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Resting behavior

Written by Christian Schiffmann

The physiology of rest in elephants

Similar to several herbivore species (Pucora et al., 2019), elephants show resting behavior in a standing as well as a recumbent position (Fig. 1). Lying on the ground makes an elephant highly vulnerable because getting back on its feet is a demanding combination of movements taking several seconds. Therefore, elephants are known to have lying rest exclusively when feeling comfortable and relaxed (reviewed in Schiffmann, Hoby, et al., 2018). Furthermore, the combination of movements for getting up and down requires functional joint mobility and a well-trained musculature. In contrast, standing rest seems far easier for the elephant. Often, elephants find places for their standing rest close to structures they can lean on, such as trees and rocks in the wild, or walls and gates in the captive environment (McKay, 1973; Schiffmann, Hoby, et al., 2018; Tobler, 1992; Wuestenhagen et al., 2000).

Recent investigations in free-ranging African elephants have detected lying rest of around 0.28 hours per night (Gravett et al., 2017), although there were nights with no lying rest at all. For free-ranging Asian elephants, quantitative observations on their resting behavior are still lacking, presumably due to the challenge of observing them in the thickets of their home ranges.

In captive environments elephants have been observed to have variable lying rest duration of zero up to 7.8 hours per night (Schiffmann, Hoby, et al., 2018; Schiffmann, Knibbs, et al., 2018). Although one might consider extended bouts of lying rest as a positive welfare indicator, it might indicate as well a state of physical handicap (e.g. due to degenerative joint disease) (Schiffmann, Knibbs, et al., 2018).

Under free-ranging as well as captive conditions, elephants seem to have their major period of rest during the night, namely between the late evening (11.00 pm) and the early hours of the morning (6.00 am) (reviewed in Schiffmann, Hoby, et al., 2018). Breeding females have been observed to express reduced lying rest in the phases pre- and post-partum (Schiffmann, Hoby, et al., 2018). The same seems to be the case in lactating females, which are frequently disturbed in their resting bouts by their calves that want to be nursed (Schiffmann et al., 2019). Although the author is aware of a case of nursing behaviour while recumbent in an Asian elephant living in a zoo, the majority of females seem to nurse their calves exclusively in a standing position (Schiffmann et al., 2019).

In a male zoo elephant, reduced lying rest has been observed during the oestrus of a female in the herd (Walsh, 2017). Apart from impacts related to reproduction, social as well as environmental factors and transfer situations have been shown to heavily impact resting behaviour in free-ranging and zoo elephants (Evison et al., 2020; Finch et al., 2021; Gravett et al., 2017; Laws et al., 2007; Schiffmann, Hoby, et al., 2018). In the latter, physical handicap due to musculoskeletal disorders seem to represent a frequent cause for alterations in an elephant's resting behavior (Schiffmann, Hoby, et al., 2018; Schiffmann, Knibbs, et al., 2018). While a negative correlation between the amount of lying and standing rest has been observed in zoo elephants (Schiffmann, Hoby, et al., 2018), the neurophysiological basis of elephant sleep remains unknown due to the fact that

detection of brain activity by an electroencephalogram (EEG) is still considered unfeasible due to the size of the brain relative to the massive skull of an elephant (Gravett et al., 2017; Manger et al., 2009). Based on our knowledge on resting behaviour in herbivore species (Gonfalone et al., 2015), I assume elephants to have satisfying rest with REM-phases exclusively in a lying position (Schiffmann, Hoby, et al., 2018). This hypothesis requires further research into the neurophysiology of elephants.

Figure 1 Elephants do express lying as well as standing rest.

Challenges regarding resting behavior when caring for elephants in captivity

Ensuring that animals under our care are having sufficient amounts of satisfying rest is considered a critical parameter in welfare assessments (Williams et al., 2018). When considering the aforementioned requirements for an elephant to have satisfying lying rest, it becomes evident that these aspects can be challenging to fulfill under the conditions of captivity (Schiffmann, Hoby, et al., 2018). Only if all following aspects are considered and fulfilled, a physiological resting behavior can be expected.

Social environment

To feel comfortable and relaxed, an elephant needs to feel socially accepted and bonded to his group members. This will be ensured in a naturally growing elephant family consisting of related individuals. The same will be the case in unrelated elephants if they have positive bonds and are harmonizing well (Finch et al., 2021). Given such social constellations, guarding behavior of a herd mate while others are having lying rest will be observed frequently (Fig. 2).

Figure 2 Guarding behavior of an unrelated but well-harmonizing pair of adult female Asian elephants.

Physical environment

In order to have satisfying lying rest, elephants require an appropriate malleable and soft substrate (Holdgate et al., 2016; Roocroft, 2005; Schiffmann et al., 2019). Ideally this should provide slopes to allow the elephant lying in a position with the head in an elevated position and facilitate getting up again (Schiffmann, Knibbs, et al., 2018) (Fig. 3). Moreover, soft substrate needs to be available for every individual in the group without compromising their individual distances. The latter is of outmost importance in elephant groups with social tension between individual members. If an elephant refuses to have lying rest, having standing rest as a substitute needs to be facilitated. This can be accomplished by providing structures in an appropriate height to lean on (Schiffmann, Hoby, et al., 2018) (Fig. 4). Nevertheless, treatment or resolution of the underlying cause with a subsequent resumption of lying rest should represent the ultimate goal.

Figure 3 Elephants prefer to have lying rest with the head on the upper part of a slope.

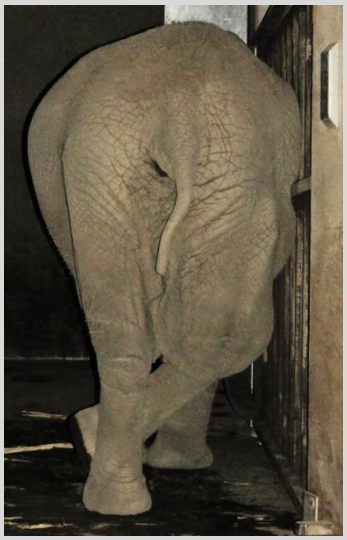

Figure 4 Elephants have been observed to show increased leaning rest as a substitute of lying rest.

Physical integrity and condition

The process of going down into a recumbent position and back up represents a physically demanding combination of movements for elephants. Therefore, a healthy and trained musculoskeletal system is required to easily switch between a lying and a standing position. This includes joint mobility and freedom of articular pain as well as well-exercised muscles. While joint health is part of the veterinary care and should be treated if alterations such as degenerative joint disease do exist, adequate training of the musculature needs to be considered in daily husbandry and can be facilitated through a comprehensive enrichment program.

Nighttime feeding

Although sophisticated feeding systems aim to provide captive elephants with opportunities to forage nearly around the clock, the provision of a new ration during nighttime might disturb resting behavior. With respect to the major period of lying rest between 11.00 pm and 6.00 am, I recommend considering this aspect when planning the feeding schedule and not provide any new food during this period.

Resting monitoring

It is strongly recommended for every elephant management to have a nighttime video monitoring system, which allows the continuous monitoring of nighttime activities of the individual elephants. Although the technical requirements might be met easily, working time of staff to check the nighttime recordings on a daily basis needs to be ensured. Only if this is given will alterations in an individual's resting behaviour be detected. If so, the latter might present a relevant and early indicator for several physical disorders (reviewed in Schiffmann, Hoby, et al., 2018). Furthermore, changes in the resting behavior of an elephant group might confirm the effect of husbandry improvements or even the impact of variations in the social structure (Evison et al., 2020; Schiffmann et al., 2019). In doing so, a comprehensive monitoring has the power to extend our still limited knowledge on elephant resting behaviour.

Consequences of an altered resting behavior in elephants

Although significant gaps in our knowledge on sleep physiology in elephants do persist, disorders potentially caused by a lack of satisfying rest have been reported. In severe cases the latter resulted in falling bouts with elephants lying on the ground unable to get back up again (Schiffmann, Hoby, et al., 2018). Apart from these dramatic situations, common sense alone leads to the assumption of a correlation between a lack of lying rest and musculoskeletal disorders. Thereof, mainly the feet and the distal joints seem to be affected (Schiffmann, 2021). In general, elephants having a reduced amount of lying rest seem to compensate for that with an increase in standing resting behavior (Schiffmann, Hoby, et al., 2018). This adaptation in an elephant's resting behavior should be considered as a substitute but not the ideal situation, and is supposed to compromise individual welfare. In severe cases this negative impact may become obvious in a reduced physical condition (Schiffmann, Hoby, et al., 2018). As sequelae of inappropriate flooring substrate, elephants living under human care do often express pressure sores on specific areas of their integument. These sores may be observed on the lateral elbow and shoulder blade, the hip region, the temporal area and may even become apparent in the form of abrasions on the lateral part of the tusks. Evidently, an appropriate malleable substrate may prevent most of these alterations.

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