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Impact of Visitors on the Activity Patterns of Captive Sindh Ibex (*Capra aegagrus blythi*)

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SUMMARY

The Sindh Ibex (*Capra aegagrus blythi*) is a wild goat species that inhabits the mountainous regions of southern Pakistan. In captivity, human presence can significantly influence their behavior. This study examines how Sindh Ibex respond to visitors in a controlled environment. We observed males, solitary females, and females with offspring, focusing on 14 key behaviors such as feeding, locomotion, vigilance, nursing, territoriality, and interactions with visitors. Data were collected during morning, noon, and afternoon periods, and we compared visitor and non-visitor days using paired sample t-tests. The results indicated a significant increase in vigilance and territoriality among males when visitors were present, while females with kids displayed increased nursing behavior. Maternal behaviors remained statistically unchanged, and solitary females exhibited mixed responses. These findings reveal both adaptive and stress-related reactions to human presence. The study underscores the importance of regulating visitor access and managing space to reduce behavioral disruption and aid conservation efforts for this vulnerable species.

Keywords: Sindh Ibex, *Capra aegagrus blythi*, Visitor Impact, Behavioral Responses

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INTRODUCTION

The Sindh Ibex (*Capra aegagrus blythi*) is found in most high-elevation and relatively extensive arid-zone mountain ranges in Pakistan, occurring at altitudes of up to 3350 m. It is a large game animal and the most common native ungulate in Kirthar National Park (KNP). The curving horns of adult males may grow to over 102 cm in length (Yamada et al., 2004). "Their horns are more prominent and impressive, making them attractive to hunters (Ullah et al., 2024). Males are more dominant and solitary, while females are usually found in small herds, often with juveniles. The study of human impacts on animal welfare in captivity first arose in the production animal industry in the late 1970s, when numerous analyses showed large variations in basic welfare outcomes (Sherwen and Hemsworth, 2019).

In captivity, animals have different living conditions as compared to the wild, such as limited areas, lower danger of predation, and consistent resource supply.

These variations can lead to behavioral alterations (Lopez et al., 2021). Captivity means keeping animals out of their indigenous habitats, transporting them over pronounced distances, and retaining them in estranged environments (Khan et al., *2018*). An animal might lack the opportunity to display behaviors that are essential for thriving in its natural habitat while in captivity (Bashaw et al., 2007). Captive environments include zoos, which are controlled areas where endangered species are protected and possibly returned to their native habitats (Bralower et al., 2021). *The* Sindh Ibex is listed as vulnerable on the IUCN Red List (Nawaz et al., 2004). In zoos, an ex-situ conservation technique is used, defined as the removal of an animal from its natural habitat and keeping it in zoos (Khan et al., 2014). Studies have shown that the Sindh Ibex exhibits varying behaviors in captivity, particularly in the presence and absence of visitors. "Behavior could be defined as the activities of living organisms that are functionally mediated by other external phenomena in the present moment" (Uher, 2016).

The main factor that influences the behavior of zoo animals is changes in their surroundings, the individual history of the animals, and their interactions with humans (Zareva-Simeonova, 2024). One prominent feature of the zoo environment is the presence of visitors. Visitor contact can be unpredictable and intense, particularly in terms of auditory and visual interactions. Visitors can have either negative, positive, or neutral impacts on animal behavior and welfare (Sherwen and Hemsworth, 2019). Varying behaviors of Sindh Ibex depend upon the frequency of visitor interaction and individual animal temperament. They can show neutral behavior and become habituated. Through habituation, animals become less stressed due to regular or routine handling by caretakers (Ahmed et al., 2024). Sindh Ibex can have negative interactions with visitors, such as vigilance, avoidance behavior, or aggression if they feel threatened, and can have positive interactions due to food expectations from them. Negative interactions might cause withdrawal or increased fear reactions, while positive interactions include regular good contact, which is associated with less stress and aggression (Ahmed et al., 2024). Negative responses of animals can be triggered by sudden movements or loud noises from visitors; these actions may be threatening for some zoo species (Sherwen and Hemsworth, 2019). In the absence of visitors, Sindh Ibex show natural behaviors like foraging, resting, and climbing (Davey, 2007). Natural behavior is defined as behavior shown by animals living in environments that allow them freedom of movement (Dawkins, 2023).

The aim of the current study was to observe the changes in behavioral patterns of Sindh Ibex in the presence and absence of visitors and to examine their relative responsive behaviors in both conditions by comparing average behavioral frequencies of 14 specific behaviors. It focuses on evaluating the influence of anthropogenic disturbance on the activity patterns of this vulnerable species.

MATERIALS AND METHODS

STUDY SITE

The study was conducted at the Lahore Zoological Garden, situated in the heart of Lahore, Punjab, Pakistan. As one of the oldest zoos in South Asia, it covers an area of 25 acres and is home to over ,1,400 animals. While the zoo features a variety of animal enclosures, the primary focus of this study was the Sindh Ibex, which is

housed in a semi-naturalistic enclosure located in the northern section of the zoo. This enclosure is designed to replicate the rocky terrain of th1e Ibex's habitat (Table 1).

Table 1: The specifications and dimensions of the enclosure of animals which were under observation

Features	Specification
Arena	7875ft^2
Vegetation	Sparse
Water troughs	Two
Feeding spots	Two
Climbing spots	Artificial rocks
Shade	Present
Fence height	2.5meters

ANIMALS UNDER OBSERVATION

A behavioral study of the Sindh Ibex was conducted in the month of March. A total of eight Sindh Ibex was kept under observation. The individuals under study were categorized based on age: one male (2 years old), one female with 2 kids (3.5 years old and two kids of 3 weeks), one female with 1 kid (2 years old and 1 kid of 1 month), and two solitary females (1.5 years old). They were housed in a single enclosure that allowed for natural social interactions.

Table 2: Observed behaviors along with their description considered in the study of captive Sindh Ibex at Lahore Zoo.

Behaviors	Description
Climbing	The act to go upward on rocks and cliffs.
Resting	Motionless standing or sitting at particular place.
Exploratory	Scanning the surroundings by moving and sniffing area.
Territorial behavior	The act of defending specific area or territory by showing alertness.
Foraging	Exploring the area for searching and gathering food resources.
Feeding	The act of consuming food like grasses, plants and other vegetation.
Social interaction	Interaction of animals with same or different species.
Maternal behavior	The act of giving care by mother towards her kids.
Alertness	Staying active, attentive or ready to respond.
Interaction with visitors	Coming close towards protective grill for food expectation.
Vigilance	Focused attention and detection of any signs by staying alert.
Ruminating	Process of chewing the cud and then swallowing it.
Grooming	The act of cleaning and maintenance of body.
Nursing behavior	The act of caring and feeding (milk)by mother to kids.
Parental behavior	The act of giving care by both parents towards kids.

Behaviors under Observation

Table 2 presents the observed behaviors of captive Sindh ibex recorded during morning, noon, and afternoon sessions, each spanning a focused two-hours observation period, under on-public and off-public conditions. A detailed description of all observed behaviors is provided below.

METHODOLOGY

Sindh Ibex's behaviors in the presence and absence of visitors were recorded during three periods: morning, noon, and afternoon, for 5 days (2 hours of readings for each time of day). The time intervals for recording behaviors were from 9 AM to 11 AM in the morning, 12 PM to 2 PM at noon, and from 3 PM to 5 PM in the afternoon. The work was conducted during the lactation period of female Sindh Ibex, during which females exhibit maternal behaviors that prioritize the care and protection of their young.

SAMPLING METHOD AND STATISTICAL ANALYSIS

Observational methods used for this study were the focal sampling method and the scan sampling method. The focal sampling method was used to observe the behaviors of all individuals at different times, while the scan sampling method was used to observe individuals at regular intervals. To assess whether the presence of visitors significantly influenced specific behaviors, a paired sample t-test was applied to compare the mean behavioral frequencies in both conditions (Manfei *et al*., 2017). This test was applied to the average values of behaviors, and the level of statistical significance was set at $p < 0.05$.

RESULTS

BEHAVIORAL PATTERNS IN RESPONSE TO VISITORS' PRESENCE

Male Sindh Ibex

The analysis showed statistically significant increases ($p < 0.05$) in 11 behaviors in the presence of visitors. Behaviors such as climbing, exploratory, territorial, and alertness increased significantly in the presence of visitors. Interaction with visitors and vigilance were analyzed in the non-public condition, while resting and grooming decreased significantly. Parental, ruminating, and nursing behaviors showed no significant difference (Table 3).

Female Sindh Ibex (having Kids)

Behaviors such as climbing, exploratory behavior, nursing, interaction with visitors, and vigilance increased significantly, and the behavior alertness was significantly elevated ($p < 0.05$) in the presence of visitors. Other behaviors such as resting, feeding, ruminating, social interaction, and maternal behavior showed no significant difference (Table 4).

Female Sindh Ibex (without kids)

Female Sindh ibex without kids in the presence and absence of visitors revealed notable variations in behaviors such as climbing, exploratory behavior, feeding,

alertness, grooming, interaction with visitors, and vigilance, which were significantly higher in the presence of visitors ($p < 0.01$). Resting, ruminating, foraging, and social interaction showed no significant change (Table 5).

Table 3: Behavioral differences in Male Sindh Ibex between Anthropogenic disturbance and undisturbed conditions.

Behaviors	Presence of visitors (mean ±SE)	Absence of visitors (mean ±SE)	P -value	sig
Climbing	2.81±0.05	1.69±0.04	<0.001	**
Exploratory	4.48±0.07	3.39±0.05	<0.001	**
Resting	3.60±0.06	3.81±0.01	0.029	**
Social interaction	1.97±0.03	1.82±0.03	0.012	*
Territorial	9.35±0.04	7.12±0.03	<0.001	**
Foraging	3.37±0.03	2.50±0.02	<0.001	**
Parental behavior	0.23±0.01	0.21±0.04	0.622	NS
Ruminating	2.63±0.05	2.79±0.03	0.065	NS
Feeding	4.25±0.05	3.77±0.05	0.004	**
Alertness	5.06±0.02	2.01±0.07	<0.001	**
Grooming	0.67±0.01	0.86±0.05	0.011	*
Interaction with visitors	2.72±0.03	0.00±0.04	<0.001	**
Vigilance	2.87±0.06	0.00±0.04	<0. 001	**

Note: **. ** = Highly significant * = statistically significant NS = Not significant**

Table 4: Behavioral differences in Female Sindh Ibex (having kids) between anthropogenic disturbance and undisturbed conditions.

Behaviors	Presence of visitors (mean ±SE)	Absence of visitors (mean ±SE)	P -value	Sig.
Climbing	3.77±0.05	0.77±0.09	0.002	**
Exploratory	4.87±0.12	2.59±0.11	0.001	**
Resting	3.53±0.12	3.33±0.14	0.295	NS
Social interaction	1.47±0.07	1.87±0.08	0.143	NS
Foraging	2.62±0.08	2.57±0.07	0.576	NS
Maternal behavior	4.04±0.18	4.18±0.05	0.468	NS
Ruminating	2.59±0.09	2.36±0.16	0.212	NS
Nursing behavior	2.89±0.07	0.79±0.06	0.001	**
Feeding	3.47±0.06	3.18±0.13	0.107	NS
Alertness	2.48±0.15	1.63±0.24	0.041	*
Grooming	1.50±0.13	1.34±0.07	0.238	NS
Interaction with visitors	2.69±0.13	0.04±0.13	0.003	**
Vigilance	3.57±0.04	0.29±0.12	0.0005	**

Note: **=indicates highly significant ($p<0.01$), * indicates significant ($p<0.05$) and NS= not significant ($p \geq 0.05$).

Table 5: Behavioral differences in Female Sindh Ibex (without kids) between anthropogenic disturbance and undisturbed conditions.

Behaviors	Presence of visitors (mean ±SE)	Absence of visitors (mean ±SE)	P -value	sig.
Climbing	3.70±0.10	1.10±0.10	<0.01	**
Exploratory	4.60±0.10	2.50±0.10	<0.01	**
Resting	3.30±0.10	2.80±0.10	>0.05	NS
Social interaction	0.90±0.10	1.00±0.10	>0.05	NS
Foraging	2.50±0.10	2.60±0.10	>0.05	NS
Ruminating	2.80±0.10	2.20±0.10	>0.05	NS
Feeding	3.50±0.10	2.50±0.10	< 0.01	**
Alertness	1.50±0.10	0.30±0.10	<0.01	**
Grooming	1.20±0.10	0.80±0.10	<0.01	**
Interaction (visitors)	2.70±0.10	0.00±0.10	<0.01	**
Vigilance	2.80±0.10	0.00±0.10	<0.01	**

In this paired sample t-test p-values have been aligned with significance; <0.01 for ** and >0.05 for NS (not significant).

DISCUSSION

The visitors' presence significantly influenced the behaviors of Sindh ibex, with noticeable differences observed among males, females with kids, and females without kids. In the captive environment of a zoo, the presence of visitors is a universal characteristic (Sherwen and Hemsworth, 2019). The statistical comparison of behavioral states between the visitor presence and visitor absence conditions revealed significant shifts, with certain behaviors amplified and others reduced.

In male ibex, several behaviors were increased and statistically significant in the on-public condition. These behaviors include climbing, interaction with visitors, alertness, vigilance, and feeding. Meanwhile, ruminating, grooming, and resting decreased significantly. Animals often display different behaviors in confined settings, such as zoos, as compared to their wild environment (Ahmed et al., 2024). The behavioral patterns of males suggest that the overall quality of rest is affected due to heightened alertness and environmental stimuli. The increased alertness and territoriality when visitors were present indicated potential threats. To show dominance and maintain control over their range, they increased territorial displays.

In females having kids, the data reflected a heightened state of vigilance in response to visitors' presence. Behaviors such as climbing, vigilance, and nursing increased significantly, indicating a dual response of both protective movement and caregiving under stress. Maternal behavior, as a broader category, did not show a statistically significant change, meaning general caregiving behavior was stable. When zoo animals show a lack of response to visitors, it means they have become habituated to visitors' presence (Sherwen andand Hemsworth, 2019). In these females, other behaviors such as grooming, ruminating, and resting were significantly reduced. The increase in nursing behavior reflects a calming mechanism. Exploratory behavior increased in the presence of visitors, and social interaction showed no significant differences while the behavior of kids was playing with one another. Positive activities such as exploratory behavior, social interaction, and playing

indicate good health, but behavioral indicators suggest chronic stress (Ahmed et al., 2024).

In females without kids, the behavioral response to visitors' presence was even more consistent. Nearly all behaviors showed statistically significant differences. The goal of the zoo is to provide welfare, but if animals show stress in visitors' presence, there is potential conflict between these goals (Sherwen and Hemsworth, 2019). Climbing, exploratory behavior, alertness, vigilance, and feeding increased in visitors' presence. In captivity, welfare and enrichment depend upon zoo enclosures (de Azevedo et al., 2023). "Interaction with visitors is also increased notably. There are also several cases of animals working to initiate interaction with andvisitors" (Sherwen and Hemsworth, 2019), such as interaction with visitors for food expectations.

CONCLUSIONS

The presence of visitors significantly influences the behavior of Sindh Ibex. These changes in behavior indicate levels of stress and adaptation to their environment. Additionally, Sindh Ibex exhibit neutral and positive behaviors, likely related to food expectations, habituation to human presence, and their sensitivity to anthropogenic stimuli. These findings offer valuable insights into the behavioral ecology of Sindh Ibex in differing visitor-related contexts.

RECOMMENDATIONS

Based on observed behavioral changes in the Sindh Ibex, it is recommended that there is a need for regulated ecotourism and habitat management to protect this sensitive mountain species. Establish buffer zones between the animals and visitors, along with the use of natural barriers. Habitat enrichment with hiding spaces and natural features is essential to reduce stress.

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REFERENCES

Ahmed, Z., U. Rauf, H.A. Hashmi, N. Mustafa, M. Awais, A. Rahman and N. Ather. 2024. Understanding Animal Behavior in Captivity, Insights from Zoo Environments and Behavioral Studies in Controlled Spaces, Exploring Welfare and Adaptation Mechanisms. Global Scientific and Academic Research Journal of Multidisciplinary Studies. 1: 25-34

Bashaw, J.M., A.S. Kelling, M. Bloomsmith and T. Maple. 2007. Environmental effects on the behavior of zoo-housed lions and tigers, with a case study on the effects of a visual barrier on pacing. Journal of Applied Animal Welfare Science. 10: 95–109.

Bralower, T., and A. Millet. 2021. Endangered Species and Ecosystems. Communities in Crisis: Student Voices on Climate Change. Pressbooks Directory.

Davey, G. 2007. Visitor's effects on the welfare of animals in the zoo: A review. Journal of Applied Animal Welfare Science, 10(2): 169-183.

Dawkins, M.S. 2023. Natural behavior is not enough: Farm animal welfare needs mode answers to Tinbergen's four questions. Animals. 13(6): 988.

de Azevedo, C. S., C. Cipreste, C. Pizzutto and R. J. Young. 2023. Review of the effects of enclosure complexity and design on the behavior and physiology of zoo animals. Animals, 13(8): 1277.

Khan, B. N., Ahmad, R., Ali, Z., Mehmood, S., Raza, H., Azhar, M., and Zakir, A. 2018. Impact of different captive environmental conditions on behavior of African lions and their welfare at Lahore Zoo and safari zoo, Lahore. Pakistan Journal of Zoology. 50:1-21.

Khan, M. Z., N. Samreen, S. Ghalib, A. Zehra, B. Hussain, F. Tabbassum, and T. Latif. 2014. Biology and behaviour study of chinkara, cheetal, nilgai, blackbuck and hog deer in captivity in Karachi Zoo and safari park. International Journal of Biology and Biotechnology. 11(2-3): 341-349.

Lopez, A. C. 2021. Conditions required for the evolution of warfare adaptations. Encyclopedia of Evolutionary Psychological Science. 1272–1281.

Manfei, X. U., D. Fralick, J. Zheng, B. Wang and F. Changyong. 2017. The differences and similarities between two-sample t-test and paired t-test. Shanghai archives of psychiatry. 29(3): 181-184.

Nawaz, M. A., B. Khan and H. Hasan. 2004. Response of Sindh ibex (*Capra aegagrus blythi*) to petroleum exploration in Khirthar national park, Pakistan. In *SPE* International Conference and Exhibition on Health, Safety, Environment, and Sustainability. SPE.

Sherwen, S. L., and P. H. Hemsworth. 2019. The visitor effect on zoo animals: Implications and opportunities for zoo animal welfare. Animals. 9(6): 366.

Ullah, N., I. Basheer, Z. Minghai, M. Rajpar, M. Rehan and M. T. Khan. 2024. Spatiotemporal distribution and population trends of Sindh ibex (*Capra aegagrus blythii*) in Balochistan during 2019–2022. European Journal of Wildlife Research. 70(2):1-36.

Uher, J. 2016. What is behaviour? And (when) is language behaviour? A metatheoretical definition. Journal for the Theory of Social Behaviour. 46(4): 475-501.

Yamada, K., M. Ansari, R. Harrington, D. Morgan and M. Burgman. 2004. Sindh Ibex (*Capra aegagrus blythi*) in Kirthar National Park, Pakistan. Species conservation and management: Case studies, 469.

Zareva-Simeonova, K. T. 2024. Influence of human and environment on the behavior of selected mammal species in captivity-application in zoos and conservation. Doctoral dissertation. Faculty of Biology, Department of Ecology and Environmental Protection. Sofia University" St. Kliment Ohridski.

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