

RESEARCH ARTICLE



Ex-Situ Management and Daily Behaviours of Southern Red Muntjak (*Muntiacus muntjak*, Zimmermann 1780) in Semarang Zoo, Central Java, Indonesia

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Abstract

The Southern Red Muntjak, or barking deer, is widely distributed in Southeast Asia. Muntjaks are commonly raised ex-situ due to their ability to breed efficiently and adapt to diverse environmental conditions. This research aimed to evaluate ex-situ management practices and explore the daily behaviours of muntjaks in captivity. Data were collected from October to November 2023 through direct observation and interviews with the managers and zoo staff on aspects such as enclosures, diet, health monitoring, and population management. Daily behaviour data were gathered using scan sampling. Semarang Zoo has seven muntjak individuals of varying ages. The enclosure was 15 x 5 x 2 m, equipped with shelters, drinking facilities, and feeding areas. Feeding was practiced once a day. The zoo followed veterinary recommendations for diet composition, including water, spinach, papaya, banana, and cucumber. The enclosures provided ad-libitum water access and were supplemented with mineral blocks to meet mineral requirements. Zoo staff cleaned feeding areas daily, and health monitoring, including routine parasite evaluation, was performed every three months. There are 14 distinct behaviours were identified, with relaxed state or resting behaviour being the most frequent (59–69%), followed by consuming (14–20%), movement (5–6%), foraging and self-directed behaviour (2–3%), and other activities. Muntjaks exhibited heightened sensitivity to human presence, often becoming alert or running when approached or disturbed. The predominantly male population required active management to maintain reproductive success.

Keywords: behaviour, enclosure, feeding, muntjak, Semarang Zoo

1. Introduction

Ex-situ conservation programs, including zoos, play a crucial role in supporting the conservation of species across various conservation statuses. Zoos contribute to this goal by maintaining healthy populations that can potentially be reintroduced into natural habitats. They also play essential roles in education, research, and the preservation of genetic diversity through breeding programs, helping to prevent inbreeding and sustain population viability [1,2]. Additionally, animals affected by habitat destruction, poaching, or other threats can find refuge in zoos. While ex-situ conservation provides controlled environments for population management, it complements in-situ conservation efforts to ensure the long-term preservation of wildlife [2]. Conservation efforts focus on ensuring the sustainability of these species by linking ex-situ and in-situ strategies.

Both approaches, in-situ and ex-situ conservation, are important and complementary, and zoos can play a significant role in supporting in-situ conservation efforts by providing expertise, resources, breeding facilities and reintroduction programs [2]. The success of ex-situ conservation programs for wildlife depends on several factors, including the management system, the role of society in conservation efforts [3], and the effectiveness of reintroduction programs. For instance, the self-supporting captive breeding program for Timor deer in West Nusa Tenggara involves the participation of local people in breeding and reintroducing deer into the wild, which helps to bridge the social and conservation [3,4].

Semarang Zoo is located in Semarang, Indonesia [5]. The zoo presents both domestic and foreign animals, with a wide range of species maintained inside [3]. Semarang Zoo offers a concept that integrates conservation, education, and recreation. The Semarang Zoo demonstrates this concept by regularly adding and maintaining animal and plant collections and supporting facilities. Forty species comprise the current animal collection, with 24 classified as mammals, including the Southern Red Muntjak [5].

The Southern Red Muntjak (*Muntiacus muntjak*, Zimmermann 1780) is a species of deer native to Southeast Asia, commonly called the "barking deer" due to its distinctive alarm call. This species is part of the genus *Muntiacus*, which includes several other species of muntjaks. The Southern Red Muntjak is characterized by its small size, soft, short, brownish, or greyish hair, and omnivorous diet. It is a terrestrial mammal that inhabits forests and is resilient to changes in its habitat. Initially known as the Indian muntjak or common muntjak, taxonomists revised the species to represent only populations of Sunda and possibly Malaysia, attributing other populations to *Muntiacus vaginalis* (northern red muntjak) [6].

Muntiacus muntjak is widely distributed across Indonesia. It is known by various local names, such as "kijang" in Sumatera, Java, and Bali, and "menjangan" in Kalimantan [7]. The species is listed as Least Concern (LC) on the IUCN Red List, indicating a relatively stable population. Furthermore, muntjak is protected in Indonesia under the Ministry of Environment and Forestry Regulation Number 106 of 2018, which aims to safeguard the country's plant and animal species.

The body size of the muntjak is smaller compared to other the deer. The length of its body from head to tail is approximately 89–135 cm, its shoulder height is 40–65 cm, and its body weight ranges from 25–35 kg. The male muntjak is characterized by antlers with a length of 12–15 cm [8]. The muntjak has curved tines only present on the upper jaw, approximately 2.5 cm in length. In general, adult muntjak is solitary and pair during mating season. According to Ekanasty [9] and Nagarkoti et al. [10] almost 97% of muntjak found in their natural habitat at Ujung Kulon National Park lead solitary lives. The muntjak is an active animal during both day and night. The mating season for this species lasts throughout the year, with a gestation period of about six months and a single offspring per birth. Females can reach reproductive maturity at nine months, while males at 11 months. The lifespan of muntjak in captivity can reach 15 to 21 years [8].

Understanding animal behaviour, including social interactions, feeding patterns, and responses to environmental stimuli, is recognized as providing valuable insights into their needs and preferences. This knowledge is regarded as the foundation for effective management practices aimed at optimizing animal health, productivity, and quality of life. Furthermore, it is emphasized that the identification of stressors, disease outbreaks, or deviations in behaviour, which may signal underlying health issues, is facilitated by this understanding, allowing for timely interventions to be implemented [11,12]. The study aimed to investigate the management system and daily behaviour of muntjak at Semarang Zoo. The findings are expected to serve as guidelines to enhance breeding success and support the effective management of muntjak.

2. Methods

Data management practices and daily behavioural observation were conducted at the herbivore enclosure area of Semarang Zoo (−6.972311°N, 110.311404°E) from October to December 2023. The average daily temperature during the observation period ranged from 31.7°C to 33.4°C with clear skies and light rain. The observation of the management and behaviour of muntjak at Semarang Zoo was conducted on a single group, or one family, consisting of four deer individuals and kept in one enclosure. The age structure was differentiated into adult males, adult females, and two young individuals. The equipment used in the observation included data sheets, writing tools, time recorders, and cameras.

Data were collected during the zoo's normal operating hours, generally Monday to Friday (08:00 AM to 3:00 PM). Data collection for animal management was conducted through direct observation in the field, interviews with keepers and veterinarians. Before conducting

daily behavioural observations, researchers compiled a list of behaviours or Ethogram, which was obtained through a literature review of existing research related to muntjak.

Behavioural data was collected using scan sampling over a period of five days from 9:00 AM to 3:00 PM WIB. Activity recording was done every two minutes as a "point sample," resulting in a total observation time of 1,800 minutes. Data was recorded in pre-prepared data sheets. The behaviour used in the observation was adopted from the research by Aktar et al. [13] which categorized into 13 behaviours and modified into 14 behaviours by adding the behaviour of nursing (Nursing/NU). The behaviour of deer in the enclosure is presented in Table 1.

Table 1. The list of muntjak daily behaviour and its description

Behavioral categories	Description
Foraging (FG)	Searching for food
Consuming (CO)	Taking food or water for survival
Movement (MV)	Changing location
Relaxed state (RS)	Animals are in active state
Investigative (IV)	Response to stimuli or potential stimuli
Self-directed behavior (SD)	Animals perform activities focused on themselves, including grooming, scratching, or other self-maintenance behaviours
Affinitive interaction (AI)	Direct physical contact between individuals, without obvious conflict
Agonistic interaction (AG)	Aggressive behaviors with or without direct body contact
Submissive behavior (SB)	The behaviors of an inferior animal when approached by a dominant animal
Sexual (SE)	Behavior related attract opposite sex for reproduction
Scent marking & deposition (MD)	Behaviour associated with exploring a new area or an object
Vocalization (VO)	Gives calls usually on sensing a predator or during withdrawal to an approaching male who attempt to mount
Elimination (EL)	Release urine or feces from body
Nursing (NU)	Offspring nurses from its mother

Behavioural data was processed using a Microsoft Excel application in tabular form, whereas data ex-situ management analysis was done descriptively and qualitatively. After the data had been calculated and percentages computed, diagrams and graphs would be used to display it.

3. Results

3.1. Management Practices

3.1.1. Population and reproduction

Semarang Zoo maintained all its deer species through communal or group system. The total population of muntjak at Semarang Zoo consisted of seven individuals. The broodstock comprised four adult males and one adult female. The muntjak were kept in an open enclosure divided into two separate enclosures. One enclosure contained three adult males, while the other housed a group of four individuals of varying ages and sexes, including one adult male, one adult female, and their two young calves. The two calves consisted of one female, approximately one year old, and one male, estimated to be about six months old, and were observed exhibiting nursing behaviour with the mother.

3.1.2. Enclosure

The enclosure was approximately eight meters in width and fifteen meters in length. Concrete walls and a netted fence formed the enclosure, which stood about 1.8 m high. (Figure 1). Both enclosures had substrate that were muddy and grassy, with each enclosure containing both natural and artificial shelters. Artificial shelters, such as purpose-built structures, and natural elements like trees or plants, were used. The muntjak enclosure had simple artificial shelter made from wood with tin roofs and concrete structures. For natural shelters, each enclosure contained two or three identified as mango species (*Mangifera* spp.). The primary purpose of an animal enclosure's shelter was to provide a safe and

comfortable refuge for the animals, particularly during bad weather or protection from external threats [14]. The enclosure was also equipped with feeding and drinking containers made from plastic. The feeding area and drinking containers were cleaned daily.

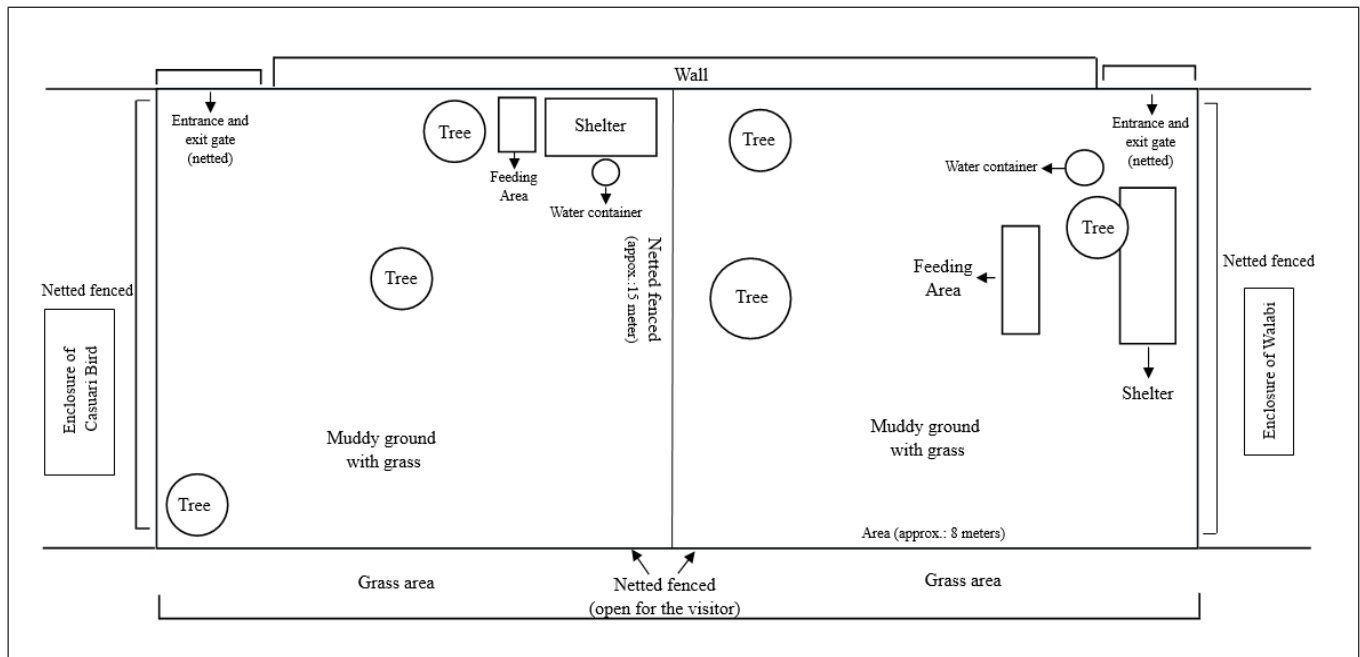


Figure 1. Layout of muntjak enclosure at Semarang Zoo, Central Java, Indonesia (based on visual observation during the present study from October to November 2023).

3.1.3. Feeding

Each zoo had its own guidelines for providing a muntjak diet. The Semarang Zoo provided a diet consisting of vegetables and fruits such as water spinach, carrot, cucumber, papaya, and banana. Muntjak received the diet ad-libitum once a day, between 9:00–11:00 AM (Figure 2). The Alipore Zoological Garden in Kolkata offers a variety of diets, such as wheat bran, crushed barley, leafy vegetables, cabbage green fodder, oats, boiled lentil, soaked gram, red potato, carrot, and banana, and gives them three times a day [15]. Gembira Loka Zoo gave the muntjak of sweet potatoes and peanuts. The supply of feed must be considered in terms of both quality and quantity. Fresh feed should be provided to animals every day, without any storage especially in herbivores. An average of 10% of their body weight in feed was typically given to animals.

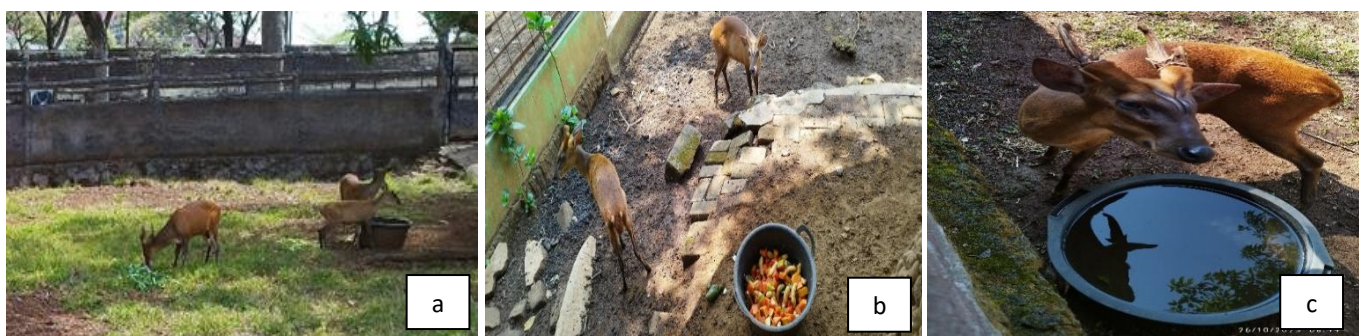


Figure 2. Feeding containers (a and b) and drinking containers (c) were provided in each enclosure.

Semarang Zoo provided mineral block licks, especially for ruminants, with one block in each enclosure. The mineral blocks help to ensure optimal health and development in ruminants, particularly in captive environments where natural nutrient sources may be limited. Furthermore, according to Mondal and Dutta [15], mineral blocks provide consistent nutrients for rumen microorganisms and host animals. They adjust the rumen environment,

improve rumen fermentation, aid in nutrient digestion and absorption, and address any deficiencies or imbalances in nutrient intake.

3.1.4. Veterinary care

The animals at Semarang Zoo were cared for by three veterinarians, while zookeepers handle enclosure cleaning, animal feeding and health monitoring. A veterinarian performed health checks, including endoparasite checks, on the muntjak and other animals every three months. According to the veterinarian's information, diseases that affect deer generally also affect in muntjak, such as worm infestations, attacks by ectoparasites like flies, and injuries from fighting.

3.2. Daily Behaviours

Muntjak behaviour research in captivity has been conducted by several researchers, such as [13,15]. The observation indicated that the most dominant behaviour across all age groups in one group of muntjak at Semarang Zoo is the relaxed state (RS) followed by consuming (CO), behaviour and movement behaviour (Table 2 and Figure 3).

Table 2. The percentage of time spent in major behaviour of muntjak based on age classes.

Behaviour categories	Behaviour percentage (%)			
	Adult male	Adult female	Young male	Young female
Foraging (FG)	3.33	4.86	4.65	2.21
Consuming (CO)	15.34	17.24	20.46	14.92
Movement (MV)	6.76	6.41	5.75	6.08
Relaxed state (RS)	63.20	64.31	59.07	69.72
Investigative (IV)	0.75	1.22	4.65	2.21
Self-directed behaviour (SD)	3.97	3.98	2.99	3.65
Affinitive interaction (AI)	3.22	0.66	0.00	0.11
Agonistic interaction (AG)	0.00	0.00	0.00	0.00
Submissive behaviour (SB)	0.21	0.00	0.00	0.00
Sexual (SE)	2.25	0.00	0.00	0.00
Scent marking & deposition (MD)	0.11	0.44	1.11	0.00
Vocalization (VO)	0.00	0.00	0.11	0.00
Elimination (EL)	0.86	0.88	1.22	0.11
Nursing (NU)	0.00	0.00	0.00	1.00

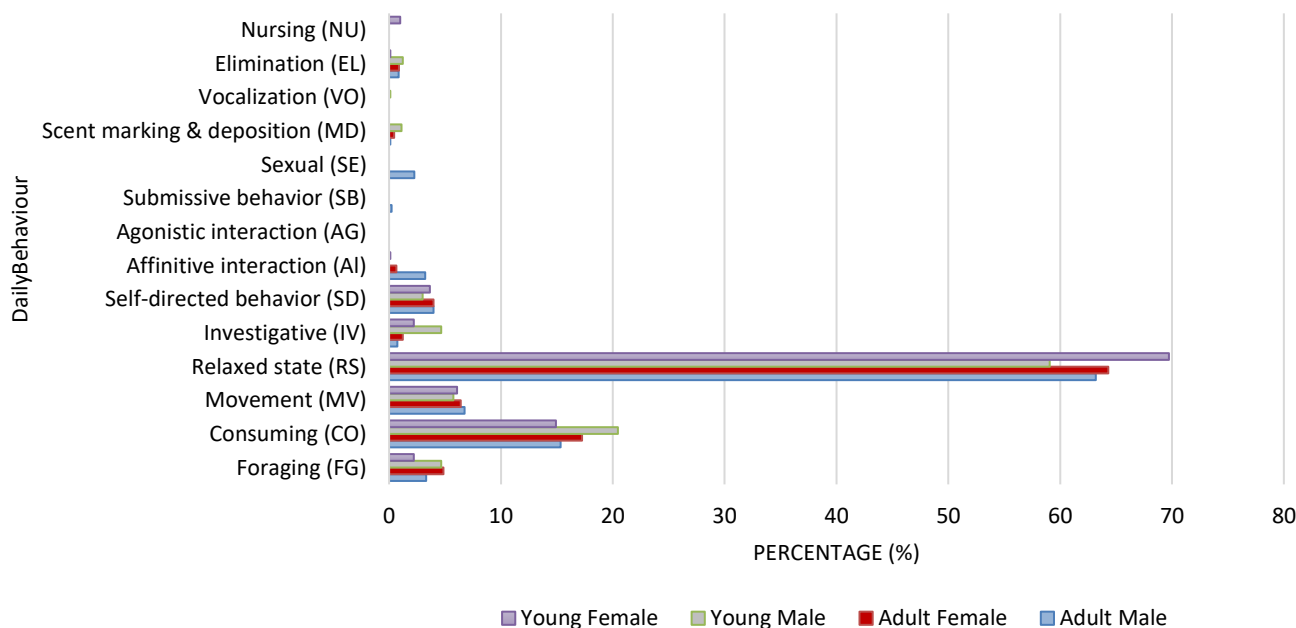


Figure 3. The percentage of time muntjak at Semarang Zoo allocated to various daily behaviour, including feeding, resting, walking and other activities, based on the observational data collected during the study period.

3.2.1. Foraging (FG)

Foraging behaviour involves a variety of strategies to locate and consume food sources. Our observations indicated that foraging behaviour was still observed despite food being supplied daily. This behaviour included eating grass inside and around the enclosure and consuming fallen leaves or fruits. It demonstrated that the animals were not solely reliant on the provided food and continued to use their natural instincts to search for food. Table 2 represents the highest foraging percentage in young males (4.65%) and the lowest in young females (2.2%).

3.2.2. Consuming (CO)

Consuming behaviour consisted of drinking, eating, and rumination. Consuming behaviour in the four observed muntjak individuals was the second largest behaviour after resting. The observation resulted that deer had eating behaviour throughout the day. In terms of consuming behaviour, young males also show a higher percentage (20.46%) compared to young females (14.9%).

3.2.3. Movement (MV)

Movement behaviour was characterized by the animals' transition from one place to another. Moving behaviour is distinguished into two types: running and walking. Running movements are typically observed during chasing or when sensing a threat. Muntjak are among the animals known for their high alertness. If they sense a threat, muntjak will become vigilant and exhibit running behaviour back and forth, sometimes even while jumping. While walking, deer also demonstrate slow and cautious movements, often pausing momentarily and standing still. Male deer were seen to engage in short runs, usually after resting, eating, or defecating. In terms of movement behaviour, the percentages were relatively close between young males (5.75%) and young females (6.10%). However, young females showed a slightly higher percentage of movement than young males.

3.2.4. Resting (RS)

Resting or relaxed state behaviour was shown with the highest frequency during observations on the four deer individuals. Some behaviours categorized as resting behaviour include standing, sitting, and sleeping. Deer are often observed resting in a standing position, still and staring ahead [15], with their heads facing upwards and legs straight. When sitting, the front legs are often tucked under the body. The sleeping position of deer is seen in a curled-up position, with the head curved into a semi-circle and resting on the neck. The resting and relaxed state behaviour was shown in Figure 4a and Figure 4b.



Figure 4. Three different behaviours observed in muntjak at Semarang Zoo, including resting behaviour characterized by a stationary posture (a), a relaxed state with minimal physical activity (b), and consuming behaviour, such as feeding or drinking (c).

The results showed that relaxed behaviour was exhibited at different levels across age and sex groups. Adult females displayed the highest percentage of relaxed behaviour (64.31%), followed closely by adult males (63.20%). Young females exhibited the highest level among

juveniles, with 69.72% of their activities being relaxed, while young males demonstrated the lowest percentage (59.07%). These findings suggest that younger individuals, especially males, spent less time in relaxed states, potentially reflecting their higher engagement in exploratory and active behaviours.

The rumination process in herbivorous animals is known to be divided into four stages. The first stage involves biting or pulling grass or other food. The second stage involves coarse chewing, where the food is quickly digested without being chewed thoroughly. The third stage is regurgitation, where some food is digested and then returned to the mouth to be chewed again thoroughly in the final stage. After re-chewing, the animal swallows its food, which has been broken down into smaller particles. The food then continues its process in the stomach for further digestion. During this food digestion process, rumination behaviour performed concurrently with resting behaviour. The consuming behaviour was shown in Figure 4c.

3.2.5. Investigative (IV)

The investigative behaviour pattern includes behaviours such as flehmen, scanning, moving ears, or biting and licking an object. This behaviour occurs in both male and female deer. Investigative behaviour aims to explore the environment by raising the head vertically for a few moments. This behaviour was also observed when deer suddenly hear loud noises; they engage in scanning and also move their ears [15]. The results showed that investigative behaviour was exhibited at varying levels across age and sex groups. The highest level of investigative behaviour was observed in young males (4.65%). In contrast, it was displayed less frequently by adult males (0.75%) and adult females (1.22%). Young females demonstrated a moderate level of investigative behaviour (2.2%).

3.2.6. Self-directed (SD)

Self-directed behaviour was often observed in these animals, as they frequently lick their bodies or their own preorbital glands, groom their fur with their incisors, and scratch their bodies using their hind claws. The behaviour pattern of shaking the head and body is usually performed after eating, sitting, and sleeping. Moving the tail is also part of self-care behaviour to ward off flies or other insects that may be clinging to their bodies (Figure 5).

The results showed that self-directed behaviour was exhibited consistently across age and sex groups, with minor variations. Adult females displayed the highest percentage of self-directed behaviour (3.98%), followed closely by adult males (3.97%). Young females demonstrated a slightly lower percentage (3.6%), while young males exhibited the lowest level of self-directed behaviour (2.99%). These findings suggest that self-directed activities, such as grooming or scratching, were relatively stable across groups, though slightly less frequent in juvenile males.



Figure 5. Self-directed behaviours exhibited by muntjak at Semarang Zoo, including grooming (a), scratching (b), and head shaking (c), as part of their personal maintenance activities.

3.2.7. Affinitive interaction (AI)

Both males and females showed affinitive interaction behaviour by licking each other's bodies. Males were more likely to lick the female's body, while the female licks the male's

body during mating. This behaviour was also observed in male and female parents licking their offspring. Adult males displayed the highest affiliative interactions (3.22%), while adult females showed a notably lower percentage (0.66%). Young females exhibited minimal affiliative interactions (0.1%), and young males did not display any (0.00%).

3.2.8. Submissive (SB)

Submissive behaviour was shown in the form of bowing (withdrawal). It is usually found if there is a dominant male in the group. The body posture will show crouching behaviour where the lower-ranking animal remains still and submissive when approached by the dominant animal. Adult males displayed a low percentage of submissive behaviour (0.21%), while adult females, young males, and young females did not exhibit any submissive behaviour (0.00%). These findings suggest that submissive behaviour was rarely performed, indicating that dominance hierarchies or conflict avoidance might not play a significant role in the observed social interactions.

3.2.9. Sexual (SE)

Sexual behaviour was observed during the observation. Sexual behaviour exhibited includes the male quickly approaching the female, usually from behind with the head or below a horizontal position (Figure 6a). When the female is in heat, the male often places his head on the back or the female's back after licking the vulva and flehmen. This often occurs before mating, and the female usually moves away from the male. The male is often seen licking the vulva when following or standing near a female who appears to be in heat and does not withdraw. The male usually does flehmen as a response to urine.

3.2.10. Nursing (NU)

Nursing behaviour was observed during the observation (Figure 6c). Nursing behaviour is an instinct and instinct possessed by the parent and offspring. The offspring will approach the parent to seek and attempt to find the mother's nipple with head and mouth movements to find the right position. The nursing process will create an emotional bond between the parent and the offspring, resulting in physical contact and touch from the parent to their offspring. In mammals, nursing behaviour typically involves the mother providing milk to her young through lactation. This milk contains nutrients and antibodies that help the young develop and grow. Nursing behaviour also involves behaviours such as grooming, which helps to keep the young clean and free from parasites, and behaviours that promote bonding and social interaction, such as cuddling and playing.



Figure 6. Sexual behaviour (a), nursing behaviour (b), and elimination behaviour (c) observed in muntjak at Semarang Zoo, representing key aspects of their reproductive and physiological activities during the study period.

4. Discussion

4.1. Management Practices

Every zoo prioritizes animal welfare, as well-cared animals are known to live longer, remain healthier, and produce more offspring. Five key principles are considered essential for ensuring animal welfare: access to food and water, provision of a suitable living environment, health care for sick or injured animals, opportunities to express natural behaviours, and protection from fear and distress [14]. *Muntiacus muntjak* is known as a polyestrous type,

which means these animals can go into heat (estrus) and be receptive to mating multiple times within a year. Zoos carefully manage breeding to ensure a consistent supply of pregnancy-related tissues and fluids, which are essential for ongoing research and conservation efforts.

Breeding management included monitoring breeding behaviour, estrus cycles, and mating success. Regular health check-ups and fertility assessments were conducted to ensure that the animals were healthy and capable of reproducing. Additionally, habitat and diet were carefully managed to create optimal conditions for successful breeding. The primary goal of reproduction management for *Muntiacus muntjak* in zoos is to maintain a genetically diverse and healthy population. By monitoring all aspects of their reproductive health and behaviour, informed decisions can be made about pairing individuals for breeding. The species' long-term survival relies on this genetic diversity, as it helps prevent inbreeding and maintain a healthy population.

Muntjaks at Semarang Zoo were housed in groups of 5–7 individuals to support their social and behavioural needs, promote overall well-being, and facilitate naturalistic interactions. For mating purposes, males and females were grouped in ratios ranging from 1:1 to 1:6, allowing for natural breeding behaviour and social interaction to occur.

Observation results indicated that the reproduction management of *Muntiacus muntjak* at Semarang Zoo had not yet been optimally implemented. The population of adult males ready to mate was found to be significantly higher than that of adult females, with a ratio of 4:1. To support a healthy population, increasing the number of females through collaboration with various institutions or other zoos was recommended.

4.2. Behaviour Observations

Based on the observation results, it was shown that the relaxed state behaviour was more dominant across all age classes in the observed group of muntjak. In a controlled environment like a zoo, where stressors were minimized and resources were provided, more relaxed behaviours were displayed by muntjaks. The presence of sufficient food, water, and shelter contributed to an overall relaxed state as they adapted to their surroundings. Muntjaks, which are generally social animals that often lives in small groups, exhibited a relaxed state that indicate a sense of safety and social cohesion within the groups. This allowed individuals to feel secure enough.

The second highest percentage of behaviour was indicated by consuming behaviour. Both adult females and young females exhibited a high percentage of time spent on consuming behaviour. Adult female muntjaks were observed to be in a nursing condition, necessitating a substantial intake of nutrients. During pregnancy and lactation, female herbivores require an increased nutrient intake to support the developing fetus and produce sufficient milk. Inadequate nutrition during these critical periods can lead to lower birth rates, reduced offspring survival, and impaired growth of young animals [16]. The findings highlighted the importance of ensuring that female muntjaks receive an appropriate diet during these stages to promote their health and the well-being of their offspring. Without adequate nutritional support, long-term population dynamics could be negatively impacted.

Muntjak exhibit foraging behaviour through grazing and browsing [13]. They explore their surroundings to find food sources such as fallen leaves or fruits. Additionally, foraging behaviour is also demonstrated through preying and nibbling, as reported by Hofman and Stewart [17]. Young males may have higher energy requirements as they grow, leading to more time spent foraging to meet their nutritional needs.

Males often have faster growth rates, especially as they prepare for future reproductive and competitive roles in adulthood [16]. Young males may be more active and curious, engaging in exploratory behaviours while foraging. This might involve searching for new food sources, which would increase their foraging time compared to young females who may be more conservative in their activity. In some species, young males start learning territorial and competitive behaviours earlier, which might manifest as increased foraging as they test and explore their surroundings for food resources. In some cases, young females might receive more direct care or have a different relationship with their mothers (e.g., spending more time

nursing or near the mother), reducing their need to forage independently compared to males. Since young males also show higher foraging behaviour, they may be more likely to discover additional food sources within the enclosure. This exploratory nature could lead to more consumption opportunities, increasing their food intake.

If young females are still nursing or spending more time near their mothers for care, they might rely slightly more on maternal provision and engage less in independent food consumption. Young males, in contrast, might already be more independent and rely more on foraged food.

5. Conclusions

The maintenance of muntjak at Semarang Zoo is conducted in groups. The sex ratio must be considered in this grouping method, especially under current conditions where the male population is larger than the female population, to ensure breeding is not disrupted. To support the animals' health, variations in feed provision should be considered, including enrichment within the enclosures. The study of daily behaviour identified at least 14 behaviours, dominated by relaxed state, consuming, and movement behaviours. Further research is needed to study daily behaviour in more detail or focus on specific behaviours, including the impact of visitor presence on the behaviour of muntjak in captivity.

Author Contributions

DIDA: Conceptualization, Methodology, Investigation, Data Analysis, Writing, Data Collection; **UM:** Conceptualization, Data Collection, Writing, Review and Editing; **UFF:** Conceptualization, Data Collection, Writing, Review and Editing.

Conflicts of Interest

There are no conflicts to declare.

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