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BEHAVIOURAL RESPONSES AND FEEDING PREFERENCE OF *HEMIECHINUS COLLARIS* (EULIPOTYPHLA: ERINACEIDAE)

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Hemiechinus collaris, Behavior, Digging, Aggressiveness, Roll up

ABSTRACT

The behavioral aspects of Hedgehog *(Hemiechinus collaris*, Gray, 1830) kept in Nocturnal Captive, Nocturnal free range, diurnal captive and diurnal free-range conditions were recorded and compared with each other. The behavior aspects such as Jumping, aggressiveness, digging, stress, roll up, immovability, walking, standing, drinking, lying and feeding were observed. Non-significant differences were observed in jumping and feeding behavior of all four type conditions. Similarly, aggressiveness, digging, stress, roll up, immovability, walking, standing, drinking and lying behaviors show significant differences in Nocturnal Captive, Nocturnal free range, diurnal captive and diurnal free-range condition. Different feeds as natural feed, bakery waste, meat waste and tea stall waste were offered to *H. collaris* which were arranged in four groups (G-I, G-II, G-III and G-IV). Natural feed consumed constantly by animals of all groups and non-significantly difference observed in percentages of consumed feed. The maximum bakery waste feed consumed by animals of Group-I which significantly differed from other three groups G-II, G-III and G-IV, while percentage of consumed meat waste feed recorded highest in G-I which significantly differed with other groups. The fourth type of feed was tea stall waste which was consumed highest by *H. collaris* which was kept in G-IV and also shows significant difference with animals of G-I, G-II and G-III.

1. INTRODUCTION

Hemiechinus collaris (Gray, 1830) is a nocturnal and burrowing species, noted near water and agricultural landscapes (Roberts, 1997). This species is helpful indirectly to human being as it ingests termites, snakes, scorpions and insects. They dig their burrows. Burrow opening is covered under shrub and bushes. This species, like other hedgehogs, hunts mostly by scent and exclusively at night. They build their own tunnels to escape the heat of the day, and can live in the same burrow for a year without ever sharing it with another hedgehog.

They will attack any edible item they can get their hands on, including deadly snakes, scorpions, lizards, frogs, and toads, although their primary diet consists of Orthopterous and Coleopterous insects (Molur et al., 2005). If a hedgehog seizes a snake's tail or a large animal's leg, it will frequently roll into a ball and begin chewing on the grabbed piece. This feeding practice has been seen with a captive Hemiechinus (Mirza, 1969; Krishna & Prakash, 1965). Only in recent years have records of hedgehog mating in captive been discovered. *Hemiechinus auritus* produced offspring in captivity 37 days after mating, and the gestation period was observed to range between 35 and 42 days (Herter, 1965).

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The hedgehog can split its spines to some amount, allowing saliva to be plastered onto exposed skin without injuring the animal's tongue. Herter (1965) observed captive hedgehogs and discovered that this process of self-anointing was frequently triggered by strong scent stimulation. Most analysts believe that the importance of this surgery is yet unknown. Because the paste eventually dries and cakes off, it appears that anointing might be a technique of grooming otherwise inaccessible regions or assisting in the removal of dried skin. Eates (1968) depicts two adolescent Long-eared Hedgehogs anointing themselves after nibbling on Dhoob Grass (*Eragrotis spp*.).

The Algerian hedgehog *Atelerix algirus* is an insectivorous species. However, the exact composition of its natural diet remains largely undetermined, especially in relation to seasonal variations in food availability (Mouhoub-Sayah et al., 2018). Lucy et al., (2020) observed that the West-European hedgehog (*Erinaceus europaeus*) has declined markedly in the UK. The winter hibernation period may make hedgehogs vulnerable to anthropogenic habitat and climate changes. Therefore, we studied two contrasting populations in England to examine patterns of winter nest use, body mass changes and survival during hibernation. The current study was designed to study the behavior aspects of *Hemiechinus collaris* to use this animal for biological control.

2. MATERIALS AND METHODS

Animal keeping

Present study was conducted in Captive Breeding Facilities for animals at Veterinary Teaching Hospital, Cholistan University of Veterinary and Animal Sciences, Bahawalpur. A total of 10 animals (*Hemiechinus collaris*) were captured from different localities of Division Bahawalpur containing three districts as Rahim Yar Khan, Bahawalnagar and District Bahawalpur. The research animals were divided into four groups each containing five animals (male/female). Group-I Animals were kept in nocturnal condition and group-II animals were kept in diurnal condition to observe their ethological activities. Animal's cages were kept into two different floor cages having dimensions 6ft × 6ft × 4ft (length × width × height). These cages were placed in a 14 ft× 16 ft well ventilated room having fans and side curtains to adjust the light and room temperature. The sand and soil from Cholistan desert was added on the floor of cages to study the digging behavior of animals. Temperature was maintained at 26-27°C with the help of thermometer hanged in room and photoperiod 12h was controlled with room curtains and electricity bulbs. For nocturnal and diurnal behavioral observations in free range, animals were also kept in indoor grassy lawn having plantation. Feeders and drinkers were also placed in cages and free-range conditioning for food and water purposes. The feed and ad libitum water supply was delivered to the animals in cages and free-range systems.

Observation procedure

Behavioral observations of hedgehog kept in cages and free-range rearing systems were observed and compared. These behavioral activities included digging, jumping, roll up, aggressiveness, immobility, walking, lying, standing, feeding and drinking (Table I). Behavioral parameters were observed with naked eye (focal scanning) through instantaneous-scan sampling and observations also made with the help of CC cameras which were fixed in indoor room and on wall of grassy lawn. The observation of each hedgehog was made for the time of five minutes and time is noted which spent in various behavioral activities in seconds by using stopwatches during night (11:00 pm to 12 pm) for nocturnal behavior and day time (09:00am to 10:00 am) for diurnal activities on daily basis. The observer positioned near animals quietly, to keep animal away from any disturbance and noted behavioral Activities of hedgehogs.

Table 1. Definitions of Behavioral parameters observed during study

Behavioral parameters	**Definitions**
Jumping	Movement by leaping with all feet off the ground.
Aggressiveness	A response that carries something unpleasant.
Digging	Break down and despoil earth with hands, paws and snout etc.
Stress	A feeling of emotional or physical tension.
Roll up	Turn something into roll up on itself to form, tube or ball like.
Immovability	Animal remain standing and not moving.
Walking	Animal Movements with slow speed.
Standing	Stands with alert, neck extend, eyes fully open.
Drinking	The act of using water and liquids.
Lying	Animal is lying on the dry land or landscape and in relaxed state.
Feeding	The act of using food for body nature.
Morbidity	Relative incidence of disease.
Mortality	The ratio of being death.

3. RESULTS AND DISCUSSION

Statistically analysis of behavioral aspects of *H. colloris* showed that the animals kept in Group-II to study nocturnal behavior shows highest jumping (4.56±02.05)

and lowest (2.37±01.35) in animals of group-III but non-significant deference observed for jumping behavior in all four groups. While significant difference in aggressiveness observed between animals of kept in G-I, G-II and G-III, G-IV and highest aggressiveness (18.89±05.95) recorded in animals of G-I which were kept in captivity for study of nocturnal behavior of *H. colloris.* The digging behavior perceived highest (4.39±03.42) in *H. colloris* which kept in group-IV which differ significantly from digging behavior of *H. colloris* which kept in other three groups as G-I, G-II and G-III. The animals which reared in G-I shows highest value (8.597±06.27) for stress which was highly significant with other animals kept in G-II, G-III and G-IV. Similarly, the lowest value (9.11±51.23) of roll up behavior observed in animals retained in G-I which differed significantly with other values of roll up behavior, highest mean value (32.97±12.21) of roll up behavior recorded in G-IV. Maximum walking (144.66±12.05) recorded in animals of G-II and minimum (59.39±10.76) in G-III animals and values shows highly significant deference with other Groups.

Immovability found maximum (11.14±03.099) in animals of G-III and minimum in G-II, immovability behavior shows significant deference in all four groups. Only two behavioral parameters e.g. jumping and drinking observed non-significantly differed in all four groups G-I, G-II, G-III and G-IV. In *H. colloris* standing and lying behaviors recorded maximum (16.12±02.90, 189.19±15.03 respectively) in animals of G-III which were significantly differed with animals of other two groups (G-I and G-II) and non-significantly differed with G-IV. The maximum feeding (15.51±05.25) observed in animals of G-II kept in free range for nocturnal study which shows significant difference with other G-I and G-III and non-significant with G-IV (Table 2).

Different feeds as natural feed, bakery waste, meat waste and tea stall waste were offered to *H. collaris* which were arranged in four groups (G-I, G-II, G-III and G-IV). Natural feed consumed constantly by animals of all groups and non-significantly difference observed in percentages of consumed feed. The maximum bakery waste feed (86.13±5.43) consumed by animals of Group-I which was significantly differed from other three groups G-II, G-III and G-IV, while percentage of consumed meat waste feed recorded highest (80.26±2.78) in G-I which was significantly differed with other groups. The fourth type of feed was tea stall waste which consumed highest (80.68±2.54) by *H. collaris* which kept in G-IV and also shows significant difference with animals of G-I, G-II and G-III (Table 3).

The behavioral aspects of *H. colloris* showed that the animals kept in Group-II to study nocturnal behavior shows highest jumping (4.56±02.05) and lowest (2.37±01.35) in animals of group-III. Similarly, Feng et al. (2016) observed nocturnal and diurnal jumping behavior of hedgehogs in fields. During current study, the aggressive behavior in *H. colloris* also studied in captivity and free-range systems and significant difference was recorded. Ognev (1962) and Morris, (1969) documented that *H. colloris* are so grasping against their opponents fight and held them for a long time and can drag them from place to place.

Table 2. Variations in Mean and Standard Deviation of behavioral parameters in *H. colloris* observed in different rearing condition systems

Parameters	Group I	Group II	Group III	Group IV
	Nocturnal Captive	Nocturnal Free Range	Diurnal Captive	Diurnal Free Range
	MEAN±SD	MEAN±SD	MEAN±SD	MEAN±SD
Jumping	3.54±02.48^{a}	4.56±02.05^{a}	2.37±01.35^{a}	3.36±2.37^{a}
Aggressiveness	18.89±05.95^{a}	15.95±08.056^{a}	5.417±04.049^{b}	8.032±05.18^{b}
Digging	0.925±0.08^{b}	0.72±3.93^{b}	0.897±0.81^{b}	4.39±03.42^{a}
Stress	8.597±06.27^{a}	5.17±04.39^{b}	1.03±5.19^{bc}	2.581±1.69^{c}
Roll up	9.11±51.233^{b}	23.187±73.69^{ab}	30.905±17.08^{a}	32.97±12.21^{a}
Immovability	4.589±2.725^{b}	1.362±0.619^{b}	11.14±03.099^{a}	2.27±01.14^{b}
Walking/Slinking	117.35±12.15^{b}	144.66±12.05^{a}	59.39±10.76^{c}	61.81±19.58^{c}
Standing	3.87±26.19^{b}	3.86± 9.27^{b}	16.12±02.90^{a}	12.43±09.87^{a}
Drinking	6.804±28.57^{a}	5.08±26.27^{a}	2.94±10.04^{a}	10.15±02.43^{a}
Lying/Dreaming	89.73±16.51^{b}	79.55±21.21^{b}	189.19±15.03^{a}	159.00±18.07^{a}
Feeding	7.41±02.83^{a}	15.51±05.25^{a}	2.75±01.37^{b}	12.29±05.65^{a}

The digging behavior perceived highest (4.39±03.42) in *H. colloris* which kept in group-IV which differ significantly from digging behavior of *H. colloris* which kept in other three groups as G-I, G-II and G-III. Rosskopf (1999) reported that *H. colloris* dig themselves in a fine little shelter into the ground and seek the cover of rocks and bushes; however, in houses hedgehogs escalate a digging area; like a box filled with material like swindle, strips of newspaper. In present research, the animals which reared in G-I shows highest value (8.597±06.27) for stress which was highly significant with other animals kept in G-II, G-III and G-IV. Morris (1969) documented in his work those non-offensive loggers to deduce the stress responses in

hedgehogs by assessing behavior changes in response to a serious stressor.

Table 3. Variations in Feed Preference in different groups of *H. colloris*

Feed Type	G-I	G-II	G-III	G-IV
	MEAN±SD	MEAN±SD	MEAN±SD	MEAN±SD
Natural Feed	92.19±4.42[a]	82.33±4.36[a]	83.26±3.75[a]	80.33±2.87[a]
Bakery waste	86.13±5.43[b]	79.88±4.27[a]	82.64±2.78[a]	80.17±3.76[a]
Meat waste	80.26±2.78[c]	79.21±3.35[a]	77.35±4.04[b]	77.78±3.11[b]
Tea stall waste	79.22±4.87[c]	80.62±4.52[a]	77.62±5.73[b]	80.68±2.54[a]

During present study, the lowest value (9.11±51.23) of roll up behavior observed in animals retained in G-I which differed significantly with other values of roll up behavior, highest mean value (32.97±12.21) of roll up behavior recorded in G-IV. Rosskopf (1999) reported that *H. colloris* during defense they posture their body to take the form of rolling like tight ball when they notice a threat. This pose points quills outward and make them more effective in defense against intruder on their space.

During current study maximum walking (144.66±12.05) recorded in animals of G-II and minimum (59.39±10.76) in G-III animals and values shows highly significant deference with other Groups. Clegg (1970) observed the locomotion/walking behavior in hedgehog individuals in garden, when hedgehogs moving keeping their body lower to the ground. The animal moves energetically, yet firmly, across a hard surface.

Immovability found maximum (11.14±03.099) in animals of G-III and minimum in G-II, immovability behavior shows significant deference in all four groups. The hedgehogs showed immobility behavior and stop walking during foraging or in their nest during sleeping daytime. The reduction in immobile behavior here could mean a different sleeping posture that is more similar to balling up. The reduction of immobile behavior was due to increase of roll up behavior of hedgehogs (Bidder et al. 2014).

In present study, *H. colloris* standing and lying behaviors recorded maximum (16.12±02.90, 189.19±15.03 respectively) in animals of G-III which were significantly differed with animals of other two groups (G-I and G-II) and non-significantly differed with G-IV. Simone-Freilicher and Hoefer (2004) documented the standing behavior of hedgehogs that hedgehogs stand on their hind limbs for some time to do observations. Similarly, Rosskopf (1999) described that *H. colloris* are nocturnal naturally, so they tend to sleep in day and more energetic in the evening hours.

In current study maximum feeding (15.51±05.25) observed in animals of G-II kept in free range for nocturnal study which shows significant difference with other G-I and G-III and non-significant with G-IV. Jones et al. (2005) reported that hedgehogs feed on leaves, flower's petals, grass, and seeds, including *Rosa rubiginosa* the sweet briar. They reported that *H. colloris* also eating seed and other scraps which have fallen from tables, feeders and garden birds.

4. CONCLUSION

From present study it was concluded that light and darkness affect the behavior of Hedgehog and for different feeds Hedgehog shows significant variation.

5. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interests regarding the publication of this article.

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