ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 62 90 Number 5, 2014
http://dx.doi.org/10.11118/actaun201462050891

THE DAILY PATTERN OF MAIN ACTIVITIES IN THE GELADA BABOON (*THEROPITHECUS GELADA*)

Radek Filipčík[1], Ladislav Máchal[1], Daria Baholet[1], Gustav Chládek[1], Hošek Martin[1], Michaela Paldusová[1]

[1] Department of Animal Breeding, Faculty of Agronomy, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

Abstract

FILIPČÍK RADEK, MÁCHAL LADISLAV, BAHOLET DARIA, CHLÁDEK GUSTAV, HOŠEK MARTIN, PALDUSOVÁ MICHAELA. 2014. The Daily Pattern of Main Activities in the Gelada Baboon (*Theropithecus gelada*). *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 62(5): 891–896.

The aim of this work was to observe and analyse the main daily activities in the group of geladas kept in the Zlín Zoo. The experimental group was formed by three males (one of them was a dominant alfa male) and four females who were in the reproductive cycle at the observation period. The behavioural study included five recurrent observations which took place in March 2014. The observations revealed that geladas spent most of the time feeding (44.1%) and performing comfort behaviour (24.6%). About 7.7–10.4% of the total time the geladas spent moving, resting and observing the neighbourhoods. The settled and stable social hierarchy within the group prevented greater incidence (0.7%) of aggressive behaviour. Occurrence of other types of activities was low – play (1.7%), climbing the trees (0.5%) and sexual behaviour (2.3%). The work also studied how the incidence of a particular type of behaviour changed over time within the day. A certain pattern in behavioural activities was apparent because their incidence tended to be similar on all observation days. Foraging activities were the greatest (44.80 ± 3.64 observations) between 15.00 and 16.00, resting (8.00–9.80 observations) between 12.00 and 14.00 and comfort behaviour (23.20 ± 2.82 observations) in the morning.

Keywords: gelada, behaviour, grooming, interspecies communication

INTRODUCTION

The gelada baboon (T*heropitecus gelada)* is the only living species of the genus *Theropitecus* of old world monkeys who inhabit highland plateaus and grasslands of Ethiopia (Crook *et al*., 1966). Ankel-Simons (2007) classifies the gelada as papionine (baboons), nevertheless geladas differ from other baboons in some traits. They are terrestrial primates (animals living in wild habitats rarely climb trees). Geladas have a greatly developed system of communication with a diverse repertoire of vocal and non-vocal displays (Richman, 1976). Mancini *et al*. (2009) described miming as a means of communication among geladas. Most characteristic of geladas is the red area of skin located on the chest which also functions in communication. Unlike other primates, geladas do not use their back side for communication because they spend most of the time sitting down. Adult males typically have a long, heavy cape of hair on their backs (Ankel-Simons, 2007). They can be distinguished from other baboons by shorter jaws, a longer face, snub snout and bulging cheek pouches.

Geladas have very long canines. Their molars are deeply crenulated (T-complex) which is the result of their adaptation to feeding on grass seeds (Dunbar, 1976; Iwamoto, 1979). Richard (1985) claims that geladas are solely herbivorous, feeding predominantly on grass, leaves and seeds. Dunbar and Bose (1991) specify that grazing on grasslands is sufficient in summer, whereas in autumn and winter geladas make up for the

lack of grass by feeding on grass seeds and plant roots. Anděra (2000) points out that geladas very rarely eat insects or small animals. The social system in geladas is greatly complex, with a strong female instinct and a stable, maternally inherited dominant hierarchy (Barrett *et al.*, 1985). Di Fiore and Rendall (1994) agree that geladas have a highly efficient social hierarchy including great numbers of animals of both genders. A functional hierarchy has a positive impact on reproductive behaviour in the group; dominant individuals protect their offspring (Swedell, 2006). The primary social unit is a reproductive unit consisting of a dominant male and a few females (Kawai *et al.*, 1983). Other males may be present in the group but they are subordinate to the alfa male. McCovan *et al.*, (2008) wrote that aggression was often used by both sexes to establish the social position of the animal within a group. From the ethological point of view, the aggressive behaviour may consist of attacks and escapes, although in some behavioural models of mammal social interaction even more modalities are distinguished (Máchalová *et al.*, 2012).

The aim of this study was to analyse behavioural patterns in a group of geladas kept in captivity and determine the incidence of the observed activities throughout the day.

MATERIAL AND METHODS

The ethological study was carried out in the Zlín-Lešná Zoo. The animals were observed in the outdoor enclosure which was divided into two runs with the area of 4914 m^2 and 700 m^2 and a cage (1038 m^2). The runs were separated by wire-mesh fence. The observation was carried out in March 2014 on five observation days from 9.00 to 16.00. The subject of the observation was a group of four females and three males who inhabited one run. There was a group of four males in the neighbouring run. The two groups were kept separately in order to prevent potential competition and aggression among the males and avoid injuries acquired in fights for higher ranks in the social hierarchy. This all-male group was not involved in the study. The two groups swopped their runs on daily basis. It usually happened at about 14.00 when the male group was closed in their indoor enclose and fed.

The dominant male in the observed unit was the oldest individual born in 2005. This alfa male determined the grazing speed and area, made decisions in reproductive and all other kinds of behaviour in the group. The other two males were born in 2009. Neither of them reached full maturity – their manes were not completely developed yet. The four-year age difference between the dominant male and the two subordinate males sufficiently prevented aggressive behaviour and eliminated attempts to take over the leading post by the young males.

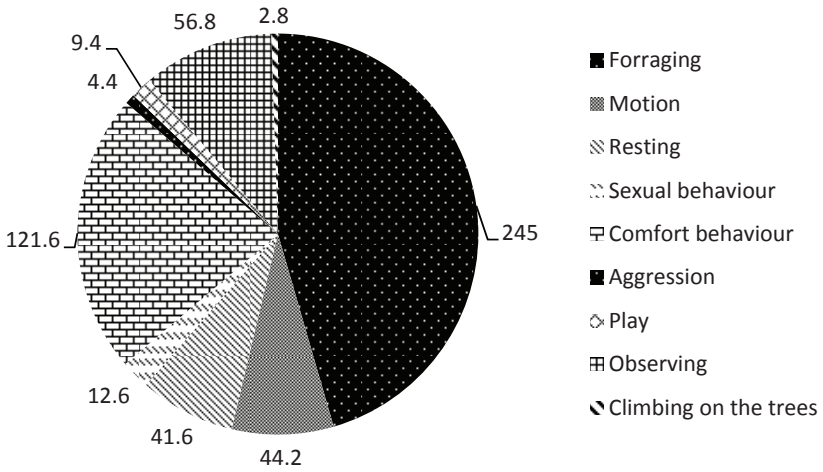
The oldest female was 11 years old. She was in the reproductive period; the apparent sign of this was a distinct, bright-red-coloured patch of skin on her chest. Two of the females were five years old which means they were just arriving at the onset of sexual maturity, showing the first signs of sexual behaviour. The last member of the unit was a four-year old female who did not reached maturity – there was no red-coloured skin visible on her chest. She had a neutral position in the group hierarchy.

The observation was carried out in five-minute intervals when the image of the whole group was taken and the exhibited activities were recorded into the ethogram (foraging, motion, resting, sexual, comfort and aggressive behaviour, play, observing of the neighbourhood and climbing the trees). Foraging included grazing, plucking the grass blades, digging for roots and small animals in the soil. Motion was defined as transfer of the animals over longer distances and run. Rest was sitting or lying down without any additional activity. Sexual behaviour included courtship and mating. Comfort behaviour involved grooming and other body care. Aggressive behaviour occurred when the personal space of the individual was disturbed or a social status of the animal in the group was threatened. Play was exhibited by individuals as well as the whole group. It included manipulation with various objects, mutual chasing, sham-biting and mounting. Animals 'observing the neighbourhood' were positioned high up, on an elevated spot or tree and, motionless, watching the vicinity. The last activity was tree-climbing. Geladas living in their natural habitat rarely climb trees, but in captivity they adopted and developed this activity and climb up to the top of the trees where they are resting, sleeping or watching the neighbourhoods. During the observation the outdoor temperature ranged between 9 and 16 °C. On three of the observation days the sky was clear or partly cloudy, on two of the days it was overcast.

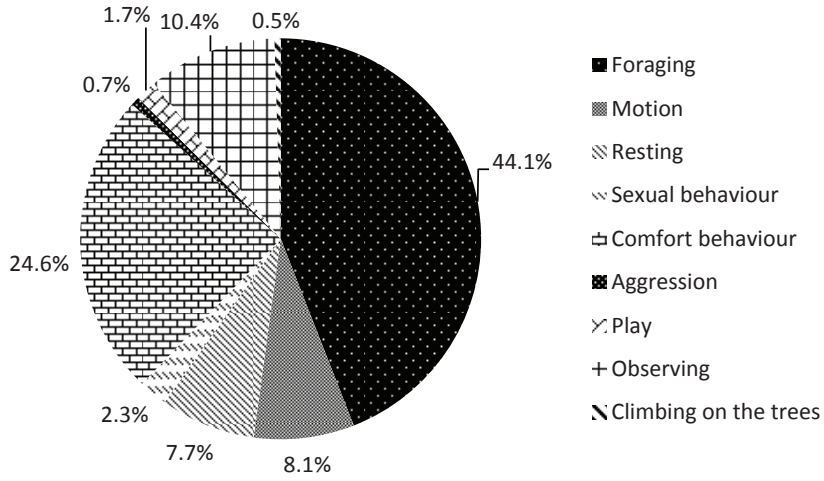
The observation data were statistically analysed using the method of non-parametrical statistics in STATISTICA 10.0.

RESULTS AND DISCUSSION

The most frequent activity in geladas was foraging (on average 245 images per day) which made up 44.1% out of the total number of observed activities (Fig. 1 and Fig. 2). Yang *et al.* (2007) carried out similar ethological observation in a related species Francois's languor (*Trachypithecus francoisi francoisi*). The authors found similar, though slightly lower (31.6 ± 7.9%) incidence of foraging behaviour. The second most frequent activity was comfort behaviour – grooming, which geladas exhibited in 121.6 images (24.6% of activities). These numbers were similar to those of Dunbar (1983) whose experimental subjects spent 21.2% of time grooming. The geladas spent similar time in motion and rest; they were seen resting in 7.7% of observations and moving around in 8.1% of observations which is 32.34 minutes in motion and 34.02 minutes



1: *Average days count of all activities (number of group image)*



2: *Percentages of all activities*

I: *Activity ratio during the day (number of monitoring)*

Activities	Time of observation						
	9.00–10.00	10.00–11.00	11.00–12.00	12.00–13.00	13.00–14.00	14.00–15.00	15.00–16.00
	mean ± s_d	mean ± s_d	mean ± s_d	mean ± s_d	mean ± s_d	mean ± s_d	mean ± s_d
Foraging	30.80 ± 8.04	26.00 ± 4.98	40.80 ± 5.65	39.20 ± 7.26	34.40 ± 3.61	19.00^{a} ± 4.02	44.80^{b} ± 3.64
Motion	2.20^{Aa} ± 0.75	4.20^{A} ± 0.73	5.60^{A} ± 1.12	3.80^{A} ± 1.93	5.60^{A} ± 1.44	14.20^{B} ± 1.16	8.60^{b} ± 1.63
Resting	5.20 ± 1.63	6.00 ± 2.00	7.40 ± 2.23	8.00 ± 2.28	9.80 ± 2.87	2.80 ± 1.96	2.80 ± 1.50
Sexual behaviour	1.60 ± 0.57	1.80 ± 0.62	2.00 ± 0.71	1.80 ± 0.66	1.40 ± 0.60	1.40 ± 0.60	2.60 ± 0.81
Comfort behaviour	18.40 ± 4.79	23.20^{A} ± 2.82	16.80 ± 2.85	19.80 ± 2.87	21.80^{a} ± 1.50	7.00^{Bb} ± 2.76	14.60 ± 1.47
Aggression	1.00 ± 0.31	0.40 ± 0.05	1.00 ± 0.28	-	1.00 ± 0.40	1.80 ± 0.52	1.60 ± 0.51
Play	6.60 ± 1.86	7.40 ± 2.48	6.00 ± 1.30	5.80 ± 1.98	7.60 ± 2.50	2.40 ± 0.75	4.00 ± 1.76
Observing	-	4.00 ± 0.88	2.60 ± 0.36	2.00 ± 0.76	3.00 ± 025	3.80 ± 0.32	3.40 ± 0.68
Climbing on the trees	-	1.40 ± 0.15	0.20 ± 0.05	0.20 ± 0.02	-	0.42 ± 0.08	0.80 ± 0.07

*a, b = $p < 0.05$, A, B = $p < 0.01$

resting per one animal and time of monitoring. Colins (1984) found out that the animals engaged in moving activity in 28% observations. According to Korstjens *et al.* (2010) geladas in the wild spend 15.1% time resting which is much more than they did in our study. The geladas spent by 2% more time (10.4%) observing the neighbourhoods than resting and moving – they were seen watching the vicinity of the enclosure in 56.8 images. Despite the presence of three sexually active females,

the signs of reproductive behaviour were rarely seen – in 2.3% of observations, which means on average in 12.6 observations per day. Because the group members were adults, playing behaviour was very rare. The animals were seen playing only in 9.4 observations which means 1.7% of total activities. The social hierarchy in the group was settled and stable and therefore the signs of aggression were minimised to 0.7%. In most cases, it was the alfa male who exhibited aggressive behaviour and it was directed outward towards non-unit males in the neighbouring enclosure. Hanuláková *et al.* (2013) found low incidence of aggressive behaviour in geladas (0.2%) which was probably due to the absence of males in the experimental group. Although our experimental group was mixed, male and female, it did not exhibit much greater aggression. In spite of the fact that geladas in the wild do not climb trees, they can sometimes be seen climbing trees in captivity (Anděra, 2000). Our geladas climbed the tree, which was in the middle of their large enclosure, on average 2.8 times a day.

Frequencies of the observed activities and their changes throughout the day are described in Tab. I. Feeding behaviour was exhibited all day until 16.00. It was significantly ($p < 0.05$) greater (44.80 ± 3.64 observations) between 15.00 and 16.00. In the morning the animals were seen foraging in 26 to 40.8 images with the peak between 11.00 and 12.00. After 14.00 the geladas spent less time feeding and more time moving around because they were transferred into the adjacent enclosure and were exploring the new environment (14.20 ± 1.16 observations). Mancini *et al.* (2009) studied geladas in the Rhine Zoo and found the greatest feeding activity at 9.30 in the morning and 14.30 in the afternoon. This trend similar corresponds with our results. The geladas showed the least motion in the morning, at the beginning of the observation day. They only moved on average on 2.2 occasions. At this morning hour the animals were resting (5.20 ± 1.63 observations) or playing (6.60 ± 1.86 observations). According to Palagi and Paoli (2007) play in adult individuals can be performed as a means of coping with novel situations. At that time, the geladas spent most of the time grooming which is a part of comfort behaviour (18.40 ± 4.79 observations). The incidence of comfort behaviour was the greatest ($p < 0.01$) between 10.00 and 11.00 in the morning (23.20 ± 2.82). In the afternoon grooming activities tended to cease (7.00 ± 2.76) and dropped to the minimum between 14.00 and 15.00 when the animals were exploring the new enclosure. The results of Lehmann *et al.* (2007) suggested that the incidence of comfort behaviour in primates depends on the size of the group. Yang *et al.* (2007) specified that primates in a small group spent only 0.33% of time performing comfort behaviour. Since 10.00 zoo visitors started to disturb geladas' routine activities who then spent more time observing the vicinity of the enclosure (4.00 ± 0.88 observations). Until 10.00 there was no sign of this activity. The geladas spent more time observing people when the weather conditions were poor and there were fewer visitors in the zoo (it was overcast on two of the observation days). Some of the animals climbed the tress to get a better view of the people and surroundings. In the afternoon between 14.00 and 16.00 the geladas climbed the trees and observed the visitors quite often (3.0–3.8 observations). However, this could also mean that the animals were tired of people and trying to escape from their presence. Aggressive and sexual behaviour were mainly exhibited by the dominant male throughout the whole observation period; only one or two instances of aggressive or sexual behaviour were observed per hour. Mccowan *et al.* (2008) consider aggressive behaviour to be an important part of social behaviour leading to stabilisation of the social hierarchy in the group and confirmation of the social status of an individual. The social hierarchy in our experimental group was firmly set and stable and aggressive behaviour was only manifestation of dominance. Zikán (2008) mentions fighting for an estrus female as one of possible forms of aggression. However, our results could not confirm this hypothesis. Snyder-Mackler *et al.* (2012) considers the geladas' social system to be very dynamic. According to Veselovský (2005), the social hierarchy may include all the animals or it can be separate for each gender. In our group, the alfa male was dominant and all the group members respected him. There were no significant ($p > 0.05$) differences between the incidence of the observed activities in the period between 12.00 and 14.00 compared to the morning. The routine was always disturbed after 14.00 when the animals were transferred into the adjacent run.

CONCLUSIONS

Our study assessed behaviour of geladas kept in captivity and the results showed that geladas spent most of their time feeding and performing comfort activities. The social system in the group of three males and four females was very stable. The evidence of the social stability in group was very low incidence of aggression between the dominant male and the rest of the group and also among the subordinate members. Although the three female members of the group were evidently sexually mature – their secondary sex characteristics were well developed, they rarely exhibited reproductive behaviour. Interestingly, the captive geladas readily climbed the trees while in the wild they very rarely do this. There were no great differences in the frequency of the observed activities throughout the day. We can conclude that the most disturbing event was the change of the environment in the middle of the day – transfer into the adjacent enclosure which was inhabited by four other gelada males for the rest of the day.

SUMMARY

The aim of this study was to determine the incidence of the main daily activities in the group of geladas kept in a zoo. The group was formed by 7 individuals (three males and four females). The social hierarchy in the group was firmly set and stable with the oldest, alfa male at the top rank. The behavioural study included five recurrent observations which took place in March 2014. Behaviour was monitored in five-minute intervals when images of the whole group were taken and analysed. The most frequent activity was foraging – the geladas were feeding continuously throughout the day (30.80 – 26.00 – 40.80 – 39.20 – 34.40 – 19.00 – 44.80 observations) with the peak between 15.00 and 16.00 in the afternoon. The second most frequent activity was comfort behaviour. Rest and play were about equal (rest 6 times, play 5.6 times). The geladas very rarely exhibited aggression (1.13 observations) and sexual behaviour (1.8 observations per day). In the morning and on days when there were fewer visitors in the zoo, the geladas showed increased interest in their surroundings and spent more time observing it. This observing and watching was closely associated with climbing the trees; the experimental geladas climbed the trees in their enclosure though it very rarely happens in the wild. The daily routine and consequently the results of the study were disturbed by transfer of the animals into the neighbouring enclosure which was otherwise inhabited by an all-male group of geladas (since morning till 14.00). After the geladas moved into the new enclosure, they started moving around in order to explore the environment and analyse novel scents.

Acknowledgement

The study was supported by the grant project IGA TP5/2014.

REFERENCES

ANKEL-SIMONS, F. 2007. *Primate Anatomy: an introduction.* 3rd edition. Academic Press.

ANDĚRA, M. 2000. *Zvířata v horách*. Praha: Aventinum.

BARRETT, L., DUNBAR, R. I. M. and DUNBAR, P. 1985. Mother-infant contact as contingent behaviour in gelada baboons. *Anim. Behav*., 49(3): 805–810.

COLLINS, D. A. 1984. Spatial pattern in atroop of yellow baboons (Papio cynocephalus) in Tanzania. *Anim. Behav.*, 32: 536–553.

CROOK, J. H. 1966. Gelada baboon herd structure and movement: a comparative report. *Symp. Zool. Soc. Lond*., 18: 237–258.

DI FIORE, A. and RENDALL, D. 1994. Evolution of social orfanization: A reappreisal for primates by using phylogenetic methods. *Anthropology,* 91: 9941–9945.

DUNBAR, R. I. M. 1976. Australopithecine diet based on a baboons: Feeding ecology. *Contributions to primatology*, 16: 279–330.

DUNBAR, R. I. M. 1983. Structure of gelda baboon reproductive units III. The male's relationship with his females. *Anim. Behav.,* 31: 565–575.

DUNBAR, R. I. M. and BOSE, U. 1991. Adaption on Grass-eating in Gelada Baboons. *Primates*, 32(1): 1–7.

HANULÁKOVÁ, Š., MÁCHAL, L., HLOUČALOVÁ P., HORSKÝ R. and CHLÁDEK, G. 2013. Social relationships existing among gelada (Theropithecus gelada) males in the Zoo Zlín. *Acta Universitatis Agriculture et Silviculture Mendelianae Brunensis*, 61(6): 1653–1659.

IWAMOTO, T. 1979. Ecological and sociological studies of gelada baboons: Feeding ecology. *Contributions to primatology,* 16: 279–330.

KAWAI, M., DUNBAR, R., OKSAWA, H. and MORI, U. 1983. Social organisation of gelada baboons: social units and definitions. *Primates,* 24(1): 13–24.

KORSTJENS, A. H., LEHMAN, J. and DUNBAR, R. I. M. 2010. Resting time as an ecological constraint on primate biogeography. *Anim. Behav.,* 79: 361–374.

LEHMANN, J., KORSTJENS, A. H. and DUNBAR, R. I. M. 2007. Group size grooming and social cohesion in primates. *Anim. Behav.,* 74(6): 1617–1629.

MÁCHALOVÁ, A., ŠLAIS, K., VRSKOVA, D. and ŠULCOVÁ, A. 2012. Differential effect of modafinil, methamphetamine, and MDMA on agonistic behaviour in male mice. *Pharmacol. Biochem. Behav.*, 102(2): 215–223.

MANCINI, G. and PALAGI, E. 2009. Play and social dynamics in a captive herd of gelada baboons (Theropithecus gelada). *Behavioural Processes,* 82: 286–292.

MCCOWAN, B., ANDERSON, K., HEAGARTY, A. and CAMERON, A. 2008. Utility of social network analysis for primate behavioral management and well-being. *Appl. Anim. Behav. Sci.,* 109(2–4): 396–405.

PALAGI, E. and PAOLI, T. 2007. Play in adult bonobos (Panpaniscus): Modality and potential meaning. *American Journal of Physical Anthropology*, 134: 219–225.

RICHARD, A. F. 1985. *Primates in Nature*. Ney York: W. H. Freeman.

RICHMAN, B. 1976. Some vocal distinctive feature sused by gelada monkeys. *Journal of the Acoustical Society of America,* 60 (3): 718–724.

SNYDER-MACKLER, N., BEEHNER, J. C. and BERGMAN, T. J. 2012. Defining Higher Levels in the Multilevel Societies of Geladas (Theropithecus gelada). *Int. J. Primatol.*, 33(5): 1054–1068.

SWEDELL, L. 2006. *Strategies of Sex and Survival in Hamadryas Baboons: Through and Female Lens.* Upper Saddle River, NJ: Pearson Prentice Hall.

VESELOVSKÝ, Z. 2005. *Etologie: Biologie chování zvířat*. Praha: Academia.

YANG, L., MINGHAI, Z., JIANZHANG, M., ANKANG, W., SHUANGXI, W. and SHUSEN, Z. 2007. Time budget of daily activity of Francois' langur (Trachypithecus francoisi francoisi) in disturbance habitat. *Acta Eco. Sinica,* 27(5): 1715–1722.

ZIKÁN, V. 2008. Dželada *(Theropithecus gelada)*. *Afrika Online*. Available online: http://www.afrikaonline.cz/view.php?cisloclanku=2008012801. [cit. 2014-06-23].

Contact information

Radek Filipčík: radek.filipcik@mendelu.cz
Ladislav Máchal: machal@mendelu.cz
Daria Baholet: xbaholet@node.mendelu.cz
Gustav Chládek: chladek@mendelu.cz
Hošek Martin: hosek@mendelu.cz
Michaela Paldusová: michaela.paldusova@mendelu.cz