Time Budget of Behavioral Activity Pattern Displays of Captive Spotted Deer (*Axis axis*)

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ABSTRACT

Behavior of spotted deer or Chital (*Axis axis*) has been studied meticulously in wild but seldom in captivity. Therefore, the behavioral activity patterns of Chital were studied in Kota Zoo, located in Kota, Rajasthan (India) to evaluate the influence of captive conditions on its 'natural behavior', which is essential to survive when released in natural habitat. This study concluded that Chital spend maximum time in feeding, which is followed by resting, social activity, movement, other activities (drinking, defecation, urination) and anti-predatory activity during day time. The vigilance responses were almost absent in captive spotted deer in the absence of danger signs, which are of utmost importance in natural habitat. Movement of Chital was restricted whereas social interactions were increased among closely associated animals in large herd owing to limited space in enclosure. Many factors of wild are absent in captivity and accordingly display different behavioral patterns.

INTRODUCTION

Spotted deer or Chital (Axis axis) is a medium sized deer and is native of India, Nepal, Sri Lanka and Bangladesh (Prater 1934, Schaller 1967). It is listed in Schedule III in wildlife (protection) act 1972 and as least concern in IUCN list (Duckworth et al. 2015). It has been reported as a preferred prey for top carnivores (Johnsingh 1992, Karanth and Sunquist 1995, Stoen and Wegge 1996, Biswas and Sankar 2002, Sartaj et al. 2010).

Being a social ungulate, spotted deer prefer to live in herd (Raman 1997) and represents fluid group or fission-fusion system of group formation (Fuchs 1977, Mishra 1982, Barrete 1991). Chital are found in small group and forms bulk of ungulate biomass in wild (Bagchi et al. 2004, Sultana 2007, Khan 2015). Among ungulates Chital has been proven significantly important herbivores in food chain (Eisenberg and Lockhart 1972, Dinerstein 1980, Sankar 1994).

This ungulate's studies on habitat, habitat utilization, density and biomass, ecology, conservation and

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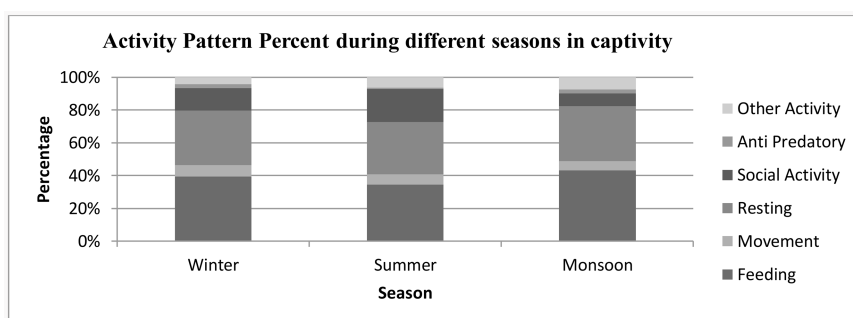*Corresponding author

Fig. 1. Activity Pattern Percent during different seasons in captivity.

management etc., exhibited it as sympatric species with other ungulates (Varman and Sukumar 1995, Khan et al. 1996). A matriarchal leadership system is common in spotted deer as in most of the cervids (De and Spillet 1966). Chital in wild has a home range of 1.5 - 2.0 km (Moe and Wegge 1994). Thus studies on behavior of Chital in captivity are rare but it has been studied in detail in wild so this study was conducted to evaluate the activity pattern of Chital in captivity 'Kota Zoo'. Captive study area is located in Kota, Rajasthan (India). It is a mini zoo and stretches over 2.2 hectare with separate enclosure for Chital and other animals.

MATERIALS AND METHODS

During study (Oct.2017-Sept.2018) direct observation using scan animal sampling technique (Altman 1974) was done. The activities of 10 animals from left to right of herd were recorded for 7 minute with interval of 3 minutes from dawn to dusk. The diurnal schedules of observation were divided into morning, noon and evening sessions. The behavioural activities were categorized into feeding, movement, social

activity, anti predatory, resting and other activities. Feeding includes grazing, feeding on fallen leaves and browsing. Movement includes running and walking indicating change in animal's location. Resting indicates sitting and standing position. Social behaviour includes reproductive and antagonistic behavior. The percentage of time spent on various behavioural activities was calculated and analyzed statistically. A Canon camera and Nikon binocular was used for observation and recording data.

RESULTS AND DISCUSSION

In captivity group size was large with mean group size of 69.25 ± 3.53 individuals in Chital herd. Chital spent maximum time in feeding (38.88%), followed by resting (32.82%), social activity (15.09%), movement (6.27%), other activity (4.93%) and anti predatory activity (1.96%).

Activity Patterns of various behavioural activities were analyzed to observe the effect of seasonal variations. ANOVA for seasonal variation in six behavioural activities during different seasons in

Table 1. One Way ANOVA between Groups for seasonal variation of activity pattern in captivity.

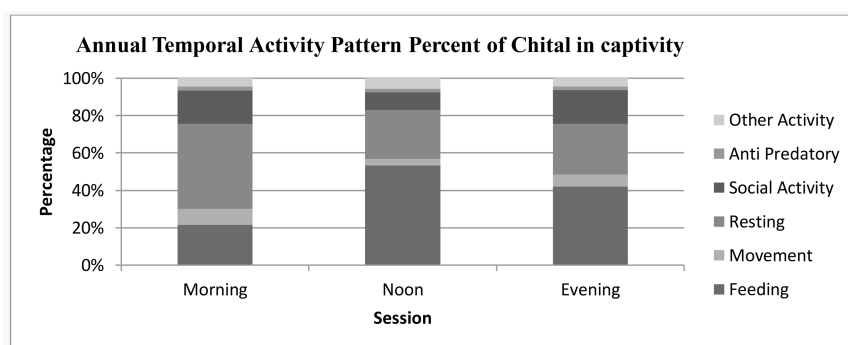| Activity	Sum of Squares	df	Mean Square	F	Sig
Feeding	0.174	2	0.087	6.855	.001
Movement	0.149	2	0.075	1.067	.345
Resting	15.73	2	7.86	33.407	.000
Social Activity	817.7	2	408.8	9.223	.000
Anti Predatory	2.21	2	1.10	2.961	.054
Other Activity	36.167	2	18.0	8.994	.000

Fig. 2. Annual Temporal Activity Pattern Percent of Chital in captivity.

captivity concluded that seasonal variation in different activities was statistically significant for feeding, resting, social activity and other activity but was not significantly different for movement and anti-predatory activity (Table 1 and Figure 1). There was significant difference for temporal change in activity pattern for feeding, movement, resting, social and other activities. Anti predatory behaviour was rarely observed and not influenced significantly by day time (Table 2 and Figure 2).

Animals were used to wait for food in morning and were observed in resting position till the food supplied to them. Grazing was at peak during noon while browsing and feeding on fallen leaves were observed rarely. Chital was used to walk in between other activities and running was observed rarely. Social activities such as sparring among sub adult males and playing among fawns were most frequent in evening. Animals were seen standing alert in response to any sudden sound or domestic cat. Drinking was mainly observed during noon session probably because animal prefer to drink water after feeding.

Chital spent most of the time in feeding, resting, moving, social activity, anti predatory and other activities in wild (Sharatchandra and Gadgil 1980, Dave 2008). In captivity Chital exhibited feeding, resting, social activities, movement, anti predatory and other activities in decreasing order of frequency dissimilar to earlier study in Jaipur Zoo, where Chital performed the activities in following descending order: resting, feeding, moving, social, others, anti predatory (Chandra 2013).

Chital was seasonal breeder in Kota Zoo unlike in captivity in Australia observed in earlier study, where rutting was significantly dispersed throughout the year (Chapple 1992) that was quite similar to wild might be due environmental conditions (Ramesh et al. 2013).

Chital was more active in feeding during noon and rested at morning in captivity contrary to prefer resting in noon and feeding at morning and evening, in wild (Graf and Nicholas 1966, Tak and Lamba 1984).

In captivity, high density of visitors possibly disturbed the activity pattern and stress might be one of

Table 2. One Way ANOVA between Groups for temporal change in activity pattern in captivity.

Activity	Som of Squares	df	Mean Square	F	Sig
Feeding	.304	2	.152	12.03	-000
Movement	.507	2	.253	3.651	.027
Resting	29.253	2	14.627	63.41	.000
Social Activity	2128.990	2	1064.49	24.57	.000
Anti Prdatory	1.904	2	.952	2.531	.083
Other Activity	38.082	2	19.01	9.492	.000

the factors resulted into different behavioural display of activity pattern. Animals were used to visitors and hence, the vigilance responses were almost absent in the absence of predators (Davey 2005, Khanpara and Vachharajani 2011). Fawning rate was good similar to earlier research in spotted deer herd in Osmania University Deer Park, Heyderabad (Srinivasulu et al. 1999).

CONCLUSION

Artificial conditions such as anthropogenic interference, constrained environment and non-existence of predators altered the natural behavior of animals. In captivity animals must be kept in their natural social composition, enclosure must be large enough so that their natural behavior could be maintained.

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