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INFLUENCE OF LACTATION STATUS ON DAILY BEHAVIOUR OF ADULT FEMALE LONG-TAILED MACAQUES (*Macaca fascicularis*) IN AN EX-SITU BREEDING COLONY

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ABSTRACT

This study aimed to analyse the influence of lactation status on the daily behaviour of adult female M. fascicularis in a breeding colony at CV. INQUATEX, Bogor, Indonesia. To achieve this, ten adult females, five lactating and five non-lactating, were observed using the scan sampling method after a habituation period. Observations were conducted twice daily, in the morning (7–9 a.m) and the afternoon (2-4 p.m.), at 5-minute intervals for 14 consecutive days. During these sessions, behavioural categories recorded included feeding, locomotion, resting, grooming, playing, sexual behaviour, human interaction, aggression, vocalisation, and maternal care. Subsequently, behavioural data were expressed as percentages and analysed using the Mann–Whitney U test. The results showed that non-lactating females exhibited higher proportions of feeding, locomotion, and grooming behaviours, whereas lactating females spent more time resting and performing maternal care. Furthermore, statistical analysis revealed significant differences in locomotion ($p < 0.01$), sexual behaviour ($p < 0.05$), and maternal care ($p < 0.01$) between lactating and non-lactating females. Taken together, these findings indicate that lactation status influences behavioural allocation in adult female M. fascicularis. Therefore, reproductive status should be considered in captive management strategies to support animal welfare and enhance breeding success in ex situ conservation programs.

INTRODUCTION

The long-tailed macaque (*Macaca fascicularis*) is a primate species that plays an important role in various fields, including ecology, medicine, and economics (Fachrozi & Setyawatiningsih, 2020). Ecologically, this species functions as an effective seed disperser, contributing to the regeneration of tropical forests (Pratama et al., 2022). In the medical field, *M. fascicularis* is widely utilised as an animal model for biomedical research and drug development (Ernita et al., 2021). Economically, *M. fascicularis* serves as a key supply species for legal export markets, making a significant contribution to economic activities (Nurwahid & Nizar, 2018). Its remarkable adaptability enables the species to fulfil diverse roles across multiple sectors. The population of *M. fascicularis* is widely distributed throughout Southeast Asia and demonstrates a high capacity to adapt to various natural habitats, such as mangrove forests and riverbanks, as well as human-modified environments, including plantations and residential areas (Nabilah et al., 2018). This high adaptability to diverse food resources supports the species' rapid reproductive capacity (Giraud et al., 2021).

The long-tailed macaque (*Macaca fascicularis*) is classified as Endangered (EN) by the International Union for Conservation of Nature Red List and listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora due to increasing exploitation and threats (CITES, 2026). These concerns have prompted ex situ conservation efforts, such as captive breeding programs. For example, CV. INQUATEX plays an important role in supplying medical research and maintaining populations through managed breeding (Fitria & Rifqiyati, 2022; KSDAE, 2018).

This study addresses the knowledge gap regarding the daily behaviour of adult female M. fascicularis in the ex-situ breeding colony of CV. INQUATEX, where such data have not yet been documented. By systematically analysing their behaviour, we aim to clarify how captivity influences key activities—such as locomotor behaviour, exploration, maternal care, grooming, and social interaction—compared to wild populations. Such understanding is crucial, as these behaviours play essential roles in social bonding and communication, particularly among adult females (Siagian et al., 2023; Sarti et al., 2024; Bimantara et al., 2019).

MATERIALS AND METHODS

The macaques were housed in colony cages for ex situ management, with group enclosures providing visual and limited social interaction. Cages had perches and basic structures to support resting, locomotion, and interaction.

This study involved 10 adult female *M. fascicularis*, comprising 5 lactating and 5 non-lactating females, housed in a breeding colony enclosure. Observations were preceded by a habituation phase aimed at facilitating adjustment between the observer and *M. fascicularis* (Zahra & Winarno, 2017). Behavioural observations were conducted using the scan sampling method. Scan sampling is a technique for directly recording animal activities by observing individuals as the primary objects of study (Santoso, 2020). In this study, scan sampling was performed in the morning from 7 to 9 a.m. and in the afternoon from 2 to 4 p.m. over a two-hour period with five-minute intervals for 14 consecutive days. The behavioural parameters observed included feeding, moving, resting, grooming, playing, sexual behaviour, human interaction, aggression, vocalisation, and parental care. Each observation session consisted of repeated scans at 5-minute intervals, yielding multiple behavioural records for each individual during the observation period. The total number of scans obtained during the 14-day observation period was used to calculate the proportion for each behavioural category.

The initial phase of the study involved habituation to familiarise long-tailed macaques with the observer's presence, thereby facilitating data collection (Zahra & Winarno, 2017). Habituation was conducted through routine activities such as daily health checks, feeding, and fruit provisioning for *M. fascicularis*. The habituation process lasted 1 week and aimed to develop and finalise the ethogram for subsequent use in the scan sampling method. Behavioural observations were systematically recorded, and the observed behaviours were evaluated according to the parameters presented in Table 1.

Table 1. Daily Behavioral Parameters of Adult Female *Macaca fascicularis* in the Breeding Colony at CV. INQUATEX

No	Behavioral Parameters	Description
1	Feeding Behavior	Activities involving opening food, placing food into the mouth, chewing, storing food in the cheek pouch, and swallowing.
2	Locomotion Behavior	Movement from one location to another by walking, jumping, or climbing.
3	Resting Behavior	Remaining inactive without performing any activities, such as sitting, sleeping, or lying down.

4	Grooming Behavior	Activities involving self-grooming or grooming of other individuals, such as cleaning the fur from dirt and parasites.
5	Play Behavior	Interactions with objects or other individuals in a relaxed manner, such as swinging or chasing.
6	Sexual Behavior	Activities related to mating, such as courtship, copulation, or sexual grooming.
7	Human Interaction Behavior	Interactions directed toward humans, including approaching, food solicitation, or avoidance.
8	Aggressive Behavior	Activities involving attacking or threatening other individuals, such as biting, chasing, or striking with the hands or feet.
9	Vocalization Behavior	Producing vocal sounds, such as calls, alarm signals, or other forms of communication.
10	Maternal Care Behavior	Activities related to caring for offspring, such as grooming, nursing, or protecting them from threats.

Modified from Heafiz et al. (2023)

Data analysis was conducted using both quantitative and qualitative approaches to identify the most frequently observed behaviours of adult female *M. fascicularis* in the breeding colony enclosure at CV. INQUATEX. The quantitative approach utilised Microsoft Excel to calculate the percentage of each recorded behaviour, which was then presented in tabular form. Behavioural percentages were calculated using the formula.

$$\text{Percentage of behavior x} = \frac{\text{Frequency of behavior x}}{\text{Total number of scans}} \text{ x } 100\%$$

The total number of scans represented the accumulation of all observation points recorded every five minutes during the morning and afternoon observation sessions over 14 consecutive days. This approach allowed the calculation of behavioural proportions based on the relative frequency of each behaviour compared to the total observations obtained during the study period. The qualitative approach involved analysing and interpreting the quantitative results to provide a deeper understanding of the observed behaviours, supported by relevant literature and discussion of the findings. The observation method was designed to be flexible and efficient, enabling the collection of accurate data in accordance with the research objectives (Muslimin et al., 2023).

In addition to descriptive analysis, statistical analysis was performed to determine whether there were significant differences in behavioural patterns between lactating and non-lactating females. The Mann–Whitney U test was used to compare the percentage of each behavioural category between the two independent groups. This non-parametric

test was selected because the sample size was relatively small and the data did not necessarily follow a normal distribution. The analysis was conducted for each behavioural parameter, and a significance level of $p < 0.05$ was used to determine statistically significant differences between groups (Borras-Chavez et al., 2022).

RESULTS AND DISCUSSION

Behavior of Adult Female Macaca fascicularis in the Breeding Colony at CV. INQUATEX

The present study provides a detailed description of daily behavioural patterns of adult female Macaca fascicularis under captive breeding conditions, with particular emphasis on differences associated with lactation status. This study analysed the daily behaviour of adult female *Macaca fascicularis* at CV. INQUATEX, distinguishing between non-lactating individuals (1–5) and lactating individuals (6–10). Non-lactating females exhibited higher levels of exploratory and play behaviours, indicating a broader allocation of energy toward social and motor activities. In contrast, lactating females tended to allocate more time to resting and maternal care behaviours. This pattern is consistent with the increased reproductive and energetic demands during lactation in adult females (DeAngeli et al., 2017). Such behavioural adjustments support previous findings that lactation status influences activity priorities in female primates, particularly in captive environments, where environmental stressors may further affect behavioural dynamics (Almeling et al., 2017).

This study represents one of the first systematic behavioural assessments of adult female Macaca fascicularis in an ex situ breeding colony in Indonesia, with explicit differentiation based on lactation status. By separating lactating and non-lactating females, this research provides more precise insights into how reproductive condition shapes activity budgets and behavioural priorities in captivity. The findings provide practical baseline data for captive primate management, particularly for adjusting enclosure design, environmental enrichment, and husbandry practices based on reproductive status. Moreover, this study strengthens the use of behavioural monitoring as an evidence-based tool to support animal welfare and breeding success in ex situ conservation programs. The daily behaviour of adult female *M. fascicularis* in the

breeding colony cages of CV. INQUATEX, expressed as percentages, is presented in Tables 2 and 3.

Table 2. Daily behavior of non-lactating adult female *Macaca fascicularis* in the breeding colony cages of CV. INQUATEX (%)

Individual	Behavioral Parameters									
ID	A	B	C	D	E	F	G	H	I	J
1	16,96	14,73	30,96	32,45	1,93	0,89	1,93	0	0,15	0
2	24,17	16,62	26,44	16,31	1,06	0,76	2,27	12,08	0,30	0
3	24,30	18,85	28,19	17,91	0,47	0,62	2,18	7,01	0,47	0
4	18,75	14,43	31,85	30,95	0	0	1,64	0	0	0
5	24,05	17,72	28,80	19,62	0,32	0,95	2,06	6,33	0,16	0
Mean	21,65	16,47	29,25	23,45	0,76	0,66	2,02	5,08	5,13	0

Note: Behavioral values are expressed as percentages of occurrences over a 14-day observation period. Behavioral categories include: A. Feeding, B. Locomotion, C. Resting, D. Grooming, E. Playing, F. Sexual behavior, G. Human interaction, H. Aggressive behavior, I. Vocalization, and J. Maternal care. Individuals (1–5) represent non-lactating adult females.

Table 3. Daily behavior of non-lactating adult female *Macaca fascicularis* in the breeding colony cages of CV. INQUATEX (%)

Individual	Behavioral Parameters									
ID	A	B	C	D	E	F	G	H	I	J
6	18,15	11,46	34,23	22,47	0,74	0	1,49	0	0	13,84
7	17,88	12,37	30,40	22,80	0,75	0	1,64	0	0,30	13,86
8	17,53	10,70	29,87	20,51	0	0	2,53	0	0,45	18,42
9	18,45	11,90	30,36	19,79	0	0	1,79	0	0,15	17,56
10	18,30	12,20	29,02	21,58	0	0	2,08	0	0,15	16,67
Mean	18,06	11,76	30,78	21,43	0,29	0	1,91	0	0,21	16,07

Note: Behavioral values are expressed as percentages of occurrences over a 14-day observation period. Behavioral categories include: A. Feeding, B. Locomotion, C. Resting, D. Grooming, E. Playing, F. Sexual behavior, G. Human interaction, H. Aggressive behavior, I. Vocalization, and J. Maternal care. Individuals (6–10) represent lactating adult females.

Behavioral Comparison of Lactating and Non-lactating Macaca fascicularis

The behavioural comparison between lactating and non-lactating adult female Macaca fascicularis revealed differences in several daily activity patterns within the breeding colony enclosure. Resting behaviour accounted for the largest proportion of daily activities in both groups, 29.25% in non-lactating females and 30.78% in lactating females. This finding indicates that resting is a dominant activity in captive macaques, which is generally associated with energy conservation and adaptation to captivity. In captive primates, resting behaviour often occupies a large portion of the daily activity budget due to stable food availability and reduced environmental pressures compared with wild populations (Li et al., 2023). Feeding and grooming behaviours were also frequently observed in both groups. Grooming behaviour accounted for 23.45% in non-lactating females and 21.43% in lactating females, indicating its important role in

maintaining social bonds and reducing social tension among group members. Grooming is widely recognised as a key affiliative behaviour in primates that helps maintain group cohesion and social stability (Disarbois & Duhamel, 2024).

Statistical analysis using the Mann–Whitney U test revealed significant differences in locomotion, sexual behaviour, and maternal care between lactating and non-lactating females. Non-lactating females showed significantly higher locomotion ($p < 0.01$), suggesting that lactating females move less due to the energetic costs of milk production and infant care. Lactation increases metabolic demands in female primates and can alter their activity as they allocate energy toward offspring care (Webb et al., 2023). Maternal care behaviour was observed only in lactating females, with a mean of 16.07%, and showed a highly significant difference ($p < 0.01$). This reflects the reproductive role of females in nurturing and protecting infants. Maternal investment is critical for primate reproductive success and infant survival (McFarland et al., 2024). Sexual behaviour occurred only in non-lactating females and was significantly different ($p < 0.05$). This may relate to hormonal and reproductive conditions, as lactating females often experience temporary suppression of reproductive cycles. Other behaviours such as feeding, resting, grooming, playing, human interaction, aggression, and vocalisation did not differ significantly between groups ($p > 0.05$). These activities represent general daily behaviours that occur regardless of lactation status in captive long-tailed macaques.

Table 4. Behavioral comparison between lactating and non-lactating adult female *Macaca fascicularis* in the breeding colony of CV. INQUATEX based on the Mann–Whitney U test.

Behavior	Mean Non-lactating (%)	Mean Lactating (%)	U value	p value	Significance
Feeding	21.65	18.06	20.0	0.1508	ns
Locomotion	16.47	11.73	25.0	0.0079	$p < 0.01$
Resting	29.25	30.78	8.0	0.4206	ns
Grooming	23.45	21.43	10.0	0.6905	ns
Playing	0.76	0.3	17.5	0.3321	ns
Sexual	0.64	0.0	22.5	0.0254	$p < 0.05$
Human interaction	2.02	1.91	15.5	0.6004	ns
Aggression	5.08	0.0	20.0	0.072	ns
Vocalization	0.22	0.21	14.0	0.8315	ns
Maternal care	0.0	16.07	0.0	0.0075	$p < 0.01$

Note: Behavioral values are presented as mean percentages of observations during the 14-day observation period. Statistical analysis was performed using the Mann–Whitney U test to determine differences in behavioral frequency between lactating and non-

lactating females. Differences were considered significant at $p < 0.05$ and highly significant at $p < 0.01$. ns = not significant.

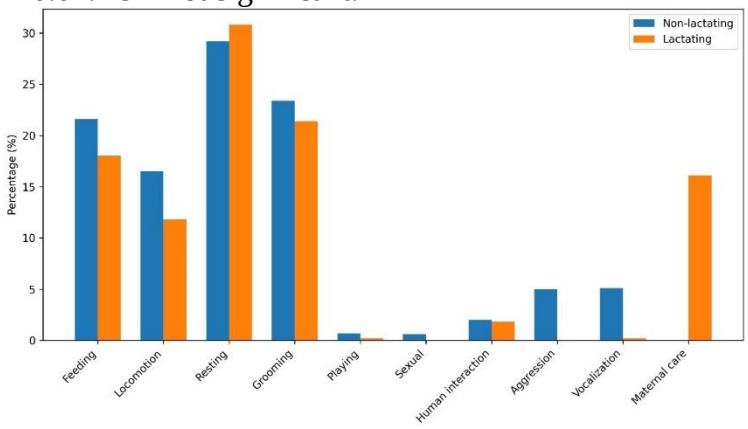

Figure 1. Comparison of daily behavioral activities between lactating and non-lactating adult female Macaca fascicularis in the breeding colony of CV. INQUATEX. Behavioral values are expressed as percentages of observations during the 14-day observation period. (Mann–Whitney U test)

Feeding Behavior

Observation results showed that non-lactating adult female *Macaca fascicularis* spent more time feeding, as presented in Table 2, with percentages from 16,96 to 24,30%. Their longer feeding duration indicates greater involvement in food searching and consumption, essential for meeting daily energy needs (Rizaldy et al., 2016). Non-lactating females can move, explore, and access food more freely, as they are not restricted by infant care (Iffatalya et al., 2023). This pattern suggests non-lactating individuals prioritise resource acquisition. Dominant individuals in primate colonies usually access food more easily and feed without as much competition from other group members (Lemoine et al., 2020). Conversely, lactating adult female long-tailed macaques showed lower feeding percentages, as shown in Table 3, ranging from 17,53 to 18,45%. Their reduced feeding time is mostly linked to their focus on infant care during nursing, limiting time for foraging and food consumption (Santoso, 2020).

Lactating females often occupy lower positions in the social hierarchy, resulting in more limited or more competitive access to food resources than non-lactating individuals (Alam et al., 2022). At CV. INQUATEX, *M. fascicularis* are fed twice daily, with monkey chow provided in the morning and a variety of fruits, such as bananas and snake fruit (*Salacca* spp.), offered in the late afternoon. Despite the regular provision of food, *M. fascicularis* at CV. INQUATEX still exhibited exploratory feeding behaviour in search of additional food sources. This behaviour is consistent with the species' opportunistic,

omnivorous nature (Iffatalya et al., 2023). Opportunistic omnivory is the tendency of individuals to exploit a wide range of available food items in their environment (Chatami et al., 2024). Several adult female *M. fascicularis* at CV. INQUATEX were observed consuming insects and wild grasses found outside the cage area.

Figure 2. Feeding Behavior of Adult Female *Macaca fascicularis* in the Breedin Colony at CV. INQUATEX

Locomotion Behavior

Observation results showed that non-lactating adult female *Macaca fascicularis* spent more time feeding, as presented in Table 2, with percentages from 16,96 to 24,30%. Their longer feeding duration indicates greater involvement in food searching and consumption, essential for meeting daily energy needs (Rizaldy et al., 2016). Non-lactating females can move, explore, and access food more freely, as they are not restricted by infant care (Iffatalya et al., 2023). This pattern suggests non-lactating individuals prioritise resource acquisition. Dominant individuals in primate colonies usually access food more easily and feed without as much competition from other group members (Lemoine et al., 2020). Conversely, lactating adult female long-tailed macaques showed lower feeding percentages, as shown in Table 3, ranging from 17,53 to 18,45%. Their reduced feeding time is mostly linked to their focus on infant care during nursing, limiting time for foraging and food consumption (Santoso, 2020).

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Figure 3. Locomotion Behavior of Adult Female *Macaca fascicularis* at CV. INQUATEX

Resting Behavior

The observation results indicated that non-lactating adult female *Macaca fascicularis* spent less time resting, as shown in Table 2, with percentages ranging from 26,44 to 31,85%. Non-lactating females were more actively involved in exploration, foraging, and social activities, thereby reducing the time allocated to resting (Sarti et al., 2024). This pattern reflects differences in behavioural priorities between females focused on maternal care and adult females that are more oriented toward resource acquisition. Nevertheless, non-lactating female *M. fascicularis* still require adequate resting time to support optimal physiological functioning, including effective digestion and a sense of security within cohesive social groups (Sinta & Hakim, 2022). Dominant females also tend to have better access to more comfortable and secure resting sites.

In contrast, lactating adult females spent more time resting, as presented in Table 3, with percentages ranging from 29,02 to 34,23%. Lactating *M. fascicularis* require increased resting periods and often share resting spaces with other group members. This increased resting behaviour is associated with the need to restore energy expended during milk production and intensive infant care (Bandini et al., 2022). Lactation is an

energetically demanding process that significantly influences time allocation for rest. The physiological condition of lactating females requires additional recovery time to support the elevated metabolic demands during lactation (Samuni et al., 2020). Resting behaviour is therefore essential to allow the maternal body to recover following periods of intense activity, such as feeding or locomotion (Zeksen et al., 2021). According to Albanese et al. (2021), the resting duration of adult female *M. fascicularis* varies depending on food quality and social density. Observations at the breeding colony cages of CV. INQUATEX showed that adult female *M. fascicularis* frequently rested in more concealed areas, such as cage corners, likely to enhance their sense of safety.

Figure 4. Resting behavior of adult female *Macaca fascicularis* at CV. INQUATEX

Grooming Behavior

The observation results showed that non-lactating adult female *Macaca fascicularis* engaged in grooming behaviour more frequently, as presented in Table 2, with percentages ranging from 16,31 to 32,45%. Grooming is a crucial activity that serves not only hygienic functions but also plays an important role in strengthening social bonds among individuals within a group (Putri et al., 2023). Grooming behaviour also contributes to stress reduction and reinforces social relationships, particularly between subordinate and dominant individuals. Non-lactating females tend to be more socially active and therefore have greater opportunities to participate in grooming interactions. This behaviour supports the establishment and maintenance of social bonds and the preservation of social status within the group (Dewi et al., 2024).

In contrast, lactating females exhibited reduced grooming behaviour, as shown in Table 3, with percentages ranging from 19,79 to 22,80%. This reduction may be attributed

to their prioritisation of maternal care. Lactating adult females allocate a substantial portion of their time to caring for their offspring, thereby limiting the time available for social activities such as grooming. Additionally, the lower social rank often occupied by lactating females within the group hierarchy may influence the frequency of their participation in grooming interactions. Dominant individuals within the group tend to receive grooming more frequently and for longer durations, a pattern influenced by social proximity and kinship relationships (Hidayat et al., 2019).

Figure 5. Grooming behavior of adult female *Macaca fascicularis* at CV. INQUATEX

Playing Behavior

The observation results showed that non-lactating *Macaca fascicularis* females exhibited play behaviour more frequently, as shown in Table 2, with a percentage ranging from 0 to 1.93%. Playing behaviour was generally observed among individuals who were not involved in infant care. Non-lactating females tended to engage more in physically oriented and exploratory social interactions, which support their social development within the group (Azwir et al., 2021). In contrast, lactating females displayed lower levels of playing behaviour than non-lactating females, as shown in Table 3, with percentages ranging from 0 to 0,75%. The observed play behaviour in lactating females indicates that, although they are actively engaged in maternal care, these individuals still seek opportunities to divert attention or release excess energy, albeit under more limited conditions (Entezami et al., 2024). This pattern reflects that maternal responsibilities reduce opportunities for lactating females to engage in play or broader social interactions (Jawadi & Rita, 2019).

Play behaviour in *M. fascicularis* is more commonly observed in juveniles; however, adults may also participate in play (Jawadi & Rita, 2019). According to Syafutra

(2024), playing behaviour contributes to the development of motor and cognitive skills. Play may involve physical interactions with conspecifics or manipulation of objects within the environment. This behaviour is typically performed to channel excess energy or reduce boredom (Munir et al., 2019). Observations in the breeding colony cages of CV. INQUATEX revealed that adult female *M. fascicularis* exhibited playing behaviour such as pulling each other's tails, swinging, and manipulating detached cage wire objects.

Adult female long-tailed macaques (*M. fascicularis*) that engage in object play, such as manipulating detached cage wires, may use this behaviour as a form of self-entertainment. However, this type of play can have negative consequences. Detached cage wires pose a risk of physical injury if individuals interact with them carelessly. Injuries caused by sharp objects, such as cage wires, increase the risk of wounds and infections, potentially compromising animal health (Tarigan et al., 2023). Furthermore, frequent interaction with inappropriate objects reflects a lack of natural, varied mental stimulation in captivity. Insufficient environmental enrichment may lead to maladaptive behaviours, such as boredom, which can result in unproductive or even destructive activities (Van Oosten et al., 2025). Playing behaviour plays an important role in social development by providing opportunities for individuals to interact with other group members. For adult female *M. fascicularis*, play also contributes to the establishment of social bonds and the enhancement of non-verbal communication skills (Wibowo, 2017).

Figure 6. Playing behavior of adult female *Macaca fascicularis* at CV. INQUATEX

Sexual Behavior

The observation results showed that non-lactating female *Macaca fascicularis* exhibited a higher percentage of sexual behaviour, as presented in Table 2, ranging from 0 to 0,95%. This pattern occurs because females in the non-lactating phase are more frequently involved in sexual interactions with males within the colony. During this phase, the female body is not constrained by infant care, allowing individuals to allocate more attention to reproductive behaviour. Non-lactating females experience sexual motivation influenced by their reproductive cycle, which is associated with increased levels of estrogen and progesterone that stimulate sexual behaviour (Dewi & Cline, 2021).

Figure 7. Sexual behavior of adult female *Macaca fascicularis* at CV. INQUATEX

According to Table 3, lactating females did not exhibit sexual behaviour during the observation period. This absence of sexual activity is directly associated with the lactation process, which suppresses sexual motivation as the female's physiological resources are prioritised toward milk production and infant care, both of which require substantial energy investment. Lactating females experience lactational anovulation, a condition that reduces the likelihood of ovulation and suppresses sexual drive (Titisari et al., 2021). Lactational anovulation in female *M. fascicularis* is a natural physiological condition in which ovulation does not occur during the nursing period due to elevated prolactin levels, which inhibit the release of ovulation-stimulating hormones such as gonadotropin-releasing hormone (GnRH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH) (Yue et al., 2024). In addition to physiological constraints, lactating females tend to prioritise infant care and actively avoid social disturbances or potential conflicts that could disrupt social stability. Although lactating females may still engage in sexual behaviour, such occurrences are extremely rare and are strongly influenced by

maternal priorities and biological mechanisms that suppress further reproductive activity during this period (Kobayashi et al., 2017).

Human Interaction Behavior

The observation results showed that non-lactating female *Macaca fascicularis* interacted more frequently with humans, as presented in Table 2, with percentages ranging from 1,64 to 2,27%. These individuals tended to be more open to social interaction and more frequently engaged with humans, both within the captive environment and in situations involving routine human supervision. This increased interaction reflects greater behavioural flexibility and habituation to human presence (Mashuri, 2024). In contrast, lactating females more frequently avoided interactions with humans, although a slight increase in interaction frequency was observed in Table 3, with percentages ranging from 1,49 to 2,53%. Lactating individuals tended to remain in calmer areas and avoid disturbances in order to focus on infant care. This avoidance behaviour may also be influenced by social hierarchy within the group, as lactating females often occupy lower hierarchical positions and therefore tend to avoid attention or potential disturbances from humans (Sinta & Hakim, 2022).

Several adult female *M. fascicularis* at CV. INQUATEX were observed to be more tolerant of human presence, particularly individuals accustomed to receiving food or attention from animal caretakers. Patterns of avoidance or attraction toward humans illustrate how adult female *M. fascicularis* adapt to human presence in captive environments. Avoidance of human interaction is commonly a response to discomfort or fear arising during such encounters (Syafutra, 2024). Conversely, females that show attraction to humans tend to adapt more readily to captive conditions, indicating greater comfort with human-associated environments (Suwannarong et al., 2023). Human interaction behaviour also reflects the level of anxiety or stress experienced by adult female *M. fascicularis* in captivity. Although *M. fascicularis* does not have an inherent attraction to humans, individuals may learn to interact with humans through stimuli from caretakers or others in their surroundings (Oryza et al., 2019).

Figure 8. Human interaction behavior of adult female *Macaca fascicularis* at CV. INQUATEX

Aggressive Behavior

The observation results showed that non-lactating female *Macaca fascicularis* exhibited higher levels of aggressive behaviour, as presented in Table 2, with percentages ranging from 0 to 12,08%. This behaviour occurred because non-lactating females were more frequently involved in social competition for resources, including food and access to social interactions. In contrast, lactating females showed lower levels of aggressive behaviour, with none recorded in Table 3 (0%). This reduction in aggression can be explained by the prioritisation of infant care, which decreases involvement in social conflicts and competitive interactions. Females occupying lower social ranks tend to avoid confrontations that could disrupt maternal care activities (Sinta & Hakim, 2022).

Aggressive behaviour in female *M. fascicularis* constitutes an integral component of group social dynamics. Dominant females often use aggression to maintain their positions within the social hierarchy, whereas lower-ranking females may exhibit aggression as a strategy to improve their status or secure access to limited resources (Ziyus et al., 2019). Aggression may manifest in various forms, ranging from vocal threats to physical confrontations. In adult female *M. fascicularis*, aggressive behaviour is more frequently observed during competition for food, access to mates, or when individuals perceive threats from more dominant group members (Santoso, 2020).

The breeding colony cages at CV. INQUATEX, characterised by limited space and insufficient resource availability, may further contribute to elevated levels of aggressive behaviour. Aggression can also arise as a response to discomfort or boredom resulting from inadequate social and physical stimulation in captive environments. Dominance

relationships among female *M. fascicularis* play a crucial role in regulating the group's social structure (Fultz et al., 2019). Dominant individuals employ aggressive behaviour to enforce social order, while lower-ranking females may engage in conflict to attract attention or improve their social standing (Fitria et al., 2020).

Figure 9. Aggressive behavior of adult female *Macaca fascicularis* at CV. INQUATEX

Vocalization Behavior

The observation results indicated that non-lactating female *Macaca fascicularis* exhibited vocalisation behaviour more frequently, as shown in Table 2, with percentages ranging from 0 to 0,47%. Non-lactating adult females were more actively involved in communication with group members, serving both social functions and warning purposes, such as alerting conspecifics to potential threats. In contrast, lactating females vocalised less frequently, as presented in Table 3, with percentages ranging from 0 to 0,45%, as they tended to maintain calm conditions and avoid disturbances while caring for their infants. Adult female *M. fascicularis* housed in the breeding colony cages at CV. INQUATEX were commonly observed producing vocalisations as signals anticipating the arrival of animal caretakers during feeding times. Vocalisations serve diverse functions, including gathering group members, deterring potential threats, expressing social dominance, repelling intruders, and marking territorial boundaries (Siagian et al., 2023).

Vocalisation behaviour represents one of the primary communication mechanisms in *M. fascicularis* social systems. Vocal signals help maintain appropriate inter-individual distances and provide early warnings of danger (Marsuki, 2022). The variety of vocalisations produced allows individuals to express emotional states, signal threats, or

reinforce social dominance. Dominant females tend to vocalise more frequently to assert control and issue warnings to other group members (Zeksen et al., 2021). Overall, vocalisation behaviour observed in *M. fascicularis* within the breeding colony cages at CV. INQUATEX was less frequent than reported in wild populations.

Figure 10. Vocalization behavior of adult female *Macaca fascicularis* at CV. INQUATEX

Maternal Care Behavior

The observation results indicated that non-lactating female *Macaca fascicularis* were not involved in maternal care behaviour, as shown in Table 2. In contrast, lactating females devoted a substantial proportion of their time to caring for their offspring, as presented in Table 3, with percentages ranging from 13,84 to 18,42%. Maternal care constitutes the primary priority during the lactation period, and although lactating females often occupy lower social positions within the group, caregiving remains their main focus (Touitou et al., 2021). Lactating females share space with dominant individuals; however, maternal attention is consistently directed toward ensuring offspring survival, which represents the central objective of the lactation phase (Munir et al., 2019).

Maternal care behaviour in adult female *M. fascicularis* centres on direct offspring care provided by the mother and is essential for the survival and development of young individuals. Female *M. fascicularis* mothers engage in nursing, grooming, and protecting their offspring from potential threats (Samuni et al., 2020). Beyond ensuring physical survival, maternal care also contributes to the formation of social bonds within the group. This behaviour is particularly important in captive settings, where social pressures or spatial limitations may increase stress levels among juveniles (Bandini et al., 2022). Offspring receiving adequate maternal attention and care tend to exhibit better health and

higher developmental success. In addition to maternal involvement, group members also play a role in monitoring and caring for young individuals, reflecting the importance of cooperative group dynamics for overall survival (Heafiz et al., 2023).

Figure 11. Maternal care behavior of adult female *Macaca fascicularis* at CV. INQUATEX

CONCLUSION

The results of this study indicate that lactation status influences the daily behavioural patterns of adult female *Macaca fascicularis.* Non-lactating females showed higher levels of active behaviours such as feeding, locomotion, and grooming, while lactating females spent more time resting and performing maternal care. Statistical analysis revealed significant differences in locomotion, sexual behaviour, and maternal care between the two groups. These findings highlight the importance of considering reproductive status in captive management strategies to support animal welfare and improve breeding success.

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