10%). For lactating females (Lami and Tojali), the nearest neighbours to Lami were infants (29%), Tojali (23%), while Tojali had Lami (23%), Dogo (12%) and juvenile females (12%) as her nearest neighbours. At Gashaka site (Figure 6), mamawusiya is the only pregnant female and had infants (28%), Straight tail (13%) and Babawusiya (9%) as her nearest neighbours. For lactating females (Straight tail and Maman Kane), Straight tail had maman Kane as her closest neighbour, while Maman Kane's nearest neighbours were the infants (27%), Babawutsiya (9%) and the juvenile females (7%).

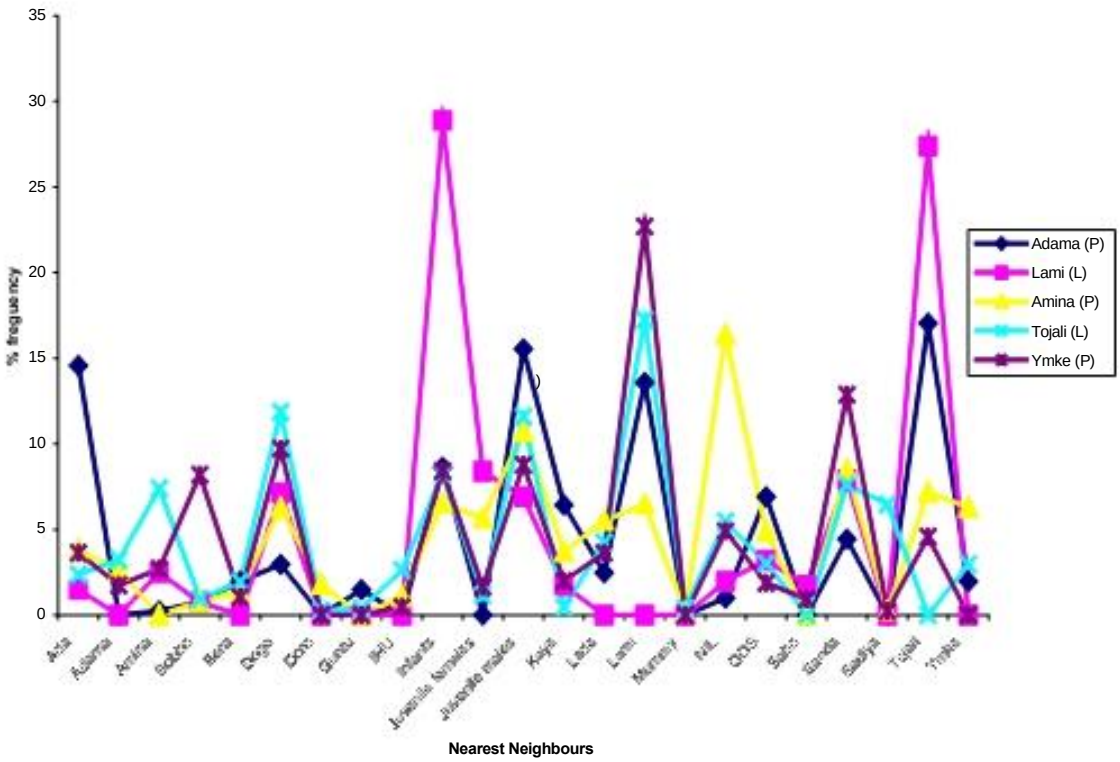

Figure 5. The Nearest Neighbours to pregnant and lactating females at WF site.

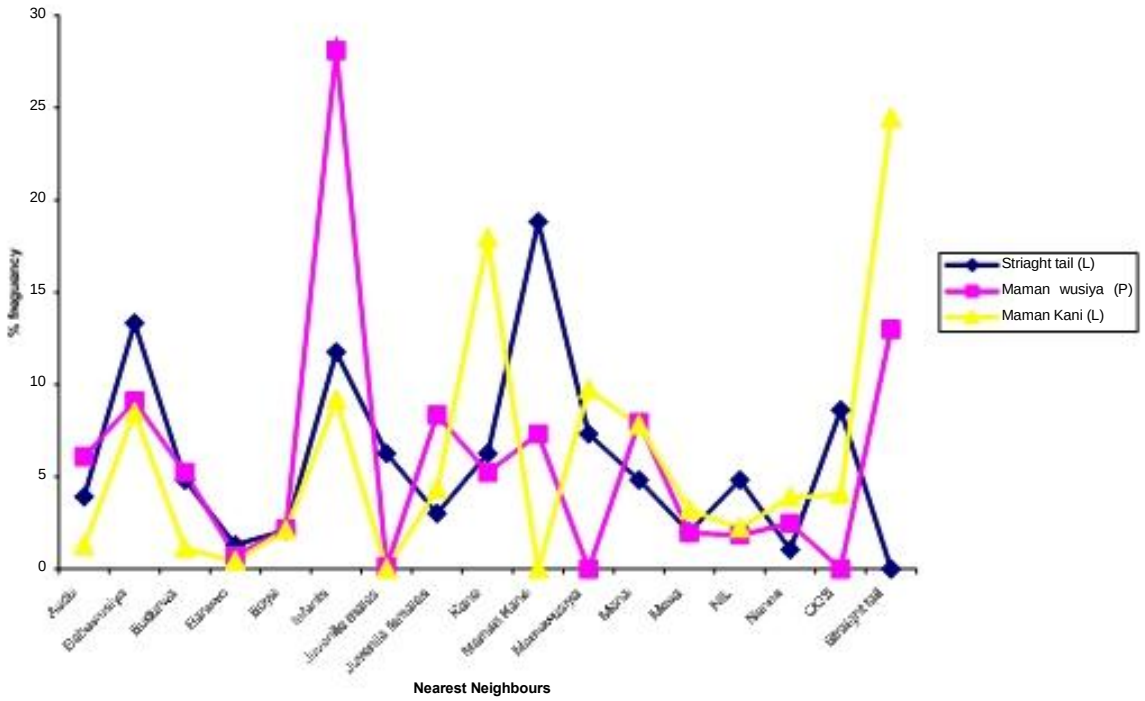

Figure 6. The Nearest Neighbours to pregnant and lactating females at CR site.

The group interaction with pregnant and lactating females at various activity budgets and distance-intervals.

The results of group interaction with pregnant and lactating females for all the activity budgets and distance-intervals are presented in Tables 11 to 14. There was significant difference (P=0.05) in-group interaction with pregnant and lactating females at all activity budgets between distance-intervals =5m and =10m; =10m and =5m as well as =5m and =10m (Table 11). However, group interaction for all the activity budgets was found to be highly significantly different (P=0.01) between =1m and the other distance intervals (=5m, =10m and =10m). Table 12 shows that there was no significant difference (P=0.05) in-group interaction between distance-intervals =1m and =5m for all the activity budgets. However, group interaction at distance-intervals =1m and =5m were significantly different (P=0.05) from distance-intervals =10m and =10m for all the activity budgets. Table 13 shows that there were no significant difference (P=0.05) in-group interactions between distance-intervals at various activity budgets. Table 14 indicates that no significant difference (P=0.05) exist in-group interaction between distance-intervals =5m and =10m and between =5m and =10m at various activity budgets. However, significant difference (P=0.05) was observed between distance-intervals =1m and all the other distance-intervals (=5m, =10m and =10m).

Table 11. Group interaction with pregnant females for all activity budgets at various distance-intervals at Kwano site.

Distance-intervals for group interaction with pregnant females.	mean values in group interaction for all activity budgets at various distance- intervals.
≤ 1m	22.00[a]
≤ 5m	82.89[b]
≤ 10m	121.00[b]
≥10m	135.22[b]

Means with different superscripts are significantly different (P 0.05).

Table 12. Group interaction with lactating females for all activity budgets at various distance-intervals at Kwano site.

Distance-intervals for group interaction with lactating females.	mean values in group interaction for all activity budgets at various distance- intervals.
≤ 1m	18.33[a]
≤ 5m	68.67[a]
≤ 10m	120.56[b]
≥10m	122.33[b]

Means with different superscripts are significantly different (P 0.05).

Table 13. Group interaction with pregnant females for all activity budgets at various distance-intervals at Gashaka site.

Distance-intervals for group interaction with the pregnant female.	mean values in group interaction for all activity budgets at various Distance- intervals.
≤ 1m	14.78[NS]
≤ 5m	34.78[NS]
≤ 10m	47.44[NS]
≥10m	50.44[NS]

Means with different superscripts are significantly different (P 0.05).

Table 14. Group interaction with lactating females for all activity budgets at various distance-intervals at Gashaka site.

Distance-intervals for group interaction with lactating females.	mean values in group interaction for all activity budgets at various distance- intervals.
1m	16.88[a]
5m	33.88[b]
10m	39.63[b]
10m	41.00[b]

Means with different superscripts are significantly different (P 0.05).

The suckling behaviour of infants at Gashaka Gumti National park.

Results of suckling behaviour of infants at Kwano and Gashaka sites are presented in figures 7,8,and 9. Figure 7 shows the average suckling time in minutes for each lactating females's infant at both sites. The result shows that Tojali's infant had the highest average suckling time (3 minutes) followed by Maman Kane's infant (2.4 minutes), while Lami's infant had the lowest suckling time of 1.7 minutes. Figure 8 indicates that infants spent more time suckling at Kwano site (52%) than infants at Gashaka site (48%). Figure 9 shows that infants at Gashaka lactate more frequently (4times/day) than Kwano infants (2 times/day).

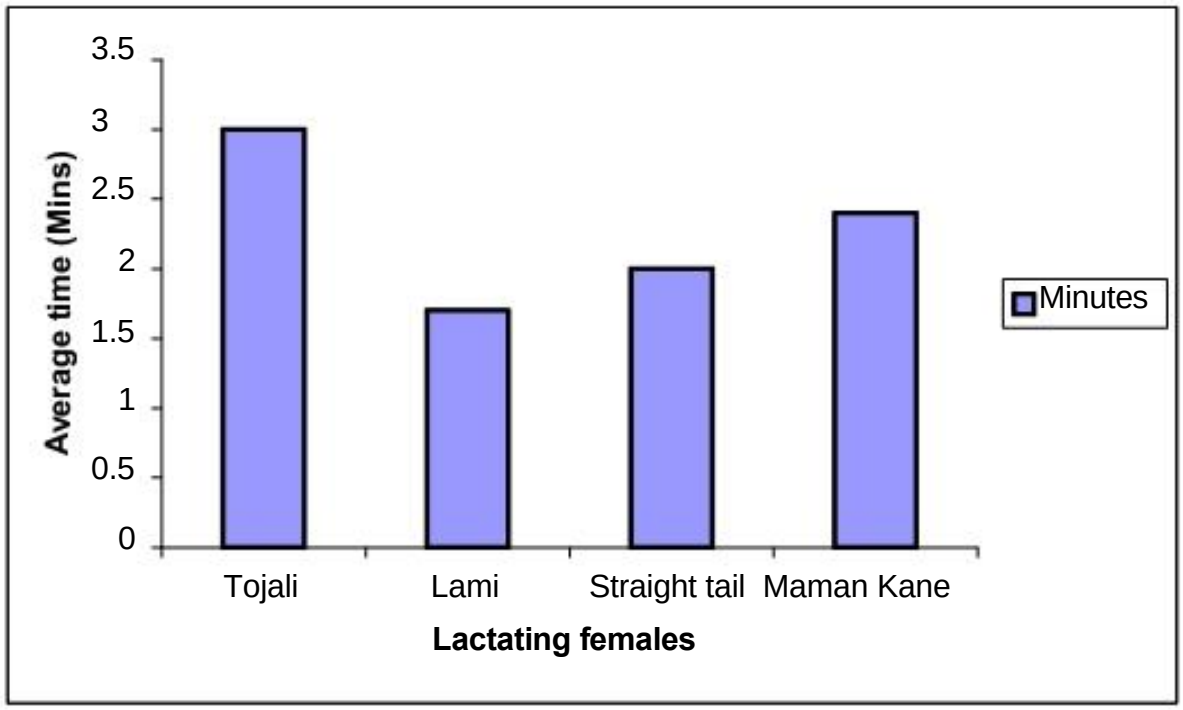

Figure 7. Average suckling Length of lactating females.

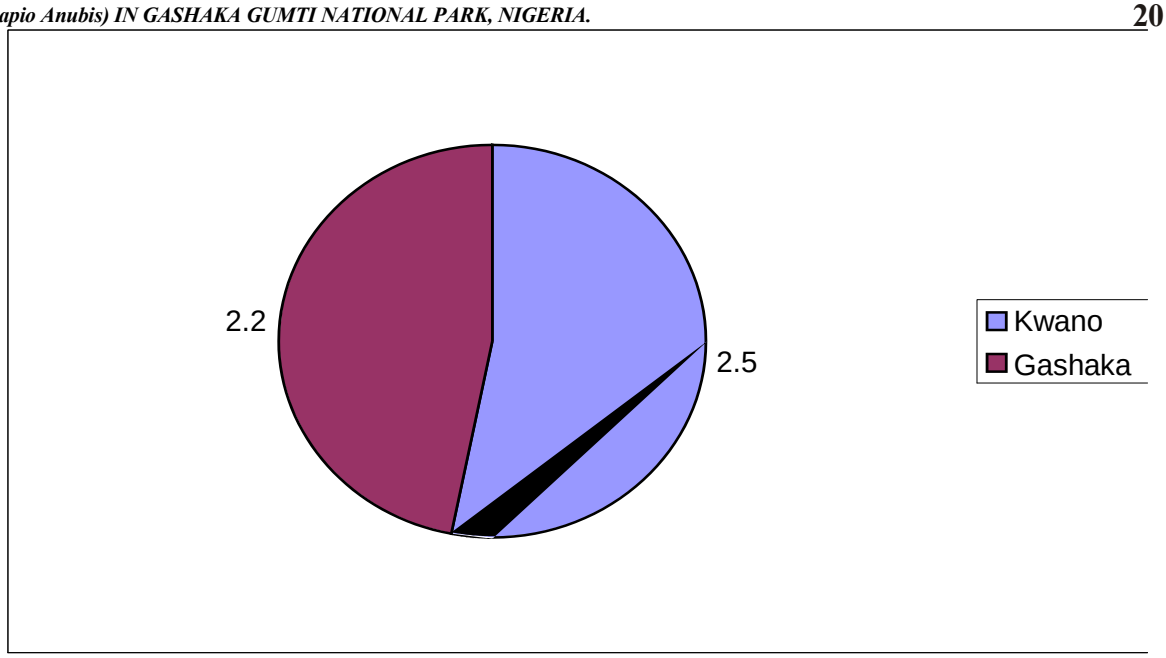

Figure 8. Average suckling length of infants at Kwano and Gashaka sites.

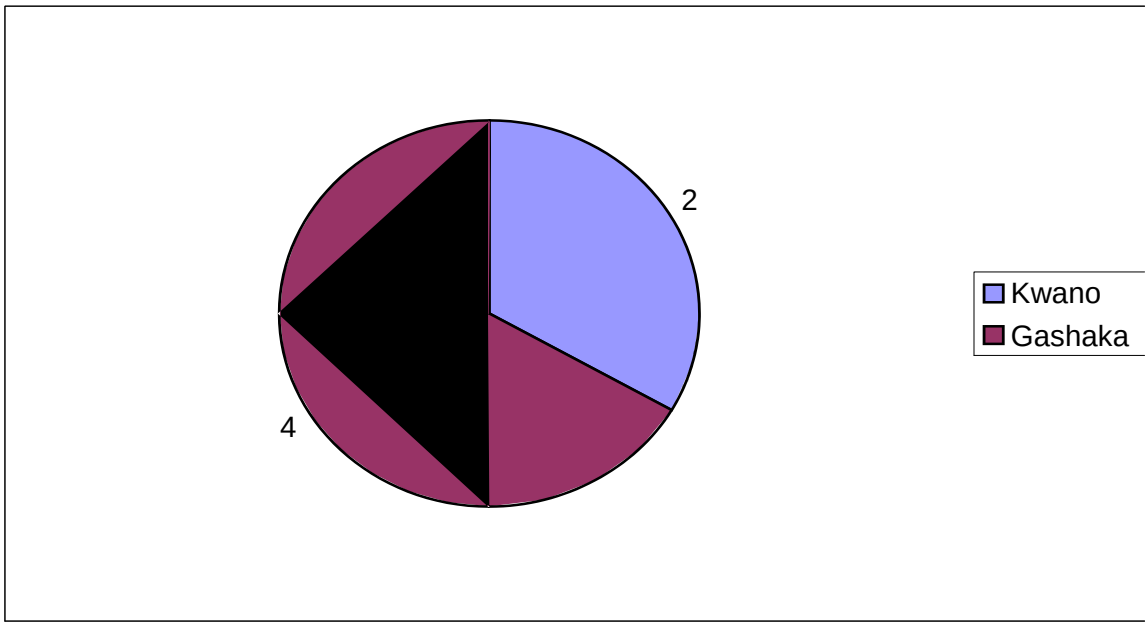

Figure 9. The suckling bouts of infants at Kwano and Gashaka sites.

DISCUSSION

The Behavioural patterns of Pregnant and Lactating baboons at Kwano and Gashaka troops.

The results indicate that pregnant and lactating baboons in both troops displayed both social, feeding, reproductive, post-patum, movement and roosting behaviours.

Social Behaviour

The social behaviours observed in pregnant and lactating baboons in GGNP troops during this study included playing, grooming, chasing, aggressive, yawning, kissing, and embracing as discussed by Kingdon (1997) perhaps, to enhance bonding as described by Barton (1989). Pregnant and Lactating baboons were considered to be playing whenever they were not involved in any other activity rather than performing some sort of exciting displays (Oxford Advanced Learner's Dictionary, 2001). Pregnant and Lactating baboons were observed playing mostly with juveniles, infants and adult females, probably to avoid the adult males and

avoid social motivation. Slight biting, kicking, slapping, pushing, dragging and lying down were used by pregnant and lactating females to initiate plays. Pregnant and Lactating females were observed to be involved in deceitful presenting to initiate plays with infants and juvenile males. A deliberate attempt to break host branches was commonly applied by pregnant females to start playful acts with infants and juveniles. Hiding the infant by complete embracement was a keen display between lactating females and juvenile females who expressed interest at collecting her infant. Pregnant and Lactating females at GGNP were also observed grooming, perhaps, to strengthen their relationship with the respected members of the group who will probably be willing to render assistance to them in times of need as discussed by Henzi and Barrett (1999).

Chasing was observed in pregnant and lactating females mostly at feeding spots, perhaps as a selfish attitude to save more food for her. Chasing and seizing was observed to be the common way of sharing the hunted meat (Smuts, 1985) among them, "a situation whereby the strongest enjoys the lion share while the weaker is suppressed". Lactating females also chase after individuals who caused their infants to scream thereby ensuring some sort of maternal protection. Observations during this study suggest that chasing was not used by pregnant and lactating females in times of conflict only, but also as a bonding tool with other members of the group and also defines the social structure of the group, which agrees with Altmann (1996) and Dunbar (1986) observations.

During this research, pregnant and lactating baboons were considered to be aggressive whenever it expresses anger and behave in a threatening way to the other individual of the group. Pregnant and lactating females showed aggressiveness at feeding, resting and sleeping sites as well as during movements. The cause of aggression is linked with the activity of the pregnant and lactating females and the category of individual involved. Generally, at feeding spots, aggressiveness shown by pregnant and lactating females suggested competition for food resources. At resting sites, pregnant females were aggressive perhaps, to resist mating displays by males and choice of grooming partners. Aggressiveness of lactating females to other members of the group suggests a caring attitude to infants. Some infants faced threatening behaviour from mothers whenever they attempted to suckle. Similarly, at sleeping sites and during movement, aggressiveness shown by pregnant and lactating females could probably signify competition for space. Some infants were generally troublesome (Tojali's) a tendency that could cause aggressiveness by lactating females towards their infants. During movement in particular, some lactating females behaved aggressively to their infants resulting in "infant blocking" an act which helps the lactating female to go on foraging without the infant. During such situations, the infant was observed to be moving around other lactating females or locates an adult male with whom it remains until the mother returns to pick it. This behaviour indicates a weaning strategy. The infant's movement with an adult male apart from gaining protection is indicative of biological lineage between them.

According the Oxford Advanced Learner's Dictionary (2001), yawning is an indication of behaviour of tiredness or bored-ness shown

by animals via opening of the mouth widely and breathing in deeply. This was also observed in pregnant and lactating females during this study. This behavioural characteristic was commonly seen in pregnant and lactating females, either sitting or lying during resting periods. This behavioural characteristic, suggests that pregnant and lactating females undergo marked fatigue from routine activities.

Kissing is defined as an act of touching somebody with the lips as greeting or as a sign of love (Oxford Advanced Learner's Dictionary, 2001). Pregnant and lactating baboons at GGNP were observed kissing with other females of the group only. Kissing was common in the morning and always initiated by pregnant and other females who visited the lactating females on their beds. The essence of this social behaviour, maybe, to greet the lactating mother as well as getting familiarized with the infant.

To embrace simply means to put your arms around somebody as a sign of love or friendship (Oxford Advanced Learner's Dictionary, 2001). This social behaviour was only observed in lactating females. This was observed between sub-adult females and their mothers who were lactating. This observation indicated that sub-adult females do not loose recognition of their biological mothers. Sub-adult males were not involved in embracing their mothers probably because of the hierarchical role or perhaps, they transferred from the group at younger ages. **Feeding behavior**

Feeding behaviour observed on pregnant and lactating baboons included browsing, grazing, hunting, crop-raiding and drinking.

Browsing by pregnant and lactating baboons included feeding in trees at various strata. This involves the collection and eating of leaves, flowers and fruits other than grasses and forbs. However, the collection of this plant parts was observe to be that of selective principles. For example, pregnant and lactating females preferred only fleshy leaves from the apical region of the plant. But the lactating females were not observed to be climbing to the apical region with their infants, perhaps to avoid tree accidents due to broken branch. They were observed to be leaving their infant within the tree trunk during lunch period. Similarly, unripe fruits were harvested eaten and dropped in the forest floor, by both pregnant and lactating females, probably as storage strategies or the general baboon's well known destructive habits as discussed by Hill (2000).

Pregnant and lactating females at GGNP were observed to be feeding on insects from grasses and flowering plants. Opening of stones in intermittent rivers was also observed to be a hunting strategy in pregnant and lactating females. However, it wasn't clear to the researcher on whether they were attempting to fish or hunt for crabs and other river animals. This was only observed in stagnant and dry riverbeds. The hunting skills shown by pregnant and lactating females on mammals and birds included stalking and jumping on the prey with the fore hands. The mouth was then used in killing the prey by biting and breaking, while hands were used in tearing the meat apart or the fittest individuals may drag the captured at each other for their various shares. Pregnant and lactating females were also observed preying on eggs from bird nests.

Pregnant and Lactating females were involved in crop-raiding during this study. Lactating females were observed to be leaving their infants in trees while going into farms to crop raid. Infants were always silent during trips into farmlands even when they were noisy from afar, perhaps, an instructive communication from their mothers. Crop-raiding skills observed with the crop-raiders included splitting of the troop into sub parties, followed by deceitful barks by an isolated adult male. While the farmer's idea of the presence of the baboons is in the direction of the single male, the majority of the troop goes into the farm from an opposite direction. This adult male, otherwise, known as the "crop-raiding commander" remains in the tree watching at the farmer's reactions. Certain calls from this male set the raiders on their heels with the stolen crops. This is related to the position of baboons in the animal kingdom as one of the closest relatives to humans and as such behaving almost in a similar manner as humans. Although, it remains difficult to conclude that baboons crop-raiding skills is tactical or not as pointed out by Hill (2000).

Pregnant and Lactating females at GGNP apart from obtaining water from food intake, also
visited river bodies on daily basis to drink some water, indicating that water is very essential for their survival. The two troops of baboons were observed visiting certain areas within their home range and socializing for longer time. During this period in such areas, they were observed to burrow into the ground with the mouth. Artifacts of other mammals were also observed in such areas, perhaps, an indication of salt licks point, which agrees with Adanu (2002) observation on primates' involvement in salt licking.

Reproductive behaviours

Reproductive behaviours observed included grooming , copulating , presenting , hierarchical mating and consort. Presenting is a reproductive behavioural characteristic that was observed to be preceding grooming in pregnant and lactating females at GGNP. Pregnant or lactating females performed it by standing straight (with the back facing the male) in front of the grooming partner. However, adult males who were always observed grooming with pregnant or lactating females were not responding positively to the presenting females. This suggests that mating among adult baboons at GGNP is certainly not a chanced activity but a naturally predetermined activity.

Copulation was observed between pregnant females and juvenile males and between lactating females and juvenile males only. After a prolonged grooming with an adult male, the pregnant or lactating females moved to copulate with a juvenile male in the hidden. This observation suggests that mating is a naturally predetermined activity in mature baboons. However, for the juvenile males and some weaker adult males of a group, copulation is secretly carried out as legal mating might result into serious conflict between them and the alpha male.

Since pregnant and lactating females were only observed mating with juvenile males and in the hidden, it follows the general rule that mating among females that exist in social systems comprising of multi-males is ranked determinant as discussed by Kingdon (1997). Otherwise, juvenile males would have been mating or copulating with pregnant and lactating females publicly. Similarly, an adult

male attempted to attack a juvenile who copulated with his grooming partner thereafter, suggesting ranked mating, otherwise, he would have attacked the female rather.

A caring adult male on an infant may be doing that as consorting strategy with the mother, a behaviour that commences from when she resumes her menstrual cycling according to Milton (1990). Similarly, it is suspected that Babawutsiya (an adult male) who was observed caring for Maman Kane's infant (Gashaka site) ended up in consortship with the mother from when she resumed her menstrual cycling. Some pregnant females were also observed to be in close relationship with some adult males and included Amina and Sanda (Kwano site) and Mamawutsiya and Babawutsiya (Gashaka site), possibly consorting.

Reports (Rajpurohit, 1994; Nicolson, 1982) have shown litter size of baboons to be one. However, findings from this study have shown that baboons in a better condition could have higher litter size. For example, mamawutsiya who gave birth to twins during the period of this study, which is suspected to be related to high quality food from human crops at Gashaka site.

Post-patum behaviour

Lactating females were observed to be carrying their infants along (either under the stomach or on the back) during the daily routine activities. A newly born infant attaches to the fur of the mother while she uses one of her hands to support her and walk on three legs only. During this period, the infant's face was observed to be red and the entire body black in colour. As the infants advanced in age, the face and ears were observed to be changing to black while the entire body changed to grey during which, the infant begins to sit on the back of the mother as she continues with her activities. The essence of this behaviour may be to ensure protection as well as introducing the infant into the social system. During certain stages in age, infant were observed to be moving in trees on their own as the mother forages around her. However, during the crossing of grasslands, the mothers always recollect them. This is a post-patum behavioural characteristic whereby a lactating female leaves her infant with a member of the group or another lactating female and moves far away for foraging as observed by Vogel, 1984. This was only observed with lactating females whose infants were older (Tojali's infant for the Kwano site) and Maman Kane's infant for Gashaka site. For the Kwano lactating females, Tojali could leave her infant with lami (lactating female) while for the Gashaka lactating females, Maman Kane could leave her infant with Straight tail (another lactating female). This was always involving series of attempt by the infant to follow her mother, "a situation that results into "infant blocking" by other females to enable the mother to escape into the vegetation. However, whenever the group was about crossing grassland, such mothers would always return to the group and carry their infants, perhaps to protect them from predators. Some infants, after the mother has disappeared, located some adult males and remain with them till when the mother returns. Such adult males were also observed to dedicate their time ensuring protection of such infants, thus, suggesting, a father-child relationship. This observation was made on Tojali's infant and Dogo (adult male) at Kwano site and between Maman kane's infant

and Mona (adult male) at Gashaka site.

Movement behaviour

This observation suggests that movement in the tree was highly controlled by certain factors. For the pregnant females, movement in the tree was accompanied by short rests in search for food resources as well as crossing from one tree to the other. The case was different with lactating females whose infants readily accepted to move on their own in trees increasing the food searching ability of their mothers. Movement in trees significantly reduces competition through the animal's ability to occupy a given stratum alone.

Movement by pregnant and lactating females in grasslands was observed to be faster and controlled, probably, to avoid the danger of being sighted by predators. Grasslands may be considered transition zones.

Movements in the forest floor were slow, steady and involved stopping at certain points to search for fallen nuts. The movement of pregnant females was observed to be slower. During movements in the forest floor, the entire group was observed to be in close proximity except for few individuals that occasionally, went on isolated foraging. It is suspected that baboon troops have a means of communicating to each other within the group. This is because no matter the distance-interval between isolated individuals and the group, they were always reuniting each time the group was to travel into adjacent forests different from where they were foraging initially.

Movement in the riverbank was also observed to be a special activity to the baboons in GGNP. Their movement was particularly observed in dry riverbed and when the river was not in session. Movement was observed to be that of jumping from one stone to the other. Pregnant and lactating females did not show interest at swimming in the rivers.

Roosting behaviour

Pregnant and lactating females at GGNP were observed to be resting from time to time per day during this study. Females in both states rested even when the entire group was involved in a particular activity, probably, to allow suckling by their infants. Pregnant females were resting more frequently than the lactating ones. Roosting characteristics observed included roosting in trees, in forest floor and in grasslands. Irrespective of the roosting environment, both troops were always selecting suitable sites with motivating structures such as fallen trees, trees with outgrowth of roots and buttresses and rocks may be to increase comfort (sitting, playing and grooming). These natural structures also adds to their height above the ground to be able to sight danger from predators.

Comparison of behavioural patterns within and between states (pregnancy and lactation) and between kwano and Gashaka groups.

At kwano site and for pregnant females (Adama, Amina and Ymke), it was found that behaviours differed significantly (P=0.05) from one individual to the other. There is likelihood that the observed differences may be related to changes in habitat resources, and probably the age of pregnant female, and attitude of group members towards her and the stage of the pregnancy. For the lactating females (Tojali and Lami) at Kwano site, the observed behaviour also differed significantly (P=0.05) between them. These observed

differences may be related to the changes in habitat resources, group movement, Father and age of the infant.

At Gashaka site and for the pregnant females, there was only a single pregnant female (Mamawutsiya), suspected to be one of the oldest females in the group. She was observed to be very caring to infants in close proximity to her. However for lactating females (Straight tail and Maman Kane), there was a significant difference (P=0.05) in their behaviours. These observed differences might be related to richness in habitat resources, age of mother, father and age of the infants.

The observed differences between states (pregnancy and lactation) and at both sites are perhaps, a reflection of the variability in stress in the different states. Pregnant females were observed to be resting more frequently alongside with other activities while lactating females sometimes travel even longer distances than the other members of the group. The differences observed between Pregnant and lactating females in the two sites and also within states (Pregnancy and lactation) at both sites may be an influence of the environmental factors such as food availability, group composition, foraging strategies and predation.

Group counts at distance-intervals away from Pregnant and Lactating females in Kwano and Gashaka troops.

The results indicated that percentages of group counts away from pregnant and lactating females at both sites increased with increasing distance -intervals . This observation reflects the general fact that movement of baboon troops is highly controlled by the availability and distribution of food resources in the home range. The association of group members with females under these states could be highly selective to avoid competition (Lee *et al*., 1986). This finding could also be associated with the already known information that adult males spent most of their time contesting for positions among cycling females who may not maintain close distances with females in these states (Kingdon, 1997; Dunbar, 1986; Rasmussen, 1985). The low percentage counts of 4% to 9% and 6% to 8% within one meter of distance-interval from the focal animals at Kwano and Gashaka sites respectively, were either representative counts of the adult males responsible for the pregnancies or who are the biological fathers of the infants. This could be true as such adult males may wish to maintain their relationship, which shall in turn favour them in the contest for mating when these females assume their menstrual cycling (Milton *et al.,* 1990), conversely they may be percentage counts of inferior individuals who were left with no option rather than to maintain group bonding with pregnant and lactating females (Dunbar, 1986; Lee, 1983; Altmann, 1980). The larger group count of 42% to 57% at Kwano and 46% to 51% at Gashaka (all at =10m from the focal animals) could be due to the groups' dispersion in search of food or due to hierarchical dispersion resulting from age-sex ratio (Mills, 1990).

Pregnant females at kwano seemed to have lower group counts (6% to 49%) than Gashaka pregnant females (7% to 57%). This could be related to the differences in food availability and distribution in the various habitats as well as the influence of the cover density on animal visibility from pregnant and lactating females. Due to the dense canopy at kwano site, it was sometimes difficult to sight

animals from large distance-intervals unlike Gashaka site where sightings were easier at even larger distance-intervals due to the scattered nature of tree species in the troop's home range, except around farmlands where elephant grasses (*panicum maximum*) form swards of up to two meters in height. Similarly, low percentage group counts from lactating females, which ranged from 9% to 43% at Kwano and 7% to 49% at Gashaka was indicative of age-class association with lactating females in each troop. The group count within =1m distance-interval from lactating females at kwano was larger (9%) than Gashaka (7%), probably because there were more adults and sub-adults than infants while in Gashaka site infants and juveniles were in the majority.

Association of pregnant and lactating females with individuals of each group

At kwano site and considering the pregnant females (Adama, Amina and Ymke), Tojali (17%) and juvenile males (16%) were found to be the closest individuals to Adama. Adama was suspected to be one of the oldest females in the group among which was Tojali. This observation suggests that female baboons within the same age-class and in the same group maintain close relationships. The older females were always moving in close proximity, perhaps for the purpose of rendering helping hands during childbirth and to assist in caring for the infants (Anderson, 1981). The result also indicated that juvenile males (16%) were closest to Adama probably because one of the juveniles was her offspring and may have attracted the interest of others towards her mother. In addition, Adama's company was observed to be that of old mothers (adult females) suspected to be the biological mothers of the juveniles. Amina had juvenile males (11%) as nearest neighbours, probably for the reason explained for Adama. However, Amina was observed to be foraging in isolation from the group sometimes during which Sanda (9%) was found to be her closest neighbour behind the juvenile males. Her closed relationship with Sanda may be indicative of secret consort to avoid conflict with Dogo who was the alpha male of the Kwano troop. Ymke was known to be an offspring of Lami and with her first pregnancy. Lami was found (23%) as her nearest neighbour probably because of the biological lineage. Behind Lami were Sanda (13%) and Dogo (10%) as her nearest neighbours. Sanda was a contestant to Dogo for leadership of the group. This observation, therefore, suggested that her pregnancy might be for Sanda or Dogo.

For the lactating females (Tojali and Lami), lami had infants (29%) as her nearest neighbours followed by Tojali (23%) who was also lactating. This result could be an indication that lactating females cooperate more within themselves than with women in other states as well as the opposite sex class (adult males). This may be to allow their infant to play and also because adults concentrate mostly around cycling females. It could also be inferred from this result that infants have a strong relationship with lactating females, perhaps, because of the care they derive from them. Furthermore, Tojali had Lami (23%), Dogo (12%) and juvenile females (12%) as her nearest neighbours. It is pertinent to note that Dogo occurred as nearest neighbour for both pregnant and lactating females. This may be the result of his position as the alpha male of the group.

At Gashaka site, Mamawutsiya was the only pregnant female and had infants (28%),

Straight tail (13%) and Babawutsiya (9%) as her nearest neighbours. Mamawutsiya was suspected to be one of the oldest females in Gashaka troop a situation that might have inferred the attraction of infants to her. Straight tail's close relationship with mamawutsiya could be as result of sex-age bonding among baboons. Straightail had Maman Kane (19%), who was also lactating as her nearest neighbour probably, because of the age-sex bonding, while Maman Kane's nearest neighbour were infants (27%), Babawutsiya (9%) and juvenile females (7%). This result tends to suggest that a strong affinity exist between lactating females and the infants. Babawutsiya's closeness with both pregnant and lactating females could be an indication of his position as the alpha male of Gashaka troop.

Group interaction with Pregnant and lactating females at various distance-intervals for all activity budgets.

For the kwano site, There was no significant difference (P=0.05) in group interaction with pregnant females (Adama, Amina and Ymke) between distance-intervals for all the activity budgets. The result suggests that the degree of interaction does not depend on the activity budgets at these distance intervals =5m to =10m and =5m to =10m, but was found to be significantly different (P=0.05) between =1m and the other distances (=5m and =10m) at various activity budgets. This nature of interaction may be to reduce competition on food resources, aggression and to avoid wanton individuals. There was a significant difference (P=0.05) in the group interaction with lactating females (Tojali and Lami) between distance-intervals =1m to =5m and =10m to =10m for all the activity budgets. This result may be an indication of the general nature of group dispersion in primates for protection against predators as observed by Noe (1997), because lactating females were observed to be occurring mostly within the group and rarely in isolation or at the sides of the group. For the Gashaka troop, and for the only pregnant female, there was no significant difference (P=0.05) in-group interactions with her between distance-intervals (=1m to =10m) for all the activity budgets. This could be due to the fact that the only pregnant female was among the oldest females in the group and probably, ensuring protection on the juveniles who were the majority. For the lactating females, there was a significant difference (P=0.05) in the group interaction with them between distance-intervals =1m and the other distance-intervals (=5m to =10m). This may be an indication of females' relationship with infants and juveniles as well as the female-females bonding in baboons, which has been described by Lott (1991). The observations follow the general trend discussed by Barton (1989) and Anderson (1981) that animals in social systems spread apart during foraging to enhance chances of gathering or capture and increase surveillance of predators while during resting, the entire group form sub-parties socializing.

The Suckling Behaviour of Infants at GGNP

Tojali's infant had the highest average suckling time (3 minutes) perhaps, because her infant was older and could endure for longer hours before suckling than Lami's infant (1.7 minutes), who was younger and suckles more frequently with shorter suckling time. A similar result was recorded between Maman Kane's infant (2.4 minutes) and Straight tail's infant (2 minutes) at Gashaka site. However, the difference between Maman

Kane's infant and Straight tail's infant (0.4 miutes) at Gashaka site was not as much as that between Tojali's infant and Lami's (1.3 minutes) at Kwano site, may be, because Straight tail's infant took advantage of the more frequent resting (an indication of females in a better condition) to close the gap.

The percentage-suckling time of infants was higher at Kwano site (54%) than at Gashaka site (46%). This observation is in line with the report of Warren (2003) that baboons spend lesser time resting and socializing at Kwano site than Gashaka site. In view of this, infants at Kwano site utilized any suckling opportunity effectively by staying longer and ensuring that no single minute is wasted for anything else. Relatively, infants at Kwano were observed to be fund of screaming more often, during various activity budgets than infants in the Gashaka troop. During resting, infants were observed to be playing in close proximity to their mothers at Gashaka site unlike the kwano troop where infants were always busy sucking during rest and were more playful during foraging.

The suckling bouts of infants at Kwano site was less frequently (2 times/day) than at Gashaka site (4 times/day). This is also in line with the observation of Warren (2004) that the Kwano troop spent more time foraging and traveling than the Gashaka troop who spent more time resting and socializing. These findings suggest that the suckling frequency of infants is a function of the quality of the habitat. The kwano troop was observed to be covering larger distances for their day to day routine search for food while in Gashaka, the troop were crop-raiders and could locate their food sometimes easily in concentrated areas within shorter distances. This situation probably provided enough resting time and favoured the suckling bouts of the infants. From this observation, it may be right to state that intake of quality food enhances milk production in lactating baboons.

CONCLUSION

Based on the results from this study, it is pertinent to conclude that baboons in GGNP exist in social organizations within marked home ranges. Some baboon populations still enjoy their natural environment while most groups are faced by habitat loss through human encroachments. Baboon troops have modified their behaviour through activities such as raiding to be able to survive alongside with humans.

Although, just as in humans individual behaviour differs with significant differences between baboon troop dwelling in naturally existing and human-disturbed environments. The population of the troop in the natural home range was higher than the crop-raider as an indication of the effect of changes in environmental conditions. Despite the high litter size of baboons on human modified ranges, human activities remains to the detriments of baboons. Detailed studies should be carried out on the seasonal reproduction, gestation period and inter birth rate and proper habitat management of the baboon range which could be pertinent to better the conditions of baboons in these sites.

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