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IMPACT OF CAPTIVITY ON SOCIAL BAHAVIOUR OF CHIMPANZEE (*PAN TROGLODYTES*)

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ABSTRACT

Chimpanzee is the most intellectual species among the animal kingdom. One-year (2009-2010) study on Chimpanzee was conducted to access the impact of captivity on their social behavior at Lahore Zoo. The group consisted of two pairs; one adult and other sub-adult housed in two separate cages. The data was recorded by instantaneous point-sampling technique to determine the frequency, prevalence and duration of different behaviors including abnormal behaviors, activity level, social behaviors and visitors-oriented behaviors. The findings revealed that Chimpanzees of Lahore Zoo were suffering from low level to high-level abnormal behavior and they also displayed natural behavior patterns like their wild relatives. The observed abnormal behaviors such as clapping, urine drinking, fumble nipple, stereotypical grooming, pacing, hair plucking and spiting were more frequent in adult pair than sub-adult pair. However, social behaviors i.e., social grooming, play, and aggression were frequent in sub-adult pair. The prevalence of visitors-oriented behaviors like affiliative and aggressive behaviours was observed in all Chimps. It was observed that attempt to interact with visitors for food, hand hold and play convert the aggression to affiliative relation. It was concluded the lack of social set up, little chance to adapt associative patterns, small cages in contrast to wild habitat and scheduled diet were the major causes to alter the social behavior of Chimps at Lahore Zoo. It is recommended that these animals should be shifted to newly constructed Chimpanzee Island for their welfare and well-being.

Key words: captivity stress, behavior pattern, animal welfare, social group

INTRODUCTION

Chimpanzees appeared in this world about 30 million years ago. Their scientific name, *Pan troglodytes*, is a Greek word, which means "god of pastures" (Goodall, 1986). Chimpanzees display notable behaviors, which are explained as social customs transferred from one generation to the next generation.

Chimps used to live in fluid fission-fusion social formation, and absence of this feature results in occurrence of abnormal behavior in captive chimpanzees. For example reduction in sexual desires, intensive level of aggression, prevalence of abnormal behavior and persistent inactivity (Bloomsmith and Barker, 2001; Coe *et al*., 2001; Fritz and Howell, 2001). There are five primary objectives of modern zoos including well-being of animals, conservation, public awareness and education, research, and recreation (AZA, 2008; Anderson *et al*., 2003). Without attracting and entertaining visitors, zoos would not maintain their goals. The caged exhibits are depressing impressions of the animals, which does not justify the conservational role of any zoo and may also urge the visitor to interact with the animal in a way which could be harmful or stressful for the animals. Active and healthy animals are attractive and interesting to visitors, but deprived and inactive animals provoke the visitors to interact the animal on their own ways. This may be dissatisfactory for visitors but dangerous for the well- being of animals as well.

The enclosure of Chimpanzees should be designed with special features for enrichments because these are important stimuli to promote curiosity among chimpanzees. In natural habitats chimps do the foraging for 30% of their daily time. Provision of short meals with planned intervals is beneficiary for chimps to explore the opportunities of food processing which are ultimately helpful to increase the nutritional variations e.g. use of sticks to extract the termites. This could be facilitating to increase time for search and consumption of food. In a bibliography of 88 chimpanzee-related enrichment articles published from 1987 to1992 only 11% referred specifically to feeding and eating, 29% could be classified as general enrichment articles, 24% referred to physical environment of captive chimpanzees and 17% referred to the social environment. As mentioned earlier processing and searching of food is very important for captive chimps, therefore it should be the top most concern of animal managers (Pruetz and McGrew, 2001).

The data regarding behavioral studies of Chimpanzee housed at zoological gardens is very limited. As a result of that, level of abnormalities in captive chimpanzees is also uncertain. Captivity is known to be a stressor to provoke abnormal behavior in many animal species and non-human primates as well (Young, 2003; Poole, 2008; Hook *et al*., 2002).

The suggested causes for the development of abnormalities are social deprivation, and maternal separation (Martin, 2002; Davenport, 1979). These features could be traumatic, or may lessen chances to acquire natural behavior. Permanent impact of all these has been observed in some hand reared chimps (Murray, 1998) but not so frequent (Martin. 2005). The solution of all these is social group housing, to establish social relations for the reduction of all negative effects (Lutz *and* Novak, 2005). It is suggested that exhibition of animals in social groups is effective measure to cope with the behavioral abnormalities, especially in primates. It is most recommended way to solve these issues without combating the original cause (Nash *et al*., 1999; Hosey, 2005).

According to Whiten *et al.,* (1999) the normal grooming in chimpanzee is a source to reduce ticks and lice. Chimpanzees use leaves and thump nails to squash this parasite prior to eating**.** Male chimpanzees sometimes kill and eat other animals (Godall, 1986); prior to this chimp was considered to be the vegetarian.

Whiten *et al.,* (1999) described that Chimpanzees do verbal communication by producing calls and so far more than 30 different calls have been discovered to be heard at the distance of 2 miles. Chimps can communicate emotions through different gestures and facial expressions within the social group. They can express their fear by nervous smile like humans to show there tension and stress. The standing of chimps in upright position is an indication of anger. At that time they also move their arms very fast, throw the tree barks and rock stones, plucking hairs, screaming loudly and bunching of lips in fierce glare (Godall, 1986).

Present research study investigated different behaviors displayed by Chimpanzee family at Lahore Zoological Gardens with the aim to explore ways to improve well-being of this endangered animal.

MATERIALS AND METHODS

The research was done on two pairs of Chimpanzee housed at Lahore Zoo. One pair is adult at breeding age brought to zoo in 1993, they gave birth to one male (hand reared) and one female the sub adult pair. In adult pair, male (Romeo) is 21 years old and female (Juliet) is 23 years old. In sub-adult pair, male (Tinkoo) is 9 years old (hand reared) and female (Pinky) is 6 years old. Both pairs are housed in two small separate cages, which share a place in the small cat section.

The cages are cubical in shape and each cage has two parts; one inner and the other is outer cage. The inner cage is usually covered and one can see the animal from inside through a narrow corridor. The inner cages are usually darker since they are away from the sunlight whereas outer cages are fully exposed to sunlight.

The outer cage of sub-adult pair is 23 feet wide and 13 feet high and inner cage is 13 feet and 3 inches wide and 8 feet high. This cage has swinging ropes, one wooden panel, a log or tree just laying on the floor and a tub of water as well as drainage pipe. The inner side of the cage is also provided with a water cooler for the animal to stay cool during the days of excessive warmth. The outer cage of adult pair is 23 feet and 9 inches wide and 17 feet high, whereas the inner cage is 13 feet and 3 inches wide and 8 feet high. The outer cage is provided with the ropes to play, three wooden panels attached to the bars of the cage in two dimensions and one to the inner walls, one water tub with an attached drainage pipe and two loges of tree which are embedded in the ground. These things are provided for the animal to play with.

The animals are given 3-4 kg of seasonal fruits like bananas, apples, melons, water melons, tomatoes, cucumber, 250-400g of bread in the morning; half a liter of milk is given to the animals each in the morning and evening along with fruits and tea is given by the midday.

A data of 288 hours was collected for present study, by instantaneous point-sampling technique (Altmann, 1974) having the time of five minutes for focal animal test observations with a gap of 15seconds. Chimpanzees were observed between 1100h and 1300 h. For preliminary studies animals were observed to determine different behaviors which are ultimately used to design an ethogram. During behavior recording the animals many times got out of sight which was defined as “time out” and on reappearing of animal data was completed. Final observations have the data only for the time in which animals were observed.

The Prevalence, Duration and Frequency of Different Abnormal Behaviors in Lahore Zoo Chimpanzee were observed as under (Table-2):-

Prevalence = number of individuals performing the behavior/total number of Individuals Duration =minutes/288hrs observation

Frequency = number of performances per 288 hrs observation (Lucy *et al.,* 2004).

The behavioral categories observed during the study are given in Table -1

RESULTS

Both pairs of chimpanzees showed all kinds of assessed behaviors at different levels. The most prevalent were stereotypical grooming, spiting and hair plucking in all four chimps. The second prevalent behavior was pacing in both males and adult female (Table-2).

The duration of each of the four focal subjects observed was: for stereotypical grooming 15.1/hr, for clapping 13.25/hr, for pacing 9.62/hr, for spiting 4.93/hr and for urine drinking only for 1.5/hr (Table-2). Frequency of abnormality varied across family like

spiting was more frequent i.e. 0.89/hr, clapping was 0.85/hr and least frequent was urine drinking 0.13/hr (Table-2). A great difference was observed regarding abnormal behaviors for frequency and duration among the individuals. The results also indicated that variations for the prevalence of abnormal behaviors varied with sex and age of animals. The impact of hand rearing on abnormal behaviors was observed in sub-adult male with prevalence of stereotypical grooming, hair plucking, and spiting.

Table-1. Behavioral Categories Observed in Chimpanzees at Lahore Zoo

No.	Behavioral Categories	Definitions of behavioral categories
a)	**Abnormal Behaviors**	
1	Clap	Clap palm of hand or sole of foot, making noise
2	Drinking urine	Drink own urine
3	Fumble nipple	Manipulate own nipple(s) with thumb or fingers. May suck on nipple if breast or nipple is extended
4	Stereotypical grooming	Groom self seemingly without intention, Drag object lightly over hairless body surface in non-focused way.
5	Hair plucking	Pull out own hairs
6	Spit	Expel saliva through pursed lips, often directed at human observer
7	Pace	Locomote, usually quadrupedally, on substrate, covering and then re-covering route in stylized fashion, with no clear objective
b)	**Activity level**	
1	Inactivity	Passive or apparently sleeping
2	Locomotion	Walking, running, suspensory locomotion; pacing and stereotypic behaviors are not included in this category
c)	**Social behaviors**	
1	Groom	Cleaning or manipulating the hair or skin of another individual
2	Play	Gnawing, wrestling, poking, and/or chasing another individual, usually with play face
3	Aggression	Behavioral sequence including at least one of the following: bared-teeth, bite, brusque rush, crouch, flight
d)	**Visitor's Oriented Behavior**	
1	Affiliative	Play invite, present to groom, hold-out hand, clap
2	Aggressive	Threat gestures, spit, throw feces

References: Bloomsmith *et al.*, (1999); Nash *et al*., (1999); Martin, (2002); Bradshaw *et al*., (2008); and Nishida *et al*,.(2010)

The highest percentage of abnormal behavior like pacing was observed (83%) for adult male, 67% for adult female and 15% for sub-adult male. Second high parentage was observed for spiting i.e. 79% in adult male; least percentage was recorded in adult female i.e. 17%. Only the adult female showed 43% fumble nipple (Figure 1). They usually spitted when ignored or to gain attention of the viewer and care taker.

In social behaviors, high percentage was recorded for grooming (83%) in adult female and least percentage of play was also observed in female (23%). Aggression was high in adult male (89%) and least in adult female (15%) (Figure 2). Activity level was highest in sub-adult male in the form of locomotion (71%) and least in adult female (19%) (Figure 3). Visitors oriented behavior were more pronounced in sub-adult female in the form of affiliative behavior (88%) and least in adult male (39%). Aggressive behavior was highest in adult male (79%) (Figure 4). In response to visitor's interaction the sub-adult pair tried to develop affiliative relations by offering their food to visitors, begging for the food and also throwing out their hanging ropes for playing.

Table- 2. Prevalence, Duration and Frequency of Different Abnormal Behaviors in Lahore Zoo Chimpanzee (n=4)

Behavior Categories	Prevalence	Duration	Frequency
Clap	0.5	13.25	0.85
Urine Drinking	0.5	1.5	0.13
Fumble nipple	0.25	2.05	0.63
Stereotypical Grooming	0.1	15.1	0.33
Pacing	0.75	9.26	0.65
Hair Plucking	0.1	8.4	0.48
Spiting	0.1	4.93	0.89

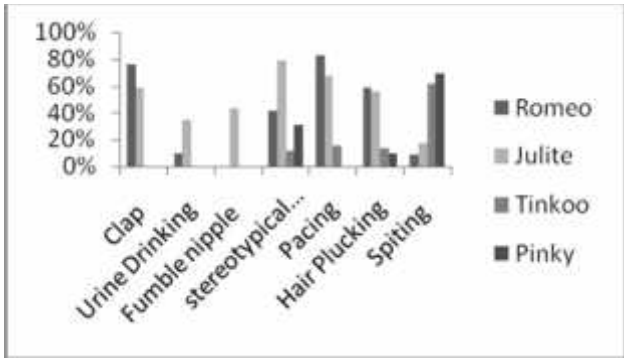

Fig. 1. Abnormal Behaviors shown by Chimpanzees

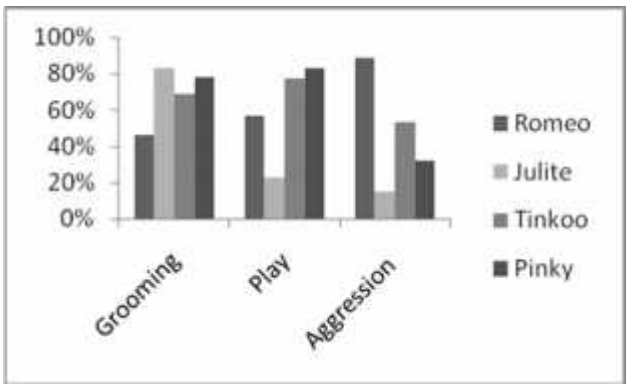

Fig. 2 Social Behaviors shown by Chimpanzees

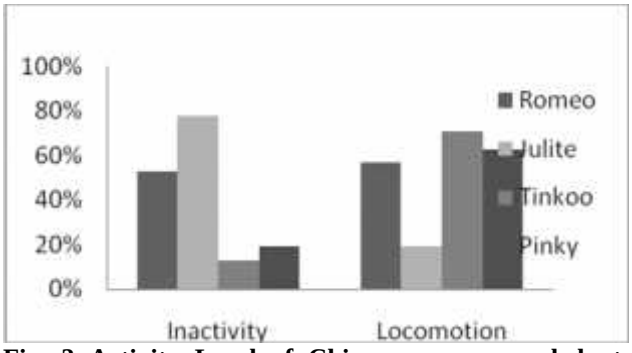

Fig. 3 Activity Level of Chimpamzees recorded at Lahore Zoo

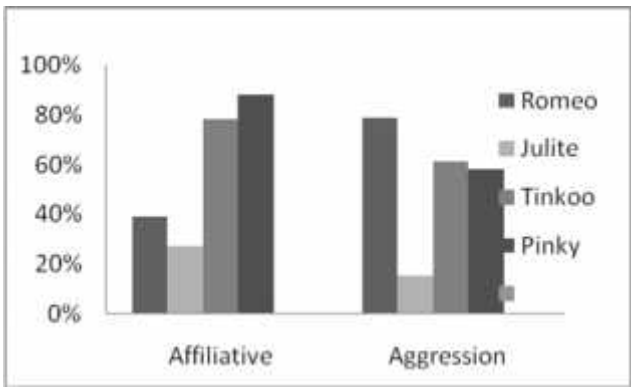

Fig. 4 Visitor -Oriented Behavior of Chimpanzees at Lahore Zoo

DISCUSSION

Results revealed that abnormal behaviors were displayed by all Chimpanzees. However, considerable discrepancy was found among individuals in the duration, frequency and prevalence of abnormal behaviors. The variations were also noticed on the basis of sex, age, and hand rearing. It was also obvious that individuals displayed abnormal behavior for less duration of their activity budget and for most of the time they behaved normally. However, adult female expressed the captivity based boredom at large time scale, which are contrary to the findings of Martin (2002).

Coe *et al*., (2001) and Pruetz and McGrew (2001) suggested that influence of design and working of animal exhibition area can be explained by two schools of thought. The first is homocentric which explains that research and technology would explain all needs of animals, while the second is biocentric which holds the reality that animals should be kept at semi-natural environmental conditions in social bonds. Cages of Chimpanzees at Lahore Zoological Gardens were not up to the standards and were neither homocentric nor biocentric. The provision of biocentric facilities will offer the chimps the better chance to explore their habitat and would have options to overcome the abnormalities. Bloomsmith and Barker (2001) reported that animals experiencing greater chance to enjoy their complex environment having lesser stress dependant syndrome than animals without such environmental conditions. In Lahore Zoo a new Chimpanzee Island having an area of 16000ft^2 (covering area 5000ft^2 and open area 11000ft^2) has been constructed, whereas the current house of Chimpanzee is only 4266ft2 which is all covered. It is necessary to shift the whole family into Chimpanzee Island to live in family bonding.

The maximum inactivity (78%) was observed in adult female (Juliet), who showed least degree of locomotion (19%). Probable reason for that could be separation from her kids at early age, Tinkoo (male) was separated at the time of birth due to severe respiratory tract infection and her second kid (Pinky) was separated from her at the age of three years to be kept with hand reared male (Tinkoo). Apparently she looked very sad and depressed, she could see her both kids from the side of the cage. It was also noticed that whenever she got any treat from someone she tried to share with her kids. If she was not able to do so, she looked very uneasy, but if she could, she felt very relaxed. Moreover, she used to lay down on the cage substrate because the sleeping board was not comfortable and not placed at proper height. Straw bedding was available only in winter but in summer no nesting material was present in cage which is important for them. The wild chimps take cozier sleep for half of their time due to comfort and security of bedding site (Pruetz and McGrew, 2001; Coe *et al*., 2001). At the

birth of birth of pinky I went closer to the cage but all of a sudden the male (Romeo) came close to the cage fence just to provide security to his new kid and nursing mother. However, the element of security and ease which is important to their finest sleep was missing there.

The quite prevalent type of 'abnormal behavior' in populations of Chimps at zoos is coprophagy, reported in many previous studies (Payne *et al*., 2008; Nash *et al*., 1999), was not observed in the present study. Coprophagy is example of social learning transmitted from generation to generation In Lahore Zoo, Chimps spiting was the result of social learning with duration of 4.93/hr and prevalence was 0.1. Its maximum percentages were observed in both adult and sub-adult males i.e. 79% and 62%, respectively. Comparison of prevalence and durations of different behavior patterns among wild and captive populations of Chimps is difficult as available data of wild populations is not enough to explain the notable behaviors at captivity. The literature published for abnormal behavior in wild chimpanzees is scanty (Goodall, 1986; Payne *et al*., 2008; Hiraiwa and Hesegawa, 1988).

It was also observed that if adult male was pacing for sometime, on arrival of school/collage students he started clapping with joy, this shows that visitors sometimes develop affiliative relations and provide a stimulus to lessen the captivity based boredom. The wild chimps have ever changing foraging behaviors and quick process of decision making in daily life which are totally contrary to control diets and predictable schedules of feeding in captivity. Housing of chimps at naturalistic exhibits, extensive chance for foraging, and chance to interact with group members seem to reduce the prevalence of abnormal behaviors (Celli *et al*.,2003; Lukas *et al.*, 2005).

Some individuals displayed three different types of abnormal behavior i.e. stereotypical grooming, hair plucking and spitting (Table 2). This depicted that captive Chimpanzees could show many normal behaviors like in their wild relatives as well but abnormalities in behavior pattern are endemic to zoo animals. In some animals it dominated their activity budget, but in others, it was constant part of their daily behavior pattern e.g. sub-adult pair. It can be concluded here that the behavior of most zoo exhibited Chimps is not typical of wild counterparts. This study suggested that Chimpanzee may struggle to resolve negative aspects of captivity. It has been described by human psychiatrists that abnormalities in captive Chimps' behaviors might be signs of conciliation mental health (Bradshaw *et al.*, 2008; Brune *et al*., 2006).

Hosey (2000) divided the zoo visitor's effects on animals in to three categories i.e. cause of stress, cause of enrichment and neutral. It has also been reported that zoo animals may familiarize with visitors and sometimes found them source of enrichment (Margulis *et al*., 2003; Nimon and Dalziel, 1992). In present study it was observed that the adult male Chimp became more aggressive in the presence of visitors and started beating doors, fences and spitted frequently. The same was also observed at some extant in sub-adult male especially spiting and door beating, in this case zoo visitors were cause of stress (Hosey, 2000). Bloomsmith *et al* (1999) suggested that increase in aggression and decrease in grooming due to big crowd is just to gain the care and attention of viewers. It is important that visitor should be provided with awareness and education regarding zoo animals without putting stress on the animals which could be harmful for the well-being and normal behavior.

The social behaviors were more prevalent in sub-adult pair than adult pair in the form of grooming, playing and aggression; activity level was also high in sub-adult pair. It can be related with the positive visitor-animal interactions, which was helpful for awareness and education of visitors and source to minimize stressful impact of caged conditions on animals, these kinds of association should be appreciated. It was observed that positive association decreased the level of abnormalities and boosted up the play behavior at one end and on the other hand they were less tense, active, no idleness, and busy in affiliative behaviors, which is in line with the findings of Maki *et al.*, (1987) and Wood (1998).

Conclusion: It is strongly recommended that these highly intellectual animals should be housed in social groups within semi-natural environmental conditions. There should be plan for positive interactions between visitors and animals and enrichment. For their betterment animals should be shifted to new Chimpanzee Island. A future research should be designed to find out the preventative and remedial ways.

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