Activity Budget and Postural Behaviors in Orangutans on Bukit Merah Orang Utan Island for Assessing Captive Great Ape Welfare

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ABSTRACT
Assessments of the welfare status of captive and semi-captive animals often compare how their expression of natural behaviors differs from that of free-ranging conspecifics. From December 2015–2016, we recorded and analyzed the activity budget and postural behaviors of three orangutans in Bukit Merah Orang Utan Island (BMOUI) to evaluate their welfare status. The orangutans’ activity budget was dominated by resting (60%), feeding (13%), playing (14%), and moving (9%). Behavioral categories followed a similar trend: resting > feeding > moving > playing, except that the subadult male spent significantly more time playing than the two adults. The most predominant posture was sitting (47.0%), followed by pronograde standing (29.4%), lying (10.5%), and clinging (4.5%). Our results suggest that orangutans on BMOUI engage in less feeding but more resting, and show less postural diversity than free-ranging individuals. We propose that appropriate interventions to shift activity budgets, especially feeding vs. resting, and postural behaviors of captive orangutans toward those found in free-ranging orangutans might be beneficial for their welfare and survival.

Introduction
Conservation programmes have become an integral aspect of zoological management of nonhuman primates, as nearly half of all free-ranging primate species are threatened with extinction due to habitat destruction and poaching (Estrada et al., 2017). The orangutans inhabiting both Borneo and Sumatra are no exception: all are critically endangered. To stop the decline in the number of orangutans it is crucial to establish self-sustaining captive and semi-captive populations, with the ultimate goal of reintroducing individuals to their natural habitats. However, although orangutan rehabilitation is one of the central features in the conservation of this great ape, it is not always successful (Russon et al., 2008).

The ability of orangutans to locate and harvest foods, and food processing skills are considered to be vital for their survival (Descovich, Galdikas, Tribe, Lisle, & Phillips, 2011). One approach for assessing the psychological aptitudes of captive or semi-captive orangutans is to compare their activity budget with that of free-ranging individuals. It is equally important for postural behaviors because proficient locomotion skills are critical for safety by allowing efficient resting and foraging high up in trees (Descovich et al., 2011; Grundmann, 2006). However, there is a lack of reports on activity budgets and postural behaviors of captive and semi-captive orangutans based on systematic observations.
BMOUI, located in Perak, Peninsular Malaysia, was established in February 2000 with assistance from the Bukit Merah Laketown Project and the EMKAY Group. In February 2008, the Bukit Merah Orang Utan Island Foundation was incorporated to develop ex-situ conservation of orangutans, including rehabilitation and research, and education of the public (Kamaluddin et al., 2018). Here, we report on the activity budget and postural behaviors of three orangutans moving freely in the two enclosures on BMOUI. We include a comparison of the present subjects’ behaviors with those of other captive, semi-captive and free-ranging orangutans, to work toward improving the housing conditions and ultimately the welfare status of the BMOUI orangutans (see Hosey, Melfi, & Pankhurst, 2009).

Methods

Study site and facilities

We conducted observations in BMOUI, in the Malay Peninsula (100° 40.6’ E, 05° 0.50’ N), from December 2015 to December 2016. BMOUI, which comprises an estimated 35 ha. It is covered by a secondary tropical forest which consists commercial wood species, e.g., Dipterocarpus spp. and Shorea spp., and some other cultivated plants (fruits are edible not only for orangutans but also humans, e.g., Nephelium lappaceum and B. buttan spp.), as the most predominant tree species. From the fossil records, it has been confirmed that orangutans have historically ranged in the Malay Peninsula (Rijksen & Meijaard, 1999; Tshen, 2016), the natural environment, e.g., vegetation and/or weather, which would be partly comparable to the current distribution habitats of orangutans, exists in the enclosures, suggesting the advantage of the facility of the BMOUI. Four enclosures (A-D), separated by an electric hotwire fence, are used as the Orangutan Release Center. The interior of the enclosures contains a secondary forest with the addition of ropes, wooden platforms, and feeding devices. The orangutans have daily access to the outdoor enclosures from 0900 to 1700 hr, and supplemental feeding is conducted twice a day. Visitors arrive almost daily; they are able to walk through a 100-m semi-circle steel-fence tunnel that runs through the middle of the enclosures, allowing them to observe the orangutans moving freely in the enclosures (Hayashi, Kawakami, Roslan, Hapiszudin, & Dharmalingam, 2018).

Subjects and data collection

There are seven different age–sex classes of orangutans on BMOUI according to Rijksen (1978). The orangutan subjects were placed in two different sized enclosures, i.e., enclosure A (80 m x 180 m): 1 adult male, 1 adult female, and 2 subadult females; enclosure B (80 m x 200 m): 3 subadult males. As focal subjects, we selected three individuals (Figure 1): an adult male (“BJ,” 29 years old), an adult female (“Nicky,” 27 years old, with a 2-year-old infant) in enclosure A, and a subadult male (“Fatt-Fatt,” 8 years old), in enclosure B. Note that the age information for the adult individuals were estimated upon their arrival to the BMOUI by veterinarians, except the subadult male and the infant of the adult-female subject.

We followed the three orangutans for 42 days, i.e., 14 days in each individual. Their behavioral data were collected by one of the authors (SNK) continuously during daily observation periods (6 hr: 0930–1330 h and 1430–1630 h), following standardized orangutan data-collection protocols. We used a focal-animal instantaneous sampling technique to record the duration of all behaviors and postures of each individual in 5-min intervals (Morrogh-Bernard, Husson, & McLardy, 2002).

During focal follow-up, the observers recorded the time spent on each behavioral activity and the food types eaten (i.e., provided by humans or natural foods). The behaviors were divided into seven categories based on Morrogh-Bernard (2009) and Martin and Bateson (1993): resting, feeding, moving, playing, grooming, and interactions with humans (keepers) including throwing branches, pushing over dead trees, chasing or making kiss-squeaks (Table A1). We also recorded whether the
focal individuals were on the ground or arboreal (i.e., on the natural tree/wooden tree platform or using a rope). Postures were divided into eight categories based on Hunt et al. (1996), with some additional definitions added based on Thorpe and Crompton (2006) and preliminary observation by Shariman and Ruppert (2017): sit, lie, cling, pronograde stand, orthograde stand, orthograde fore-limb suspend, orthograde quadrumanous suspend, and multiposture (Table A2, Figure 2). It should be notable when we analyzed the postures, especially while resting and moving in orangutans. Although we defined the stationary behavior, i.e., resting, as no movement exceeding 1 min is counted as a break (Table A1), as a high termination tendency is responsible for many short pauses and a low termination tendency makes for long rests, it was decided to distinguish two categories of stationary behavior, i.e., “pausing” (shorter than 5 min) and “resting” (longer than 5 min) as followed by the same definition by Sugardjito and Van Hooff (1986) and Thorpe and Crompton (2006). For example, when we analyzed the sitting posture, if the animal engaged in pausing (resting < 5 min), we considered as the sitting while moving.

Data analysis

We calculated the activity data on a daily basis, i.e., 14-day data for each individual, and performed Mann–Whitney U tests to compare the mean values (%) of activity budgets, terrestriality, feeding on artificial foods, and postures among the three focal individuals. For each set of hypothesis tests, we controlled the overall level of significance at 0.05 using the Bonferroni procedure.

Results

Activity budget

We followed three orangutans for a combined total of 252 hr (84 hr per individual). As shown in Table 1 and Figure 3, their activity budgets were dominated by resting (60%), feeding (13%), playing (14%), and moving (9%). The majority of their feeding time was involved in feeding on artificial foods (79.2%). Comparisons of individual activity categories revealed several significant individual differences (Table 2). Time spent on resting was highest in the adult male (82%), followed by the adult female (65%), and then the subadult male (33%). The adult male spent significantly less time feeding (9%) than the adult female (14%) and subadult male (15%); the adults relied more on the artificial foods (male, mean: 86.7%, SD: 12.2; female, mean: 87.2%, SD: 11.7) compared with the subadult male (mean: 63.6%, SD: 7.80), i.e., adult male vs. adult female: Z = −0.14 and P = 2.73; adult male vs. subadult male: Z = 3.12 and P < .05; subadult male vs. adult female: Z = −3.03 and P < .05. For all three individuals resting > feeding > moving > playing, except that the subadult male spent significantly more time playing (35%) than the others (3–4%). Noted that subadults mostly fed
on leaves, fruits and bark of bertam (*Eugeissona* sp.) and occasionally consumed fruits of cultivated plants and termites as non-artificial foods. Over 70% of the subadult male’s playing time involved social play with other subadults, i.e., playing with other individuals: 71.2%; solitary play: 28.8%. On the other hand, the observed social play with other orangutans was none in the adult male (solitary play: 100%). A similar tendency was found in the adult female (75.0%), though she engaged in the play with her infant (mean 25.0%, SD: 34.9).

*Figure 2.* Orangutan postures, a) Lie b) Sit c) Cling d) Pronograde stand e) Orthograde stand f) Orthograde quadrumanous suspend g) Orthograde forelimb suspend h) Multiposture.
Overall, three orangutans spent the majority of their time on the ground (mean 85.1%±14.7) and were occasionally observed arboreal behaviors using the wooden tree platform or using a rope. The adults (male: mean: 90.0%±16.4; female: mean: 87.8%±15.6) spent more time on the ground than the subadult male (mean: 77.5%±8.52): adult male vs. subadult male: Z = 2.34 and P = 0.06; adult male vs. adult female: Z = 2.15 and P = 0.09; subadult male vs. adult female: Z = –3.03 and P < .05.

**Table 1.** Percentages of activities and for each individual.

|                | Adult male (BJ) | Adult female (Nicky) | Subadult male (Fatt Fatt) | Mean |
|----------------|-----------------|----------------------|---------------------------|------|
| Resting        | 82.1 ± 5.5      | 64.9 ± 12.1          | 32.7 ± 6.9                | 59.9 ± 20.5 |
| Feeding        | 9.0 ± 3.3       | 14.2 ± 4.6           | 14.6 ± 4.2                | 12.6 ± 2.6 |
| Moving         | 4.7 ± 3.0       | 9.2 ± 2.1            | 12.9 ± 2.8                | 8.9 ± 3.3 |
| Playing        | 2.6 ± 3.3       | 4.4 ± 4.7            | 35.0 ± 7.7                | 14.0 ± 14.9 |
| Grooming       | 0.3 ± 0.5       | 0.1 ± 0.1            | 0.1 ± 0.3                 | 0.2 ± 0.1 |
| Interaction    | 1.2 ± 0.9       | 0.4 ± 0.4            | 3.5 ± 2.9                 | 1.7 ± 1.3 |
| Others         | 0.1 ± 0.2       | 7.0 ± 5.8            | 1.3 ± 0.7                 | 2.8 ± 3.0 |

|                | Adult male      | Adult female       | Subadult male         | Mean     |
|----------------|-----------------|-------------------|----------------------|----------|
| Activity       | Resting         | Feeding           | Moving               | Others   |
| Adult male     | 82.1%           | 14.0%             | 4.7%                 | 9.0%     |
| Adult female   | 64.9%           | 14.2%             | 9.2%                 | 4.4%     |
| Subadult male  | 32.7%           | 14.6%             | 9.2%                 | 12.9%    |

*Figure 3.* Activity budget for three study orang-utans, i.e., adult male, adult female and subadult male, and their mean.

Overall, three orangutans spent the majority of their time on the ground (mean 85.1%±14.7) and were occasionally observed arboreal behaviors using the wooden tree platform or using a rope. The adults (male: mean: 90.0%±16.4; female: mean: 87.8%±15.6) spent more time on the ground than the subadult male (mean: 77.5%±8.52): adult male vs. subadult male: Z = 2.34 and P = 0.06; adult male vs. adult female: Z = 2.15 and P = 0.09; subadult male vs. adult female: Z = –3.03 and P < .05.

**Postural behavior**

Overall posture (combining feeding, resting and social behavior) was dominated by sitting (47.0%), pronograde standing (29.4%), lying (10.5%), and clinging (4.5%). Postures while resting, feeding and traveling are shown in Figure 4 (but see Table A3 in details). Sitting was generally the preferred resting and feeding posture; pronograde standing was preferred moving. The adult male sat significantly less (33%) than the adult female (49%) and subadult male (49%) while resting, but he lay more (54%) than the adult female (32%) and subadult male (14%). The pronograde
standing posture while resting was most frequent in the subadult male (24%), followed by the adult female (8%) and adult male (4%). Conversely, the pronograde standing posture while traveling was most prevalent in the adult male (98%), followed by the adult female (87%) and subadult male (65%). Orthograde quadrumanous suspension and orthograde forelimb suspension were only recorded during moving (Table 3). Orthograde quadrumanous suspend was significantly less common in the adult male (2%) than in the adult female (10%) and subadult male (13%). Orthograde forelimb suspend was by far the most common posture in the subadult male (21%).

**Discussion**

**Activity budget**

Resting behavior was one of the major components of orangutan activity budgets in our study, and it was more prominent in adult males than others. Since the adult male often monopolized the provided foods at the feeding platform in enclosure A (SNK personal observation), he possibly obtained more foods of higher nutrient content than wild fruits (Nijboer & Dierenfeld, 1996; NRC, 2003; Schwitzer, Polowinsky, & Solman, 2009), than the adult female and the subadult male. This might explain why the adult male spent less time feeding and moving (or foraging) and more time spent resting.

Despite being the dominant individual in enclosure B, and therefore able to monopolize provided foods, the subadult male in enclosure B spent less time resting and more time feeding than the adult male in enclosure A. This difference might be related to the greater amount of time spent playing by the subadult but not by adults even between mother and infant, e.g., <1% of their waking time in social play (Van Noordwijk et al., 2009); indeed, adolescent and subadult males generally engage in more playing behaviors than adults (Galdikas, 1985; Hayashi et al., 2018; Poole, 1987; Schwitzer et al., 2009). In order to spend more time in social behaviors than adults, subadults may need to

### Table 2. Summary of statistical results using a Mann–Whitney U test. A Bonferroni correction was applied for all represented P-values. Note that we did not perform the statistical tests for all combination patterns, as it was impossible and/or meaningless for the data including a lot of zeros.

| Activity budget (Resting) | Adult male vs. Female | Adult male vs. Subadult male | Adult female vs. Subadult male |
|---------------------------|-----------------------|-----------------------------|--------------------------------|
| P            | Z        | P            | Z        | P            | Z        |
| Lying        | <.001    | 3.77         | <.001    | 4.50         | <.001    | –4.50    |
| Feeding      | <.01     | –2.89        | <.001    | –3.35        | 2.95     | –0.05    |
| Moving       | <.001    | –3.49        | <.001    | –4.18        | <.01     | 3.03     |
| Playing      | 0.81     | –1.13        | <.001    | –4.51        | <.001    | 4.50     |
| Posture (Feeding) |            |              |          |              |          |
| Lying        | <.05     | 2.66         | <.001    | 4.27         | <.05     | –2.71    |
| Sit          | <.01     | –2.89        | <.01     | –2.99        | 2.62     | –0.18    |
| Cling        | 0.06     | –2.32        | 0.08     | –2.20        | 1.13     | 0.92     |
| Pronograde stand | <.001    | –3.45        | <.001    | –4.41        | <.001    | –4.00    |
| Orthograde stand | <.05     | –2.85        | <.001    | –3.46        | 0.31     | 1.66     |
| (Moving)     |          |              |          |              |          |
| Lying        | 2.10     | 0.40         | 1.85     | –0.52        | 0.35     | 1.60     |
| Sit          | 2.84     | 0.09         | <.001    | 3.45         | <.001    | –3.45    |
| Pronograde stand | 2.18     | –0.37        | <.001    | –4.04        | <.001    | 3.36     |
| Orthograde stand |          |              |          |              |          |
| Lying        | 1.44     | –1.44        | 1.44     | –1.44        | 2.19     | –0.15    |
| Sit          | <.001    | 3.74         | <.001    | 4.53         | <.001    | –3.35    |
| Pronograde stand | <.001    | –1.00        | 0.29     | –2.11        | 0.98     | 1.31     |
| Orthograde quadrumanous suspend | <.001    | –3.55        | <.001    | –4.06        | 0.11     | 2.11     |
decrease resting and increase feeding to maintain adequate energy levels. The subadult male also moved around remarkably often, echoing observations of subadult males in the Singapore Zoo (Ting, 2011). Like his zoo counterparts, the subadult male frequently approached tourists, who sometimes gave him food. Zaki, Mansor, and Rosely (2017) also reported that the amount of time BMOUI subadult males spend moving correlated positively with time spent feeding.

Although resting is the dominant behavior of both captive and free-ranging orangutans, this may especially apply to captivity (Table 3); free-ranging orangutans generally tend to spend more time foraging, finding, processing and consuming foods, which require both manipulative and cognitive skills (Russon, 1998), and therefore less time resting compared to captive individuals. In fact, the study individuals, especially adults, fed heavily on the artificial foods throughout the study period. In captivity, reduced overall activity levels can lead to weight gain, obesity, and undesirable behaviors, such as regurgitation and reingestion (Cassella, Mills, & Lukas, 2012; Pontzer, Raichlen, Shumaker, Ocobock, & Wich, 2010). To reduce the occurrence of such abnormal behaviors and to enhance health and survival, it may be beneficial to intervene to alter the activity budgets of captive orangutans, especially feeding vs. resting, to more closely those of free-ranging orangutans. Providing more diverse food and toy enrichments and devices for cognitive experiments might play a role in increasing the amount of time foraging and decreasing resting in great apes, e.g., orangutans (Shariman & Ruppert, 2017) and chimpanzee (Yamanashi & Hayashi, 2011).

Figure 4. Time allocation patterns of postural behavior by activity (feeding, resting vs. moving) for each study orangutan and their mean.
### Table 3. Percentages of activity budget in comparison to previous studies.

| Living-condition | Study site | Resting | Feeding | Moving | Playing | Grooming | Interaction | Others | *\(^{a}\)* Observation effort | Reference |
|------------------|------------|---------|---------|--------|---------|----------|-------------|--------|-------------------------------|-----------|
| Rehabilitant     | Bukit Merah, Perak | 60      | 13      | 9      | 14      | 0        | 2           | 3      | 252 h                         | This study|
| Rehabilitant     | Bukit Merah, Perak | 46      | 20      | 12     | 9       | 8        | 5           | 2      | 20 h                          | Hayashi et al. (2018) |
| Rehabilitant     | Bukit Merah, Perak | 52      | 23      | 19     | 3       | 1        | 1           | 3      | 54 h                          | Hayashi et al. (2018) |
| Rehabilitant     | Bukit Merah, Perak | 62      | 6      | 17     | 12      | 4        | 1           | 2      | 30 h                          | Zaki et al. (2017) |
| Rehabilitant     | Bukit Merah, Perak | 33      | 24      | 27     | 9       | 6        | 1           | 1      | 180 h                         | Lee (2003) |
| Rehabilitant     | *\(^{b}\)* Meratus Forest, Indonesia | 19      | 58      | 9      | 13      | 2        | 2           | 2      | 740 h                         | Kuncoro (2004) |
| Rehabilitant     | Matang Wildlife Center, Sarawak | 41      | 23      | 7      | 25      | 2        | 2           | 2      | 96 h                          | Lee (2006) |
| Zoo              | Zoo Negara | 58      | 19      | 11     | 9       | 1        | 2           | 2      | 57 h                          | May (2004) |
| Zoo              | Zoo Tai ping | 43      | 21      | 14     | 10      | 12       | 1           | 1      | 103 h                         | Wong (2003) |
| Zoo              | Singapore Zoo | 50      | 27      | 13     | 8       | 12       | 1           | 2      | 192 h                         | Ting (2011) |
| Zoo              | Singapore Zoo | 80      | 9      | 12     | 7       | 14       | 1           | 1      | 24 h                          | Matsuda et al. (2017) |
| Zoo              | Cleveland Metroparks Zoo, USA | 32      | 15      | 10     | 7       | 3        | 3           | 3      | 3.5 mo                        | Cassella et al. (2012) |
| Free-ranging     | Batang Serangan, Indonesia | 54      | 24      | 15     | 7       | 3        | 3           | 2      | 2300 h                        | Campbell-Smith et al. (2011) |
| Free-ranging     | Danum Valley Sabah | 34      | 47      | 17     | 2       | 1786 h   | 1           | 2      | 1786 h                        | Kanamori, Kuze, Bernard, Malim, and Kohshima (2010) |
| Free-ranging     | Tanjung Puting, Indonesia | 18      | 62      | 18     | 1       | 1        | 1           | 1      | 3805 h                        | Galdikas (1988) |
| Free-ranging     | Mentoko, Indonesia | 45      | 44      | 10     | 1       | 3900 h   | 1           | 1      | 3900 h                        | Mitani (1989) |
| Free-ranging     | Ulu Segama, Sabah | 51      | 32      | 16     | 16      | 1        | 1           | 1      | 1200 h                        | Mackinnon (1974) |
| Free-ranging     | Sauq Balimbing, Indonesia | 24      | 57      | 18     | 18      | 11,700 h | 2           | 2      | 11,700 h                      | Fox, Van Schaik, Sitompul, and Wright (2004) |
| Free-ranging     | Sungai Wain Forest, Indonesia | 20      | 59      | 14     | 14      | 6        | 5           | 6      | 5 mo                          | Fredriksson (1995) |
| Free-ranging     | Tanjung Puting Indonesia | 16      | 51      | 14     | 2       | 18       | 349 h       | 2      | 349 h                         | Snailith (1999) |
| Free-ranging     | Sabangau, Indonesia | 22      | 61      | 15     | 15      | 2        | 5502 h      | 2      | 5502 h                        | Morrogh-Bernard (2009) |
| Free-ranging     | Meratus Forest, Indonesia | 36      | 42      | 17     | 17      | 5        | 14 mo       | 5      | 14 mo                         | Grundmann (2006) |

*a* Behavioral data from semi-captive orangutans using an almost entire island besides BMOUI

*b* Behavioral data from rehabilitant orangutans influenced by the rehabilitation program before reintroduced to Meratus Forest, Indonesia

*Noted that the observation effort in hours would be an important factor influencing the results (activities %), though the number of subjects not in this table may also be an influential factor, especially for the playing category if the subjects include subadults or not.
Contrary to the free-ranging orangutans which are highly arboreal (Delgado & Van Schaik, 2000), the study's captive orangutans were predominantly terrestrial. Although a recent study reports that terrestrial activity in free-ranging orangutans appears more common than previous anecdotal observations (Ancrenaz et al., 2014), it should not be like our captive orangutans with over 85% of their terrestrial behaviors. Therefore, we believe that this study would be a good example to propose a practical way to alter the behaviors of captive orangutans by introducing enrichment devices such as wooden tree platform and/or ropes, based on the clear contrast between the frequent behavioral patterns exhibited by captive orangutans (more stays on the ground) and ideal one exhibited by free-ranging counterparts (almost completely arboreal). In the meantime, we found an age-related difference at the terrestrial level in this study: adults with larger body sizes were more terrestrial than the subadult. This may be because larger individual is more dangerous for falling down from high places, and thus the adults would show higher terrestriality, though differing environmental conditions in two different enclosures may simply have created this inconsistency.

**Postural behavior**

Similar to our observations of postural behaviors in this study, other studies have found that most resting time is spent sitting and lying down (Matsuda, Chapman, Shi Physilia, Mun Sha, & Clauss, 2017; Sugardjito & Van Hooff, 1986; Thorpe & Crompton, 2006). Sitting while feeding has consistently been more common in other studies (Cant, 1987; Sugardjito & Van Hooff, 1986; Thorpe & Crompton, 2006), although pronograde standing was relatively common in our subadult male. This is because he sometimes caught foods thrown by tourists from the ground while in a pronograde standing posture; of course such a situation would not arise in free-ranging conditions.

Pronograde standing was the dominant posture during locomotion in our study, in contrast to previous studies in which sitting was the dominant posture while moving (Thorpe & Crompton, 2006). However, previous studies defined a short rest (<5 min) as a “pause,” considered as postural mode during traveling; sitting was the dominant posture (Sugardjito & Van Hooff, 1986; Thorpe & Crompton, 2006). Nonetheless, as in our study, the second most dominant posture was pronograde stand, suggesting overall similarities in posture, although a direct comparison is impossible.

We rarely observed suspensory postures, especially suspensory quadrupedalism (Niemitz, 2010). These are more common in free-ranging orangutans, not only during locomotion but also during feeding. In fact, suspensory postures accounted for about 24% (Thorpe & Crompton, 2006) and 47% (Cant, 1987) of positional behaviors during feeding. Proficient locomotion skills are necessary for reintroduced orangutans to stay safe when resting and foraging high up in trees (Descovich et al., 2011; Grundmann, 2006). Hence, modifying captive orangutans’ environments to promote greater diversity in postural patterns and to approach those of free-ranging orangutans may contribute to their health and survival after reintroduction. One recommendation from this perspective is to suspend food on furnishings including nest boxes, hanging platforms, suspended car tires, trawler nets and wire baskets, and from trees and shrubs to encourage suspensory postures, similar to interventions with other primate species (Britt, 1998).

Lastly, the sort of data presented here was basic; however, it is important to understand the behaviors of captive orangutans in order to work toward improving their housing conditions and ultimately their welfare. The current information is, nonetheless unfortunately, too limited to differentiate if the differences observed among individuals are not just an outcome of inter-individuals rather than age-sex class differences due to the sample size (only one representative of each age-class). Thus, until the captive behaviors of a larger number of orangutans has been described, these results must be considered preliminary and just a case study. Additionally, in future research, we should look into how a certain kind of enrichment (e.g., food enrichment) would affect orangutans’ behaviors by examining pre and post enrichment in terms of their activity budget and posture behaviors.
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**Authors’ contributions**

SNK and BMMZ conceived and designed this study. SNK collected the orangutan behavioral data. SNK and IM analyzed the data. SNK, IM, and BMMZ wrote the paper. All authors read and approved the final version of the manuscript.

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