

Conservation and Comparative Ethology of Hog Deer (*Axis porcinus*) and Fallow Deer (*Dama dama*) at Lahore Zoological Garden, Pakistan

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Abstract. Fallow deer (*Dama dama*) and hog deer (*Axis porcinus*) are crepuscular; however, in captivity they are also active at other times of the day. This study was conducted at the Lahore Zoological Garden, Pakistan and focuses on the conservation and management strategies, as well as the behavioral and physical similarities and differences, of these species. A complete herd of both species was observed for eating, drinking, walking, running, resting, maternal nursing, antler rubbing, grooming, alertness, aggression/mating, rumination and excretion using the scan sampling method. Behavioral observations and data collection were carried out during September and October (2023), six days a week. Average values and percentage-based graphical representations of both interspecific and intraspecific behaviors were prepared. Overall behavioral comparisons showed that sleeping, excretion/urination, antler rubbing, grooming and running were higher in fallow deer, whereas eating, drinking, walking, resting, rumination and alert behaviors were higher in hog deer. Understanding these similarities and differences can contribute to improved management of invasive species, particularly in regions where fallow deer have been introduced outside their native range and hog deer are endemic, thereby supporting better conservation and wildlife management practices.

Keywords: fallow deer (*Dama dama*), hog deer (*Axis porcinus*), captive behavior, scan sampling, conservation management, zoo ecology

Introduction

Animal behavior refers to the sum of the movements, responses, or reactions exhibited by animals under different conditions (Lindburg, 1988). Both fallow deer and hog deer are herbivorous species. Hog deer (*Axis porcinus*) are also known as “Para” in the native language.

The International Union for conservation of nature (IUCN 2024, 2015, 2008) is the world’s most diverse conservation network, working effectively to protect animal diversity and their habitats. For this purpose, it has established the IUCN Red List, which provides an assessment of the conservation status of animal species. The red list categories include least concern, near threatened, vulnerable, endangered, critically endangered and extinct. Hog deer (*Axis porcinus*) are classified as “endangered”, whereas fallow deer (*Dama dama*) are listed as ‘least concern’ (IUCN, 2024).

Both species belong to the order *Artiodactyla* and the family *Cervidae*. Fallow deer are medium-sized deer characterized by long, slender legs and a pale brown coat. Hog deer have brown fur and relatively smaller, slender legs. Hog deer (*Axis porcinus*) have experienced

a significant global population decline, particularly in Southeast Asia. Estimates indicate a population reduction of approximately 50% worldwide over the past 21 years, with declines reaching nearly 90% in Southeast Asia. This decline is primarily attributed to hunting, habitat loss and habitat degradation (Angom *et al.*, 2020).

Fallow deer (*Dama dama*) are native to Europe, whereas hog deer (*Axis porcinus*) are endemic to India and Pakistan (Rana *et al.*, 2015). Behavioral studies are closely linked to animal welfare and conservation, particularly in captive settings where effective management strategies are essential. Therefore, this study provides a comprehensive review of the conservation status, behavior and physical characteristics of fallow deer and hog deer. To our knowledge, this represents the first comparative behavioral and morphological analysis of European fallow deer and Indian hog deer.

Zoos are performing a key role in the preservation as well as conservation of these fascinating, however threatened species of the world (Hosey and Melfi, 2013). Through breeding in captivity as well as research and education of different species, zoos are playing a noteworthy role in the conservation and protection of these animals (Hutchins *et al.*, 2003). Zoos have

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emphasized the steps that are essential for animal well-being and conservation by understanding the risks associated with the decline of a large amount of biodiversity. Since the 1960s, the primary focus of zoological gardens has been the conservation of endangered and threatened species (Mench and Kreger, 1996). In addition, zoos are sites that protect animals from anthropogenic activities and serve as centers for animal conservation (Anderson *et al.*, 2003).

According to the IUCN Red List of Threatened Species, the hog deer (*Axis porcinus*) is classified as endangered, while the fallow deer (*Dama dama*) is listed as a species of least concern. The decline in the global wildlife population in natural habitats is due to disturbances and anthropogenic activities, which is why animal conservation is often carried out outside their natural habitats, such as in captivity (Russello and Jensen, 2018). For this reason, zoos and other captive breeding sites collectively house about 10,000 species of wild animals, with nearly six billion individuals (Mason, 2010). Zoological gardens and other breeding sites play a key role in the conservation and protection of biodiversity (Loh *et al.*, 2018; Hutchins and Conway, 1995).

Pakistan is home to a large amount of biodiversity, with approximately 195 mammalian species belonging to 10 orders (Roberts, 1997). However, out of these 195 species, 44 are endangered in Pakistan (Khattak *et al.*, 2022). Deforestation and habitat destruction due to the massive increase in the global human population have resulted in biodiversity decline, species extinction and an increase in global warming (Butler *et al.*, 2019; Haq, 2012; Moraes *et al.*, 2004). Hog deer are threatened by local people through hunting and in addition, they are killed by dogs during the harvesting season (Iqbal *et al.*, 2013).

The farm animal welfare committee (FAWC, 1993) of the United Kingdom published five important recommendations for the management and conservation of animals in captive environments (FAWC, 1993), which are as follows:

Freedom from thirst and starvation. Animals must be provided with proper and fresh food. The continuous availability of clean water should be ensured so that good health can be maintained.

Freedom from discomfort. Proper housing, environment and facilities can reduce stress and anxiety.

Freedom from pain. In case of injury, disease or any form of harm, proper and timely treatment should be provided.

Freedom from panic and anxiety. Not only physical but also mental health and grooming are important. These can be achieved by providing conditions that promote well-being and by minimizing factors that increase cortisol levels.

Freedom to express normal behavior. Animals should be provided with adequate space and facilities necessary for expressing normal behaviour. For example, animals should not be kept alone but housed with other members of the same species.

No compromise should be made regarding the mental and physical health of animals. Captive environments should be adapted to suit the animals rather than forcing animals to adapt to captivity. Therefore, captivity should be designed in a way that effectively reduces stress and promotes animal welfare.

Classification of subjects under study. The classification of both animals' Fallow deer (*Dama dama*) and Hog deer (*Axis porcinus*) is given in Table 1.

Ecology and distribution. Hog deer (*Axis porcinus*) give preference to live in the forests along rivers, grassland, flood plains and marshy areas (Dhungel and O'Gara, 1991). Hog deer is not only found in Pakistan but also in northern India, Nepal, Bangladesh, Southern Thailand, Vietnam and Myanmar (Biswas *et al.*, 1999). Hog deer are mostly found and native to the Indus eco regions up to Attock. It is a local population of south and south East Asia (Sinha *et al.*, 2019). In Pakistan the captive conservation of hog deer is taking place especially in Kirthar National Park, Lal Suhana National Park, Taunsa Barrage Wildlife Sanctuary, Chasma Barrage Wildlife Sanctuary, Rasool Wildlife Sanctuary

Table 1. Taxonomy of fallow and hog deer

Taxonomy	Fallow deer	Hog deer
Domain	Eukaryota	Eukaryota
Kingdom	Animalia	Animalia
Phylum	Chordata	Chordata
Sub-phylum	Vertebrata	Vertebrata
Class	Mammalia	Mammalia
Order	Artiodactyla	Artiodactyla
Sub-order	Ruminantia	Ruminantia
Family	Cervidae	Cervidae
Genus	Dama	Axis
Species	<i>Dama dama</i>	<i>Axis porcinus</i>

and head Islam/Chak Kotora Game Reserve (Arshad *et al.*, 2012). In Punjab Pakistan, the population density of hog deer was 1.2 animals/Km² in the riverine forest of Narowal and was almost 11.1 animals/Km² in the riverine forest of Taunsa barrage (Iqbal *et al.*, 2013; Arshad *et al.*, 2012). In India, Nepal and China, Bangladesh and Vietnam these are found in Mountain and wooded areas as well as in alluvial food plains (www.wildlifeofpakistan.com). The geographical distribution of hog deer and fallow deer is given in Fig. 1a and Fig. 1b respectively.

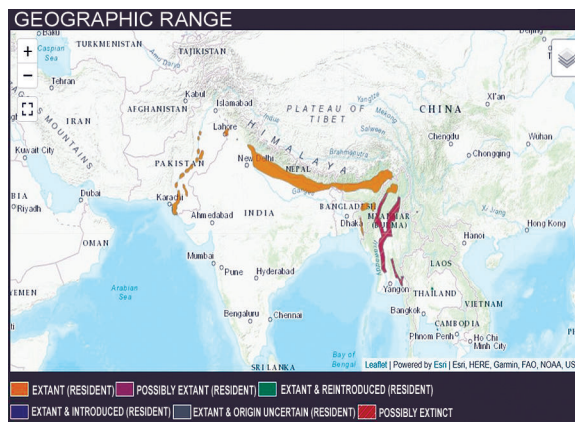


Fig. 1a. Geographical distribution of hog deer (taken from: https://www.iucnredlist.org/api/v4/assessments/22157664/distribution_map/jpg).

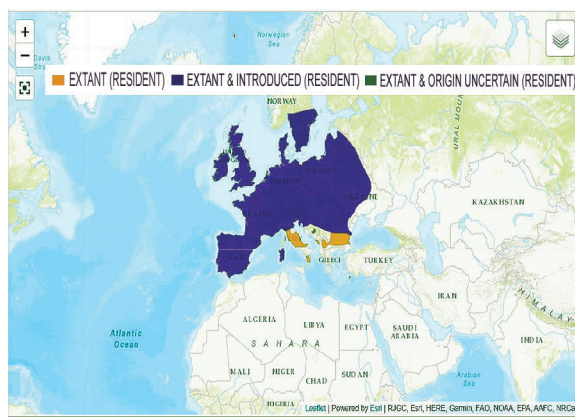


Fig. 1b. Geographical distribution of fallow deer (*Dama dama*). (taken from: https://www.iucnredlist.org/api/v4/assessments/10656554/distribution_map/jpg).

Fallow deer (*Dama dama*) is an endemic species of Turkey. Some other parts of Europe especially the Balkan Peninsula, the Island of the Rhodes and the Italian Peninsula are designated as regions with contain a fallow deer population (<https://en.wikipedia.org>). In addition, the regions in which fallow deer are introduced including the USA, South Africa, Argentina, Chile and Australia (IUCN).

Research objectives.

1. To assess the effectiveness of captive conservation and management strategies for fallow deer (*Dama dama*) and hog deer (*Axis porcinus*).
2. To examine the relationship between behavioral patterns and conservation outcomes in captive populations of fallow and hog deer.
3. To document and compare interspecific and intraspecific behavioral patterns, identifying key similarities and differences between fallow deer and hog deer under captive conditions.
4. To analyze and compare the physical characteristics and environmental adaptability of fallow deer and hog deer in relation to captive habitat conditions.

Materials and Methods

Study site. Lahore Zoological Garden is the place where this research has been done. It is situated at 90 Shahrah-e-Quaid-e-Azam, the Mall, Lahore, Punjab 54000, Pakistan. The map showing the GPS coordinates 74.325959-degree East Longitude and 31.556006-degree North Latitude location of Lahore Zoological Garden is given as in Fig. 2.

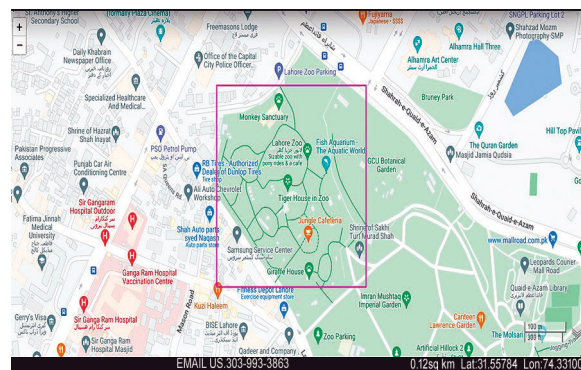


Fig. 2. The rectangular mark on the map shows the Lahore zoo (taken from: <https://imagehunter.apollomapping.com> (2024)).

Lahore zoo is among the oldest zoos in the world. Established in 1872, it is the oldest as well as the largest zoo in Pakistan. The guide map of Lahore zoo as shown in Fig. 3. It serves as a center for education, animal conservation and recreation. The management and maintenance of Lahore zoo are carried out under the supervision of the Wildlife Parks Department and the zoo Management Committee (ZMC). The zoo covers an area of approximately 25 acres (10 ha). The vision and objectives of the zoo include sustainability, ex-situ conservation of animals and the provision of educational and recreational facilities for visitors. According to the most recently published report (2018) available on the official website of Lahore zoo, the zoo houses 109 species of birds and animals, comprising a total of 1,144 individuals.

Environmental conditions of the study site. The average temperature in Lahore during September and October (2023) was 95 °F (35.7 °C) and 90 °F (32 °C), respectively. The average rainfall in September was approximately 60 mm (2.4 inches), with five rainy days recorded during the month. In October, the average rainfall was 12 mm (0.5 inches), which was significantly lower compared to September, with only two rainy days recorded.

Overall, Pakistan's climate is arid to semi-arid and subtropical. The weather conditions of Lahore can be classified into four seasons: (1) foggy winter (15 November to 15 February), (2) spring (16 February to 15 April), (3) summer/monsoon season (July to 16 September) and (4) autumn (16 September to 14 November).

Study subjects. Two species belonging to the family Cervidae and the order Artiodactyla were the focus of this study: the European fallow deer (*Dama dama*) and the Indian hog deer (*Axis porcinus*). A total of 24 hog deer were included, comprising 18 females (does), 4 fawns and 2 males (stags/bucks). The fallow deer group consisted of 7 females, 4 fawns and 1 alpha male (buck), resulting in a total of 12 fallow deer individuals. The physiology, behaviour, conservation and management of these species in Lahore Zoological Garden constitute the main focus of this study. The Fig. 3 is showing the guide Map of Lahore zoo in which 1 is indicating hog deer enclosure and 2 is showing fallow deer enclosure.

Physical characteristics of the study subjects. The fallow deer (*Dama dama*) is a medium-sized deer with a reddish-brown coat marked with white spots during summer, which changes to a light brown coat with white

spots in winter. The ventral side, including the belly, is usually white. Fallow deer are often observed moving in herds.

The hog deer (*Axis porcinus*) is a small-sized deer with a yellow-brown coat and darker underparts and it sometimes has spots on its back. Hog deer prefer to live in pairs or in a solitary manner.

The antlers of fallow deer bucks are broad, palmate and flattened, with multiple points, whereas hog deer bucks have shorter, thinner antlers with fewer points. The vocalization or barking behaviour of female fallow deer, particularly when hungry or during the male rutting season, is more frequent and louder compared to hog deer, which are generally shy and quiet animals but emit barks and whistles when disturbed.

A pictorial comparative behavioural analysis of resting, walking and mother-offspring nursing in hog deer (left side) and fallow deer (right side) is presented in Fig. 4 to 9.

Unlike other deer species, hog deer (*Axis porcinus*) run with their heads held low instead of jumping, which helps them duck under obstacles with ease. This is a small species of deer; although they have relatively higher body weight, they possess short stature and thin legs. Hog deer have larger pelvic limbs compared to pectoral limbs and they also have small, wedge-shaped faces (Roberts, 1997). These small-statured deer are bred for their skin, tusks and meat, which gives them economic importance (Kanungo *et al.*, 2012).

Food/diet. In captivity at Lahore zoo, both fallow deer (*Dama dama*) and hog deer (*Axis porcinus*) are provided with maize fodder (*Zea mays*) at a rate of 3 Kg per animal per day between 10 a.m. and 12 p.m. The herd



Fig. 3. Guide Map of Lahore zoo 1=Hog deer enclosure 2= Fallow deer enclosure.



Fig. 4. Hog deer while resting.



Fig. 5. Fallow deer while resting.

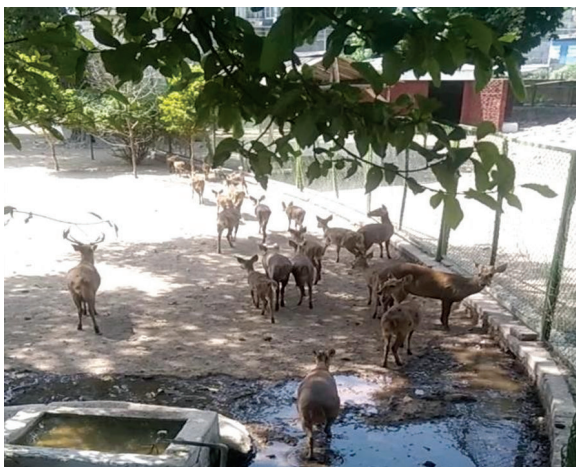


Fig. 6. Hog deer walking in herd.



Fig. 7. Fallow deer walking in herd.



Fig. 8. Mother Nursing behavior of hog deer.



Fig. 9. Mother Nursing behavior of fallow deer.

of fallow deer consists of 12 individuals; therefore, a total of 36 Kg of maize (green fodder) is offered daily. Similarly, the hog deer herd consists of 24 individuals and a total of 72 Kg of maize (green fodder) is provided daily.

Before feeding, maize fodder is cut into small pieces using a chaff or fodder cutter. Occasionally, lucerne (*Medicago sativa*) is also provided depending on the season. In the evening, roasted chickpeas (*Cicer arietinum*) mixed with corn are provided at a rate of 250 g per animal per day during summer. In winter, jaggery (gur) is also added to the mixture. Essential vitamins or honey are sometimes added to the drinking water, depending on seasonal and climatic conditions.

Hygiene and cleanliness. Leftover feed from the previous day is removed from the hay racks and replaced with fresh feed. Clean drinking water is continuously available in water pools. To remove bacteria and control excessive algal growth, liming of the water reservoirs or pools of each enclosure is carried out on a weekly basis.

It is the responsibility of the zookeepers to clean each animal enclosure, including those of deer, early in the morning. In addition, the security guards on duty ensure that visitors do not throw waste materials, garbage or shopping bags into the enclosures and do not harm or disturb the animals.

Habitat/enclosure design. Animal safety is a priority in zoological gardens and enclosure designs vary among species. Fallow deer are capable of jumping over obstacles; therefore, high fences are used to enclose their habitat. In contrast, hog deer cannot jump as high, so their enclosures require comparatively lower fences. The estimated enclosure size for fallow deer (*Dama dama*) is approximately 10 marla (2,722 sq ft), while that for hog deer (*Axis porcinus*) is about 15 marla (4,083 sq ft).

Health management and treatment. Animal well-being and health are directly linked to good mental and physical conditions; therefore, animal health can be enhanced by improving captive environments (Price, 2010). Special care and treatment are provided to sick animals at Lahore Zoological Garden. This zoo has an animal hospital equipped with necessary facilities, including a dispensary, blood testing, surgery, X-ray and ultrasound services.

Professional veterinarians and experts are responsible for daily monitoring, which includes counting each animal of a species every morning, ensuring that animals are consuming adequate food and observing normal behavior. In cases of injury or illness, appropriate treatment is provided on an emergency basis.

During our research, we observed that, on several occasions, fallow deer, hog deer, as well as other antelope and deer species suffered from diarrhea. In this condition, animals not only show reduced feed intake but also become weak. For the treatment of such cases, Scour-X, an oral anti-diarrheal suspension, is administered by mixing it with food such as roasted chickpeas, wheat bran and maize cereals, as shown in Fig. 10.

In severe cases, when animals do not recover from diarrhea, a 100 mL Flagyl drip along with Scour-X is administered directly to the affected animal. In addition, essential vitamins and minerals, such as LS Mineral, are provided by mixing them with roasted chickpeas, wheat bran and maize cereals, as shown in Fig. 11.

Data collection. The scan sampling method was used for the behavioural observation of both these deer species in which we note down the behaviour of the first animal for a specific time period and after that moved to the other species under our study and again while following this interval came back and recorded the behaviour of first deer species. This is a cyclic process and observers record behaviour quickly and repeatedly after regular intervals (Man, 1999). We have set the time interval of 10 min. for the observation of



Fig. 10. Scour-X is being added in deer feed.



Fig. 11. LS-Mineral has to be added in deer feed.

one animal. Each herbivore animal of these two species was observed for two consecutive months. Ethogram was made for the recording of behaviour, in which each behaviour is categorized and explained. The behavioral ethogram is given in Table 2.

In the September and October months of 2023, behavior was recorded for six hours a day and 6 days a week except Sunday. Each category of behaviour given was observed in separately for males, females and fawns of these species.

Statistical analysis of data. All observations of each category were converted in to an average as well as a percentage in such a manner, the total behavior for September and October was obtained. For the calculations of average as well as percentage behaviour and their graphical representations including pie graph and bar graph we have used MS Excel 2016.

The percentage behavior and average behavior of these deer species by using the formula is given below

$$\text{Percentage behavior} = \frac{\text{Number of behavior observations}}{\text{Total number of observations}} \times 100$$

$$\text{Average behavior} = \frac{\text{Sum of all the observations}}{\text{Numbers of observations}}$$

Results and Discussion

In captive conditions the daily routine for each animal almost remains same as there is fixed time to serve them food. So, these are more active in morning and evening time in contrast to the hot part of the day. In the table 3. Physical differences and similarities of

Table 2. The ethogram of the mentioned behaviors is given below

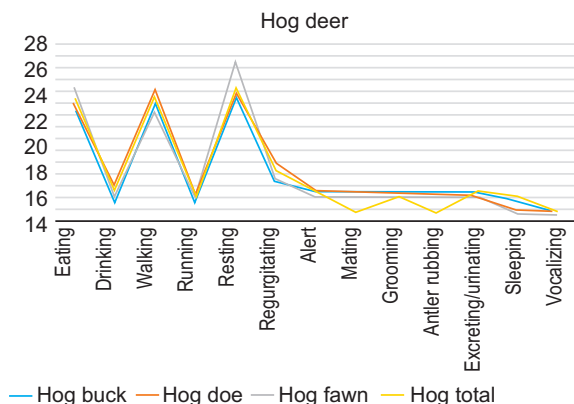
Behavior	Description
Eating	The head is often lowered, during eating food from the floor or feeding- trough and lifted when chewing.
Drinking	Deer reaches the water source lower his/her head and via mouth take water.
Walking	The graceful movement of four legs in which they cover the ground with a slow and smooth pace.
Running	The immediate or quick movement of the legs.
Resting	Lay down on the ground or sitting on the ground with open eyes.
Alert	Erect ears and raised head in response to potential threat or external stimuli.
Sleeping	Lay down on the ground or in some cases standing with closed eyes.
Mating	Courtship, copulation, or physical interaction between adult male and female.
Grooming	Cleaning/licking of the fur, legs, or other external structures by using mouth/tongue.
Mother nursing	Doe providing/feeding milk to its fawns.
Antler rubbing	Rubbing antlers against trees, shrubs, and ground.
Vocalizing	Sound produced can range from simple calls to complex. Way of communication including calls, songs and matting calls by males.
Regurgitation/ Rumination	Slow jaw movement or regurgitation especially after eating. Hog and fallow deer are often observed sitting while regurgitating.
Excretion/ urination	Removal of digestive waste material through anal opening/urethra.

fallow and hog deer are given. These deer find shelter and keep themselves under the shade of trees and walls. Although it varies at some extent from species to species. Overall average or percentage behavior is of much more importance.

These graphical representations are given below as. As shown in Fig. 12(A) this graph is made by finding the average and then its percentage of different activities of hog deer. This is the intra-species comparison in which hog deer adult male, adult female and their babies or fawn different behaviours including eating, drinking, walking, running, resting, regurgitation, alert, mating, grooming, antler rubbing, excreting/urinating and

Table 3. Physical differences and similarities of fallow and hog deer.

Characteristics	Fallow deer	Hog deer
Taxonomy	Order: Artiodactyla Family: Cervidae Genus: Dama Species: <i>Dama dama</i>	Order: Artiodactyla Family: Cervidae Genus: Axis Species: <i>Axis porcinus</i>
Native distribution	Europe including Turkey and the middle East.	Southeast Asia including India, Pakistan, Bangladesh and Nepal
Face shape	Angular and elongated	V-shaped or wedged shape.
Coat color	Pale brown with white spots or marks	Reddish brown/Brown
Limbs	Longer limbs, front legs are slightly longer than hind legs.	Shorter limbs, pectoral limbs are shorter as compared to pelvic limbs.
Ears	Larger and elongated	Smaller and rounded
Head body length	130-160 cm	105-115 cm
Shoulder height	75-95 cm	60-75 cm
Weight	30-100 Kg	30-50 Kg
Tail length	14-25 cm	17-21 cm
Body shape	Thin elongated, slope in their back from shoulder to the hindquarters.	Round, stocky and compact.
Antlers	Like palmate (broad and flat) multiple points emerging from main beam.	Shorter three tined antlers.
Socialization	Often live in large groups or herds.	Prefer to live in solitary or small herds.
Diet	Herbivorous, Folivore	Herbivorous, Folivore
IUCN Red list status	In least concerned list of IUCN.	In the Endangered list of IUCN.
Mating behavior	Polygyny	Polygyny
Gestation period	230 days	220-234 days
Baby carrying	1 Fawn	1 Fawn
Life Span	14-16 years	20 year
Sexual maturity	16-18 months	15 months
Threats	Habitat loss, fragmentation and hunting by humans.	Hunting by humans for bush meat. Wild dogs hunt them, habitat loss due to agriculture and deforestation.

**Fig. 12a.** Average percentage time spent on different activities by hog deer at Lahore zoo.

sleeping are compared. According to this representation running behaviour of hog deer fawn is highest. Mating

and reproduction are not much higher for hog deer although it's their rut (mating) period. The reasons can be there are only 2 bucks including 1 alpha male for eighteen doe. Another might be that we are only noting behavior in day light time vocalization is the lowest counted behavior of hog deer.

According to Fig. 12(B) Fallow deer fawn showing more running behavior. Sleeping is seen less in alpha male as compared to doe and fawns. The most prominent difference seen in the fallow and hog deer comparison is that vocalization is more in fallow in contrast to that of hog deer. This graphical representation is evident of this behavior. In antler rubbing and aggression as well as mating behaviors fallow deer buck is ahead as compared to that of hog deer buck.

The pie graph for Hog deer (*Axis porcinus*) shown in Fig. 13(A) is based on data collected of two months showing that how much time spent on each activity in

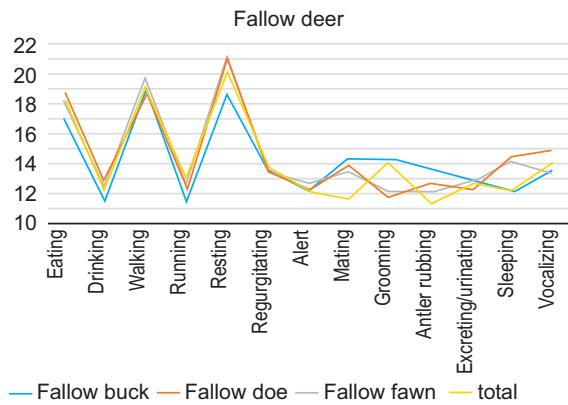


Fig. 12b. Average percentage time spent on different activities by fallow deer at Lahore zoo.

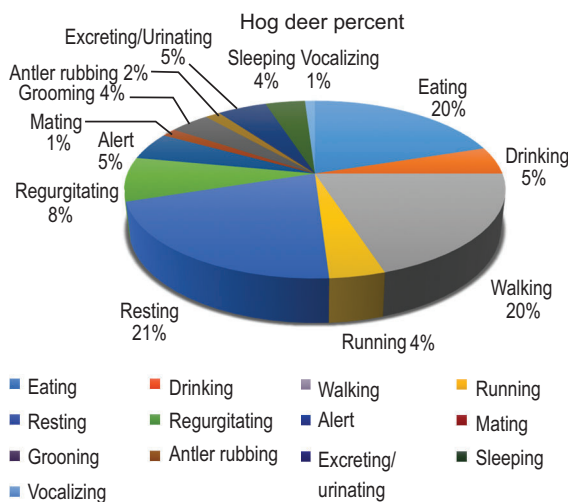


Fig. 13a. Total daily percentage of time spent on different activities by hog deer in Lahore zoo.

percentage. It is evident that in captivity especially during summer these deer species spend most of their time in resting, eating and walking. These three activities are more than the 60% of their overall behavior. Also, rumination and excretion are prominent. Fallow deer pie chart shown in Fig. 13(B) is the representative of the daily time spent on the different activities for two months in summer by fallow deer (*Dama dama*). Although the resting, walking and eating behavior percentage is higher as compared to other activities but fallow deer grooming, regurgitating and walking behaviours also have higher frequencies.

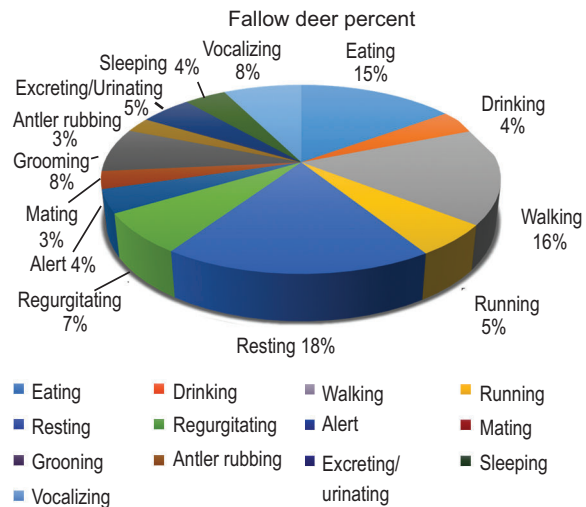


Fig. 13b. Total daily percentage of time spent on different activities by Fallow deer in Lahore zoo.

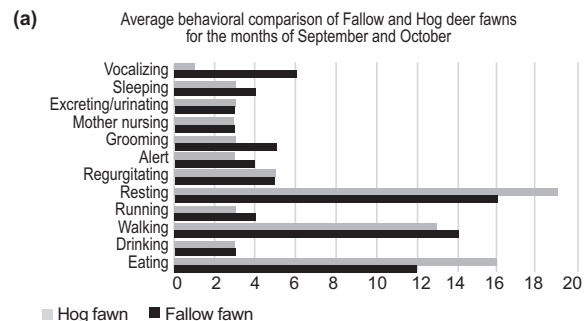


Fig. 14a. Average behavioral comparison between fallow and hog deer fawns for the months of September and October.

Fig. 14(A) is the interspecies comparison of different behavioral aspects of hog deer (*Axis porcinus*) fawns to that of fallow deer (*Dama dama*) fawns.

As it is evident from the above given representations that there is a massive difference in the vocalization of these two species. Fallow deer fawns tend to have more vocalization as compared to contrary species. Also grooming behavior is greater in fallow deer. On the other hand, eating as well as resting is seen more in the hog deer, which spent more time in eating and resting as compare to fallow deer fawns which are more agile and alert.

While looking on the behavioural comparison of fallow and hog deer females given in Fig. 14(B) graph. We

came to know that vocalization and grooming are the behavioral aspects which are far greater than else in fallow deer. However, behaviour as eating, drinking, walking and regurgitations are higher in hog deer female. In Fig. 14(C) fallow bucks have the superiority over hog bucks in most behaviors like vocalization, sleeping, excreting/urination antler rubbing, grooming aggression and walking. A few behavioral categories like eating and resting are higher in hog deer males. Most importantly look at the reproductive/mating behaviour fallow male is more active and produce rut barks to attract females for sexual intercourse. Male buck follows female most of time during rut season.

Fig. 14(D) is most important representation of overall comparison of Fallow and hog irrespective of gender.

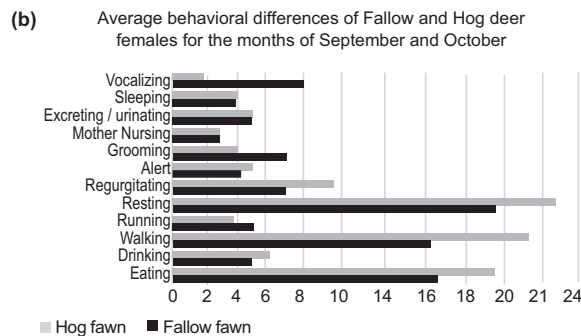


Fig. 14b. Average behavioral differences between fallow and hog deer females for the months of September and October.

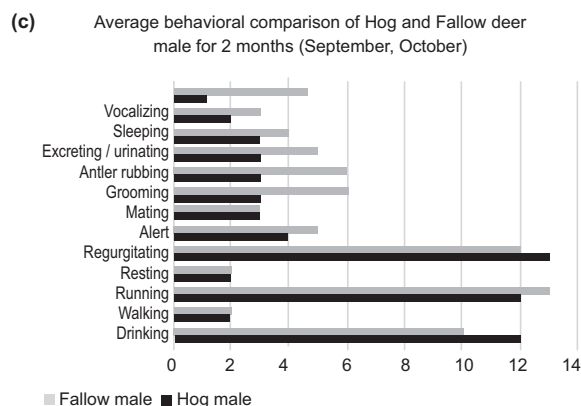


Fig. 14c. Average behavioral comparison of hog and fallow deer male for 2 months (September, October).

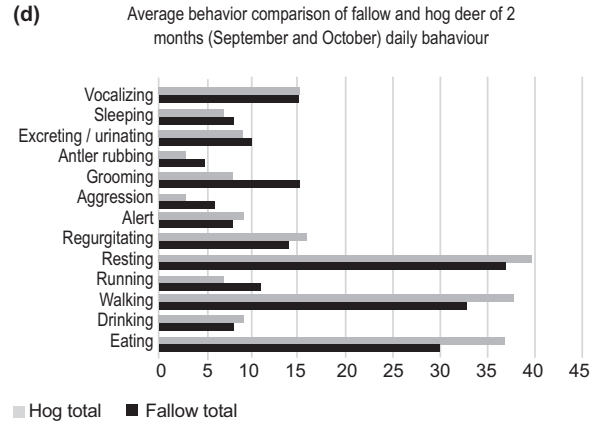


Fig. 14d. Average behavioral comparison of fallow and hog deer of 2 months (September and October) daily behavior.

The overall behavioral comparison shows that sleeping, excretion/urination, antler-rubbing grooming, mating and running are higher in fallow deer but in eating, drinking walking, resting, rumination and alert behaviours are higher in hog deer.

Conclusion

Deer including fallow deer (*Dama dama*) and hog deer (*Axis porcinus*), are among the most fascinating and captivating animals in any zoological garden. This text addresses the physical and behavioral similarities and differences between these two deer species, as well as their conservation and management. Conservation and behaviour are closely interconnected and this study also highlights how these species adapt to their environment, interact and communicate with each other. Lahore Zoological Garden plays an instrumental role in providing special care and a naturalistic environment for these animals. All aspects necessary for the well-being of captive fallow and hog deer have been discussed.

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Conflict of Interest. The authors declare that they have no conflict of interest.

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