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Diurnal activity budgeting of Golden langur (*Trachypithecus geei)* in Chakrashila Wildlife Sanctuary of Assam, India

[1]Anindita Bhattacharya, [2]Surat Zamal, [3]Prabal Sarkar

[1, 2] Department of Environmental Science, University of Science and Technology, Meghalaya (India)
[3]Department of Zoology, University of Science and Technology, Meghalaya (India)
Corresponding author: Prabal Sarkar (prabalsarkarindia@gmail.com)

Abstract: **A quantitative analysis of the diurnal variation of activity budget of a free ranging group of Golden lagur (*Trachypithecus geei*) was carried out to find out the time allotment in various activities throughout the day time. The study was conducted in Chakrashila WLS of Assam during July, 2016 to June, 2017. The study group spent a highest of 23.5% on feeding followed by 20.1% on monitoring, 19.6% on locomotion, 12% on resting, 11.1% on grooming, 6.6% on play and remaining 7.3% on other behaviour. Study on the diurnal variation of the activity profile showed that the group had bimodal peak on feeding activity during morning and evening hour, but less feeding activities during mid-day. Locomotion always coincides with feeding activity throughout the day. Less time spent on resting activity during morning in comparison to time spent during mid day and evening hours. Interestingly, three distinct peak of grooming recorded during morning, mid-day and evening hour. It clearly indicates that foraging might be the most crucial factor responsible for the variation in the diurnal activity profiles. In forest, as the food was randomly distributed, the group cost-effectively arranged their total time and spent more time on foraging, locomotion and resting and less time in grooming, monitoring and play activities. These findings clearly demonstrated that nature of distribution of food resource is the guiding force for allocating time to various activities in different habitats.**

Keywords: **Golden langur, *Trachypithecus geei*, activity budget, diurnal variation.**

1. INTRODUCTION

Activity budget is an analysis of how different species allot their time among various activities, essential to any characterization of their life styles which lays the foundation for interrelating their ecology and behaviour. [(1)] Allocating time to different activities and distribution of these activities throughout the day is also important to understand how animals adjust to various habitats to optimize resource use for survival and reproduction. This is primarily because; "time" is a hidden constraint which may affect all other behaviour. [(2)]

Enormous studies are there on the annual and seasonal variation of activity profiles of Indian primates. Among these, majority of the study conducted on rhesus macaque,[(3-5)] Assamese macaque,[(6-7)] pig-tail macaque,[(8-10)] stump-tailed macaque,[(11-12)] lion tailed macaque,[(13-14)] bonnet macaque,[(15)] On the other hand, the hanuman langur is the most studies primates among Indian langur in comparison to nilgiri, capped and Golden langur.[(16)] Interestingly, few studies are there on the diurnal variation of the activity profile on primates of India.

In India, the golden langur (*Trachypithecus geei)* receives the highest level of legal protection as a Schedule-I species in the Indian Wild Life (Protection) Act, 1972. Recently, this primate is declared as one of the 25th most endangered primates of the world. It is endemic to western Assam in India and a neighbouring part of Bhutan. The distribution of this endangered species lies on north of the Brahmaputra River, bounded on the east by Manas River, and on the west by the

Sankosh River. The range in south-central Bhutan is between the Sankosh River and a high mountain ridge (running across Pele-la) in the west, and Manas River, Mangde Chu and the high mountain ridge west of Chamkhar Chu in the east. [17]

Enormous studies were conducted on the distribution of Golden langur in India and Bhutan.[18-38] Survey conducted in 2001 estimated a population size of 1,500 Golden langur in India.[39] Few studies are also there on population dynamics of the species from different forest fragments.[32, 39-41] Most of these studies were conducted in Manas National Park and its continuing Ripu and Chirang Reserved Forests in the western boundary area of Assam.

Chakrashila Wildlife Sanctuary lies in the districts of Kokrajhar and Dhubri which is the other protected area where the Golden langur is distributed in India. Few attempts were undertaken on the study of population size, ecology and conservation of golden langur in this sanctuary.[42-46] Unfortunately, no study was there on the diurnal variation of activity profile of golden langur in Chakrashila Wildlife sanctuary. So this paper was aimed at a quantitative analysis of diurnal variation of time budgeting in the free ranging group of Golden langur in relation to time allotment in Chakrashila Wildlife sanctuary of Assam, India.

2. STUDY AREA

Chakrashila WLS is the only protected area other than Manas N.P where few groups of Golden Langur are surviving. This sanctuary (26°15'–26°26'N, 90°15'–90°20'E; 4,500 ha) is located in the districts of Kokrajhar and Dhubri in Assam. It lies in the southernmost part of the distribution range of the species.

The hilly terrain is covered with dense forest which is mostly semi-evergreen and moist deciduous, with patches of grassland and scattered bushes (scrubland). The communities living around the sanctuary belong to various ethnic groups, including Bodo, Rabha, Garo, Rajbangsi, Nepali and Muslims. The sanctuary covers an area of 45.568 km2 (4556.8 hectares). It is around 6 km from Kokrajhar town, 68 km from Dhubri town and 219 km from Guwahati. The sanctuary is mainly a hilly tract running north-south and there are two lakes (Dheer Beel and Diplai Beel) on either side, which are integral to the eco-system of the sanctuary.

3. MATERIAL AND METHODOLOGY

The visibility of Chakrashila Wildlife Sanctuary did not permit to follow the Focal Animal Sampling method. But, the ***Scan Sampling*** was found to be best suited to study group activity profiles instead of inter-individuals relationships of forest group of Golden Langur.[47] The 5 minutes scan was adopted during the study. [48] The group was followed dawn to dusk during July, 2016 to June, 2017. Observation started at 06.00 am and continued till 05.00 pm.

A specific cataloguing was followed to record activities like locomotion (travel), grooming, monitory, resting, play, feeding and other activities (including mainly sexual and agonistic interaction).

Monitoring: Activity related to observing the surroundings.

Grooming: Activity related to brushing skin to eliminate ecoto-parasites and salt granules.

Locomotion: any movement except foraging. It includes change in place and position, walking, running, jumping, climbing etc.

Feeding: Any activity related to feeding and drinking. It includes searching, feeding, drinking activities.

Resting: Motionless without eye movement (resting) and eye closed (sleeping).

Play: Any activity related to recreation – may be self-directed or may involves two or more individuals.

Aggressiveness: The activity belongs to which is showing their tooth to each other chasing and biting.

Other Activities: The activities which are less frequent categorized as other activities. It includes parental care, mating and excrete etc.

4. RESULT

The study group inhabits the Chakrashila Wildlife sanctuary premise and showed distinct variation in whole day activity profiles. The highest time was spent (23.5%) on feeding followed by (20.1%) on monitoring, (19.6%) on locomotion, (12%) on resting, (11.1%) on grooming, (6.6%) on play and remaining (7.3%) on other behaviour (Fig-1).

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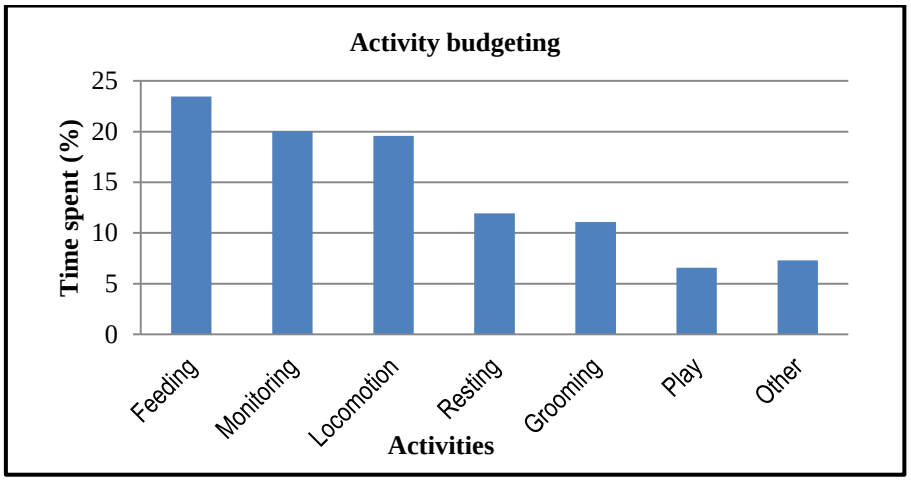

Fig 1: Time spent in various activities throughout the day

Relation between different activities:

Present study showed that there is a significant positive correlation between feeding and locomotion and a significant negative correlation between feeding and resting and also between feeding and play activities. There was a significant negative correlation between locomotion and play activities. It was also noted that there was a significant negative and positive correlation between resting and feeding and between resting and play respectively. Further there was a significant negative correlation between play and locomotion and a significant positive correlation between play and resting activities (Fig-2, Table-1).

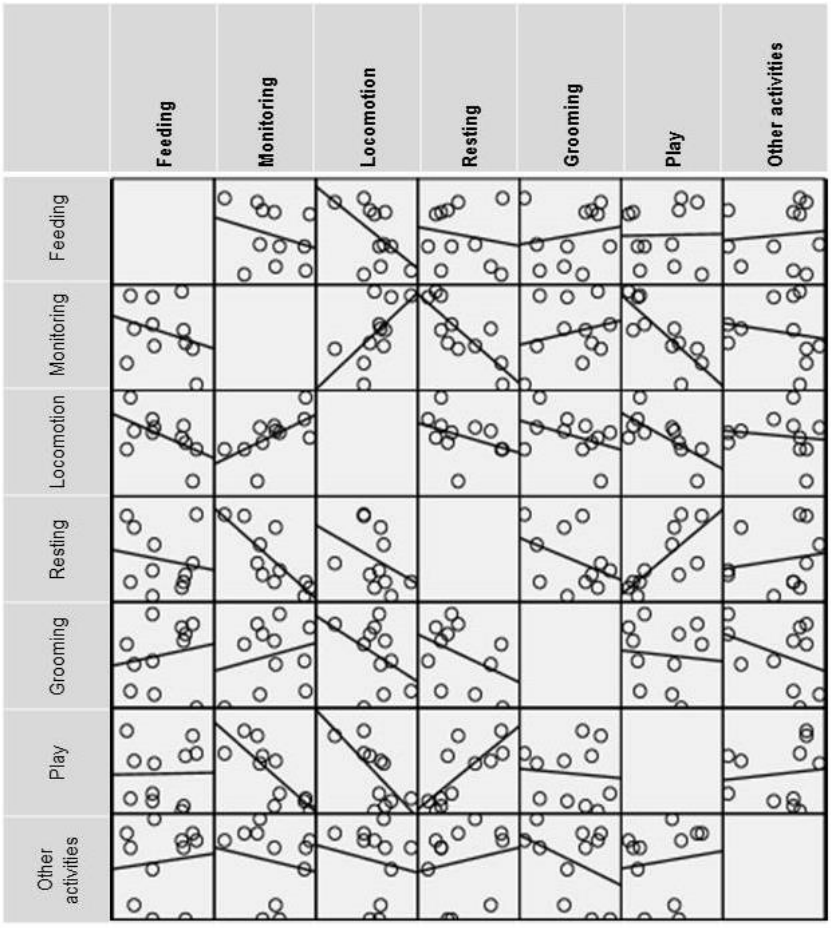

Fig 2: Relation between different activities

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Table 1: Correlation (Pearson's) between different activities of Golden langur

	Monitoring	Feeding	Locomotion	Resting	Grooming	Play	Other activities
Monitoring	1	r = -0.286	r = -0.542	r = -0.175	r =0.178	r =0.017	r =0.108
Feeding	r = -0.286	1	r =0.619*	r = -0.805**	r =0.233	r = -0.811**	r = -0.176
Locomotion	r = -0.542	r =0.619*	1	r = -0.374	r = -0.394	r = -0.698*	r = -0.143
Resting	r = -0.175	r = -0.805**	r = -0.374	1	r = -0.403	r =0.756**	r =0.176
Grooming	r =0.178	r = r =0.233	r = -0.394	r = -0.403	1	r = -0.091	r = -0.388
Play	r =0.017	r = -0.811**	r = -0.698*	r =0.756**	r = -0.091	1	r =0.125
Other activities	r =0.108	r = -0.176	r = -0.143	r =0.176	r = -0.388	r =0.125	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed)

Diurnal activities:

Feeding:

The feeding activity depends upon the monitoring and grooming activity. Feeding activity is common for all Golden langur. Comparatively, more time spent (>20%) on feeding activity during morning and evening hour, but less feeding activities during mid-day (Fig-3)**.** There was a significant difference in feeding activities during morning to evening hours ($F=3.435$, $p<0.001$).

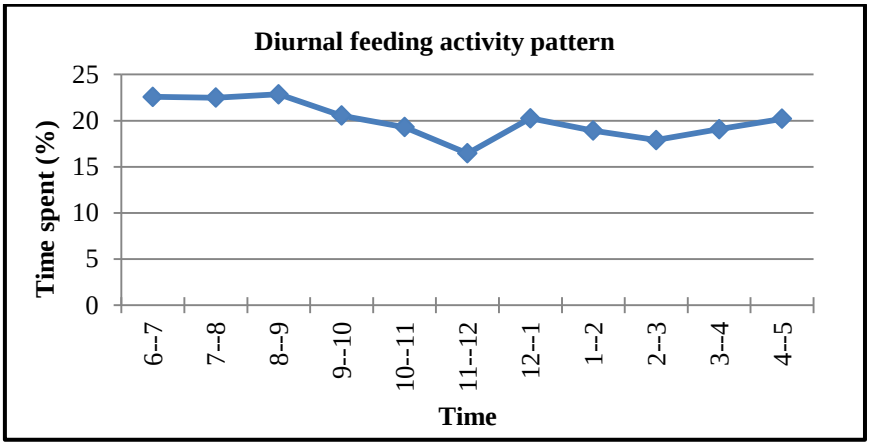

Fig 3: Diurnal feeding activity pattern by the study group

Grooming:

The grooming activity was identified as the major activity. More time was spent (>10%) on grooming during morning (9-10am) mid-day and evening hour (4-5pm) (Fig-4).

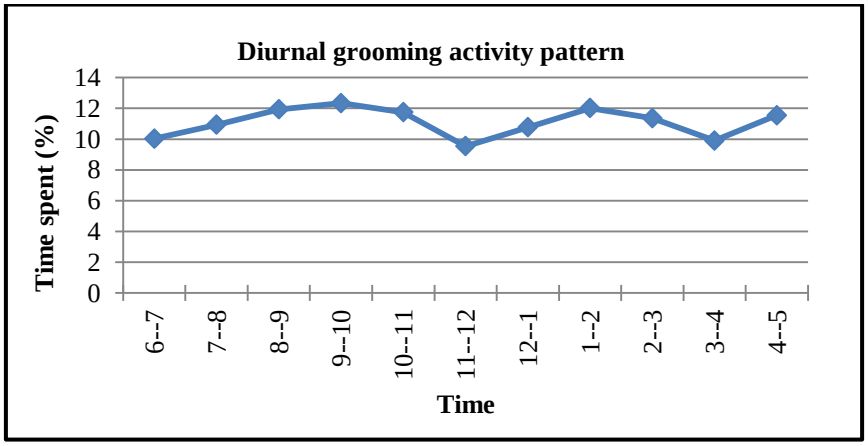

Fig 4: Diurnal grooming activity pattern

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Locomotion:

The time spent in locomotion activity depends upon monitoring and grooming and feeding activity. More time was spent (>20%) on locomotion during morning and evening hour, but less locomotion (<20%) during mid-day (Fig-5). A significant difference in locomotion activities was observed during different time period of study (F=3.560, p< 0.001).

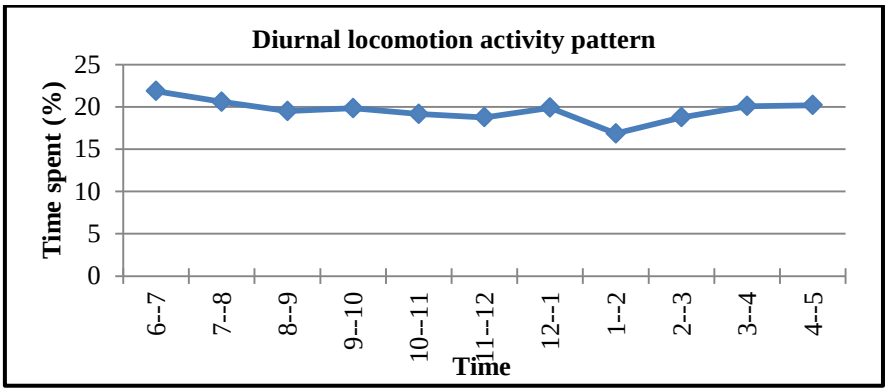

Fig 5: Diurnal locomotion activity pattern

Resting:

Less time was spent (<20%) on resting activity during morning in comparison to time spent during midday and evening hours (Fig-6).

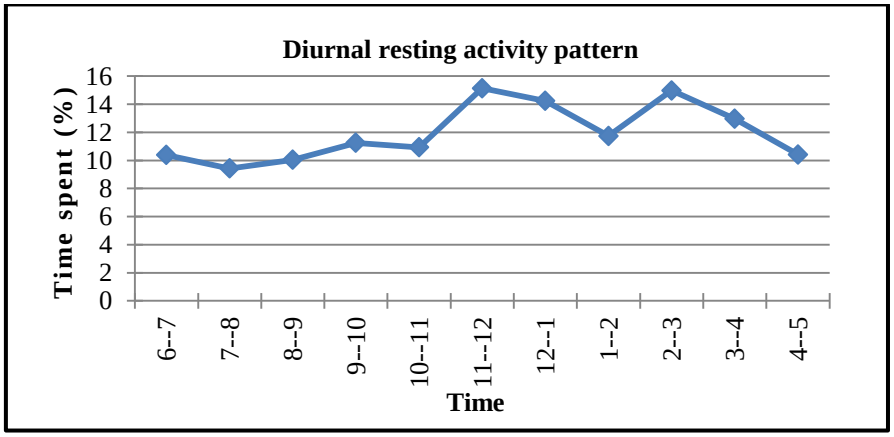

Fig 6: Diurnal resting activity pattern

Monitoring:

The study group spent between 20-25% on monitoring throughout the day (Fig-7).

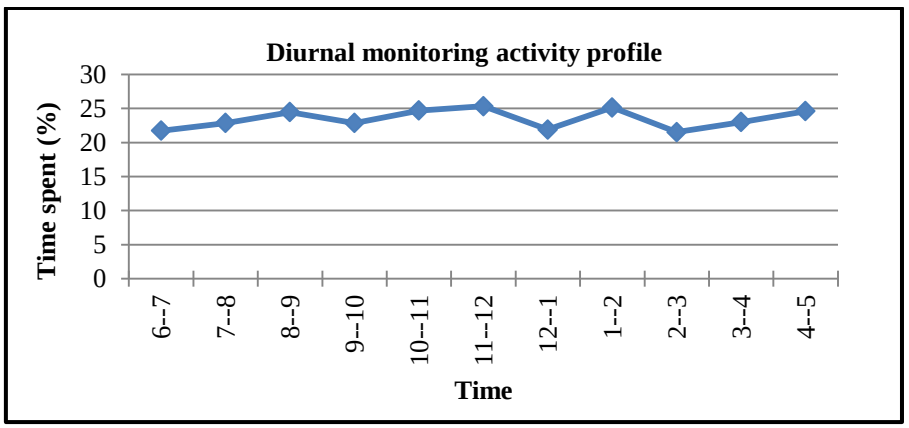

Fig 7: Diurnal monitoring activity pattern

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Play Activities:

Less time was spent about (<5%) on play activity during morning in comparison to time spent during midday and evening hour. At the end, it becomes very low (Fig-8).

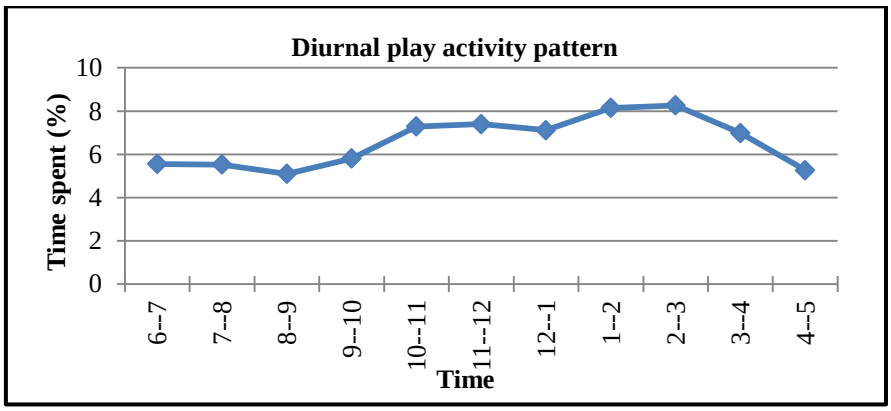

Fig 8: Diurnal play activity pattern

Aggressiveness:

Aggressive behaviour is very important behaviour. Mostly males and females performed this activity by showing canine, vocalization, attack etc. More episodes of aggressive behaviour during morning hour in comparison to midday and evening hour was observed. In infant and sub-adult Golden langur aggression activity was not observed (Fig-9).

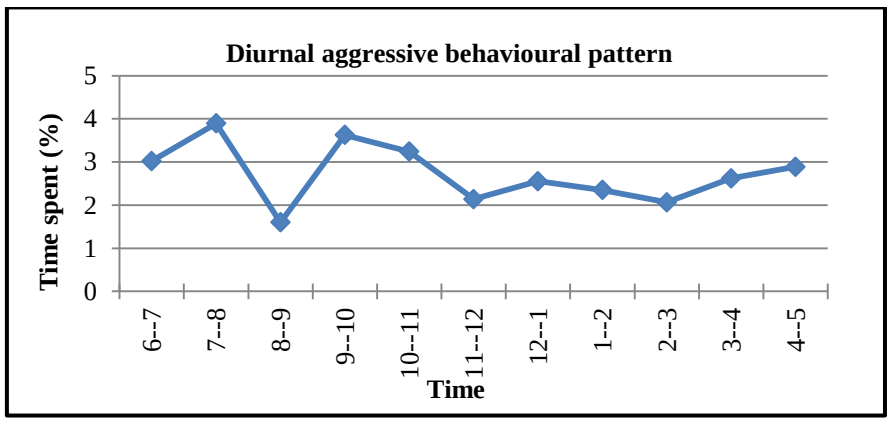

Fig 9: Diurnal aggressive behaviour

Reproductive Activities:

More episodes of reproductive behaviour were observed during mid-day (Fig-10)**.**

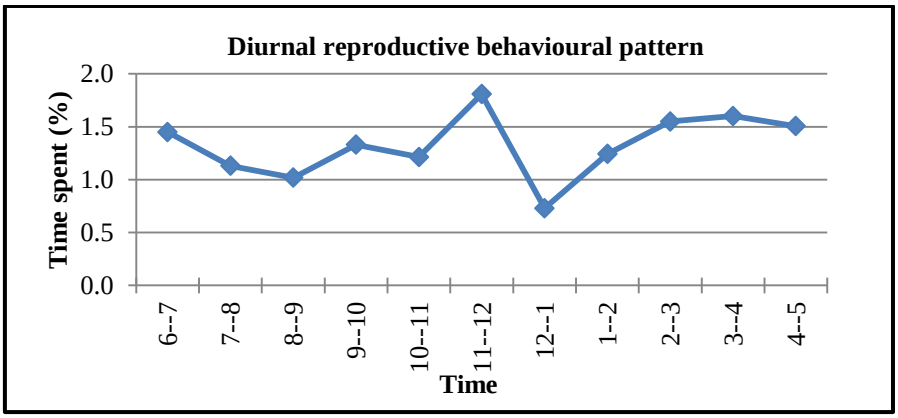

Fig 10: Diurnal reproductive behaviour pattern

5. DISCUSSION

Behaviour is the response of both physical as well as habitat condition of the animal. It varies from habitat to habitat depending upon the resource distribution. In primates, food, mates, drink and roosting trees are the most important resource, which controls activity. Among these resources, food seems to be the most crucial primary factor regulates day-to-day activity profiles. So, an allocation of time to various activities that is important to identify the interaction of species with environment (both habitat and weather).

The amount of time spent on locomotion is determined primarily by the distribution of food and food plant species in the habitat and by the nature of food items. Individuals of the study group had to move from one feeding site to another in order to get appropriate quantity of food, which were randomly distributed in Chakrashila Wildlife Sanctuary. Therefore, the study group had to allot 19.6% time to locomotion. Similar results were earlier obtained in rhesus macaque where the locomotion recorded was the maximum of 22% in the forest habitat and a minimum 12% in pond habitat, 20% in canal habitat, 19% in urban habitat and 16% in temple habitat.[49]

The present studies showed that the group spent 20% of their total time on feeding. Wild-foraging vervets spent almost 40% of the time on feeding.[50-51] Studies on activity profiles of the rhesus macaque in temple, urban, pond, roadside canal side and forest habitats, found out that the forest group spent about 30% of their total time in feeding.[52-54] A comparative study on the activity profiles of daily life between semi-provisioned and wild-feeding baboon found that the semi-provisioned group spent 22% of the day time in feeding, in contrast to 65% and 60% for two forest groups respectively.[55] This further suggests that the distribution pattern of the food resource guides in reallocation of activity profile for higher time spend of feeding activity in forest group.

Higher time spent on locomotion, costs higher expenditure of energy. Since food is randomly distributed in the forest, the group had to spend more time on locomotion in search of food. This results higher time spent on resting in order to make a balance between energy loss and gain.

The monitoring behaviour has been found to be associated with detection of predator, and inter-and inter-group of the same species interactions for the same identical resource. As the group does not have to spend more time for looking provisioned food beside predator, the time spent in monitoring activity is remarkably less. Hence, the study group spent only 20.1% of time in monitoring.

As the food is randomly distributed, individuals of primates are not able to monopolize the resources. Even, the inter-individual distances are more when the food is randomly distributed. Hence, “social tension” due to aggression is comparatively less in the forest group as compared to provisioned group. Grooming behaviour in long term serves the function of reducing “social tension” and establishes a social bonding among the individuals within the group.[56-58] So, the study group spent only 11.1% of their total time in grooming. Similar results also obtained in rhesus macaque where the forest group spent 4% of their total time in grooming instead of approximately 14% by provisioned group and 14% by urban group.[54] Hence, lack of extra social tension in the forest group reduced the time spent on grooming.

All primates have been reported to perform play activity. The time spent in play activity varies from species to species, event population to population. It also varies from habitat to habitat depending upon quality and quantity of the food availability. Previous studies found that almost all animals cut down, or even eliminate play when there is a shortage of food.[59-62] When there is either shortage or the food is randomly distributed, individuals of primates have to spend more time in feeding and locomotion and the time being saved is comparatively less in the forest group. Hence, individuals of the study group spent only 6.6% of their total time in play. But, when the food is clumped in distribution either in captivity or in temple habitat, individuals of primates have more time for social activities including play. Studies in the captive colonies have shown that the stump-tail macaque spent as high as 5-13%; pig-tailed macaque 8%; celebes black apes 8%; Sooty Mangabey 9% of their time in play.[9, 11, 63-64] Hence, the distribution of the food resource is the regulatory factor in allocating time for play.

6. CONCLUSION

The activity profile of the study group has revealed that feeding is the most crucial factor responsible for the variation in the activity profiles. In forest, as the food was randomly distributed, the group cost-effectively arranged their total time and spent more time on feeding, and locomotion. So, the time remains for resting and social activities is less in the forest

group. On the other hand, high locomotion and foraging activity cost more energy expenditure and therefore, the group re-allocates the time budgeting for higher resting activity, and allocates a less time for social activities like grooming and play activities. Beside it, as the social tension does not develop much, such strong social net-working is not required when food is not clumped and randomly distributed in the habitat, and therefore, forest group was devoting less time to grooming, monitoring and play activities. These findings clearly demonstrated that nature of distribution of food resource is the guiding force for allocating time to various activities in different habitats.

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REFERENCES

[1] Struhsaker T.T. and Leland L. (1979). Socioecology of five sympatric monkey species in the Kibale Forest, Uganda. In : *Advances in the study of behaviour,* Vol. 9 (Eds. by Rosenblatt J.S., R.A. Hinde, C. Beer and M. C. Busnel), Academic press, New York.

[2] Dunbar R.I.M. (1992). Time : a hidden constraint on the behavioural ecology of baboons. *Behav. Ecol. Sociobiol.* 31 : 35-49.

[3] Bernstein I.S. and Mason W.A. (1963). Activity patterns of rhesus monkeys in a social group. *Anim. Behav.* 11 : 455-460.

[4] Seth P.K. and Seth S. (1986). Ecology and behaviour of rhesus monkeys in India. In : Elase J and Lee P (eds.), *Primate Ecology and Conservation*. Cambridge University Press, London, pp. 89-103.

[5] Pooja U., Laxman K., Hideshi O. and Mukesh K.C. (2018). Behavioral Asymmetries among Mother-Infant Dyads of Syntopic Macaques (*Macaca assamensis* and *M. mulatta*) in Shivapuri-Nagarjun National Park, Nepal, *Journal of Ecology & Natural Resources, 2(5): 1-12,*

[6] Sarkar P., Srivastava A., Dasgupta S. and Bhattacharjee P.C. (2012). Activity profile of free ranging forest group of Assamese macaque, The Clarion, Vol 1 (2), 59-67.

[7] Sarkar P., Bhattacharjya A. and Mohnot S.M. (2013). Time budgeting and activity profile of free ranging forest group of Assamese macaque. JBES, 3 (11), 104-111.

[8] Bernstein I.S. (1970). Activity patterns in Pigtail Monkey Groups. *Folia Primatol.* 12 : 187-198.

[9] Bernstein I.S. (1972). Daily activity cycles and weather influences on a Pigtail Monkey Group. *Folia Primatol.* 18 : 390-415.

[10] Ruppert N., Holzner A., See K.W., Gisbrecht A. and Beck A. (2018). Activity Budgets and Habitat Use of Wild Southern Pig-Tailed Macaques (*Macaca nemestrina*) in Oil Palm Plantation and Fore, Int J Primatol.

[11] Bernstein I.S. (1980). Activity patterns in a Stumptail Macaque Group (*Macaca arctoides*). *Folia Primatol.* 33 : 20-45.

[12] Chetry D. (2004). Socioecology of stump-tailed macaque, *Macaca arctoides* (I. Geoffroy, 1831). PhD thesis, Gauhati University, Guwahati, Assam.

[13] Kumar A. (1987). *The ecology and population dynamics of the lion-tailed macaque (Macaca silensis) in South India*. Ph.D. Dissertation, Cambridge University, U.K.

[14] Kurup F.U. and Kumar A. (1993). Time budget and activity patterns of the lion-tailed macaque *(Macaca silensis). Int. J. Primatol.* 14(1) : 27-39.

[15] Singh M. and Vinathe S. (1990). Interpopulation differences in the time-budgets of Bonnet monkeys (*Macaca radiata*). *Primates*, 31: 589–596.

[16] Alam M., Jaman M.F., Hasan M., Rahman M., Alam S.M.I and Khatun U.H. (2014). Social interaction of hanuman langur (*Semnopithecus entellus*) at Keshabpur and Manirampur of Jessore district of Bangladesh, Bangladesh J. Zool., 42(2): 217-225.

[17] Choudhury A.U. (2008). Primates of Bhutan and observations of hybrid langurs. *Primate Conserv.* (23): 66–73.

[18] Khajuria H. (1956). A new langur (Primates: Colobidae) from Goalpara district, Assam. *Ann. Mag. Nat. Hist.*12(9): 86–88.

[19] Khajuria H. (1961). The distribution and feeding habits of the golden langur, *Presbytis geei*. *Ann. Mag. Nat. Hist.*58: 1–12.

[20] Gee E.P. (1961). The distribution and feeding habit of Golden Langur. Presbytis geei Khajuria, 1956. J. Bombay Nat. Hist. Soc. 53: 252.

[21] Wayre P. (1968). The golden langur and the Manas Sanctuary. *Oryx* 9: 337–339.

[22] Mukherjee R.P. (1978). Further observation on the golden langur (*Presbytis geei* Khajuria, 1956) with a note to capped langur (*Presbytis pileatus* Blyth, 1943) of Assam. *Primates* 19(4): 737–747.

[23] Mukherjee R.P. (1980). *Distribution and present status of the Golden langur, Presbytis geei, Khajuria, in some forests of Assam, India. Proc. Wildl. Workshop*,pp .129–132.

[24] Mukherjee R.P. (1994). Status of golden langur, *Presbytis geei* Khajuria. *Zoological Survey of India*. *Status of Endangered Species Report* 1: 1–16.

[25] Mukherjee R.P. (1995). New localities for the golden langur. *Asian Primates* 4(4): 17.

[26] Mukherjee R.P. and Saha S.S. (1974). The golden langurs (*Presbytis geei* Khajuria, 1956) of Assam. *Primates*15(4): 327–340.

[27] Mukherjee R.P. and Southwick C.H. (1997). Present status of the golden langur in Assam, India. *Asian Primates* 6: 1–4.

[28] Mukherjee R.P., Murmu A. and Choudhury S. (1992). A note on the golden langur (*Presbytis geei* Khajuria, 1956) of Dhubri district of Assam. *Cheetal, J. Wild Life Preserv. Soc. India* 32(1–2): 31–32.

[29] Mukherjee R.P., Srivastava A., Mohnot S.M., Bernstein I.S. and Southwick C.H. (1997). Population status of the golden langur (*P. geei*) in Assam. *Am. J. Primatol.* 42 (2): 135. (Abstract)

[30] Subba P.B. (1989). The status and conservation of the golden langur (*Presbytis geei* Khajuria, 1956) in the Manas National Park, Bhutan. *Tiger Paper* 16: 16–18.

[31] Choudhury A.U. (1992). Golden langur—distribution confusion. *Oryx* 26: 172–173.

[32] Choudhury A.U. (2002). Golden langur, *Trachypithecus geei* threatened by habitat fragmentation. *Zoo's Print Journal* 17(2): 699–703.

[33] Wangchuk T. (1995). A census and the bio-geography of golden langurs (*Presbytis geei*) in Bhutan. *Tiger Paper*22: 1–6.

[34] Mohnot S.M. (1995-2001) Indo-US Primate Project Reports. Year 1 (1995), 23pp.;Year 2 (1996), 16pp.; Year 3 (1997), 24pp.; Year 4 (1998), 40pp.; Year 5(1999), 69pp.; Year 6 (2000), 86pp.; Year 7 (2001), 102pp. Primate Research Centre, Jodhpur.

[35] Mohnot S.M. (2002). *Report.* Primate Research Centre, Jodhpur. 51pp.

[36] Srivastava A., Biswas J., Das J. and Bujarbarua P. (2001a). Status and distribution of golden langurs (*Trachypithecus geei*) in Assam, India. *Am. J. Primatol.* 55: 15–23.

[37] Medhi R., Chetry D., Bhattacharjee P.C. and Patiri B.N. (2004). Status of golden langur, *Trachypithecus geei* in a rubber plantation in western Assam, India. *Int. J. Primatol.* 25(6): 1305–1337.

[38] Ghosh S. (2009). *Report on the distribution and population status of golden langur (Trachypithecus geei) in Bodoland Territorial Council*, Assam, India. 44pp.

[39] Srivastava A., Baruah M. and Mohnot S.M. (2001b). The population dynamics and conservation of golden langurs. *J. Bombay Nat. Hist. Soc.* 98(1): 12–17.

[40] Biswas J. (2004). *Ecology and Social Behaviour of Golden Langur (Trachypithecus geei)* Khajuria, 1956). PhD thesis, Gauhati University, Guwahati.

[41] Medhi R. (2004). *Behaviour of Golden Langur, Trachypithecus geei* Khajuria, 1956) *in a Riverine Island.* Phd thesis, Gauhati University, Assam, India.

[42] Cherry D. (2002a). *Socioecology of Golden Langur (Trachypithecus geei) in Chakrashila Wildlife Sanctuary, Assam, India.* Report to Primate Conservation, Inc., Charlestown, RI. 21pp.

[43] Cherry D. (2002b). *A Socioeconomic Study for Identification of Threats of Golden langur (Trachypithecus geei) in Chakrashila Wildlife Sanctuary, Assam, India.* Report to Primate Conservation, Inc., Charlestown, RI. 11pp.

[44] Chetry D., Medhi R., Patiri B.N., Bhattacharjee P.C. and Mohnot S.M. (2002a). *Activity budget of golden langur (Trachypithecus geei) in Chakrashila Wildlife Sanctuary, Assam, India.* Abstracts: XIXth Congress of the International Primatological Society, p. 198. 4–9 August, 2002, Beijing, China. (Abstract)

[45] Chetry D., Medhi R. and Bhattacharjee P.C. (2002b). *A community-based study for identification of threats in different habitats of golden langur (Trachypithecus geei).* Report Pittsburgh Zoo and PPG Aquarium, Pittsburgh, PA. 22pp.

[46] Chetry D., Medhi R. and Bhattacharjee P.C. (2005). Domestic dog (*Canis familiaris*): threat for the golden langur *Trachypithecus geei*. *J. Bombay Nat. Hist. Soc.* 102(2): 220–221.

[47] Altmann J. (1974). Observational study of behaviour: sampling methods. *Behaviour* 49 : 227-267.

[48] Sarkar P. (2000). Ecology and dynamics of social relationships of Assamese macaque : *Macaca assamensis* (McClelland, 1839), Unpublished Ph.D. thesis, Gauhati University, India.

[49] Chopra P.K., Seth S. and Seth P.K. (1992). Behavioural profile of free-ranging Rhesus Monkeys. *Primate Report* 32.

[50] Brennan E.J., Else J.G., Altmann J. (1985). Ecology and behavior of a pest primate :Vervet monkeys in a tourist lodge habitat. *Afric. J. Ecol.*23 : 35-44.

[51] Lee P.C., Brennan E.J., Else J.G. and Altmann J. (1986). Ecology and behavior of vervet monkeys in a tourist lodge habitat. In : *Primate Ecology And Conservation* (eds. by Else J.G. and P.C. Lee), Cambridge University Press, Cambridge. pp. 229-235.

[52] Malik I. (1986). Time budgets and activity patterns in free ranging rhesus monkeys. In :*Primate Ecology and Conservation* (eds. by Else J.G., and P.C. Lee), Cambridge University Press, Cambridge. pp. 105-114.

[53] Seth P.K. and Seth S. (1986). Ecology and behaviour of rhesus monkeys in India. In :Elase J and Lee P (eds.), *Primate Ecology and Conservation*. Cambridge University Press, London, pp. 89-103.

[54] Chopra P.K., Seth S. and Seth P.K. (1992). Behavioural profile of free-ranging Rhesus Monkeys. *Primate Report* 32.

[55] Altmann J. and Muruthi P. (1988). Differences in daily life between semi-provisioned and wild-feeding Baboons. *Am. J. Primatol.*15: 213-221.

[56] Carpenter L.R. (1942). Sexual behaviour of free ranging rhesus monkeys *Macaca mulatta*. *J. Comp. Psychol.* 33: 113-142.

[57] Kurland J.A. (1977). Kin selection in the Japanese monkey. *Contribution to Primatology.* Vol. 12.

[58] Schino G., Scucchi S., Maestipieri D. and Turillazzi P.G. (1988). *Allogrooming as a tension-reduction mechanism: a behavioural approach. Am. J. Primatol. 16, 43*–50.

[59] Southwick C.H. (1967). An experimental study of intragroup agnostic behavior in rhesus monkeys (*Macaca mulatta*). *Behaviour* 28 : 182-209.

[60] Baldwin J.D. and Baldwin J.I. (1972). The ecology and behaviour of squirrel monkeys (*Saimiri oerstedi*) in a natural forest in western Panama. *Folia Primatol.* 19 : 161-184.

[61] Baldwin J.D. and Baldwin J.I. (1976). Primate population in Chiriqui, panama. In : *Neotropical primates : Field studies and conservation* (Eds. by Thorington Jr. R. W. and P. G. heltne), National Academy of Science, Washington D.C.

[62] Muller-Schwarze D., Stagge B. and Muller-Schwarze C. (1982). Play behaviour : persistence, decrease and energetic compensation during food shortage in deer fawns. *Science, NY* 215 : 85-87.

[63] Bernstein I.S. (1976). Activity patterns in a Sooty Mangabey Group. *Folia Primatol.* 26 : 185-206.

[64] Rhine R.J. and Kronenwetter C. (1972). Interaction patterns of two newly formed groups of stumptail macaque (*Macaca arctoides*). *Primates* 13 :19-33.