

ORIGINAL ARTICLE

**Observations on the Foraging Behaviour and Activity Patterns of Globally Endangered Egyptian Vulture, *Neophron Percnopterus* in Uttar Pradesh, India**

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ABSTRACT

*The basic concern for species survival is the food availability; consequently, it is a fundamental component to identify the habitat preference, population density and endurance of the species. In the present study, our goals were to assess the foraging behaviour and other activity patterns of Egyptian Vulture. The focal animal sampling method described by Altman (1974) was followed for recording the time-budget and activity pattern of Egyptian Vulture during feeding. Data on various activities were recorded at the prominent feeding site in Unnao from January 2016- January 2019. Various foraging activities were followed keenly throughout the day. Following the techniques adopted by Kambale [39], the day was divided into three-time frames to observe various behavioral activities of the Egyptian Vulture throughout the day. 17 different types of behavioural activities were observed at the feeding site, of which maximum time spent in performing sunning and least time spent in Parental care. Egyptian Vultures spent maximum time for foraging during afternoon followed by morning and evening hours. The major factor in predicting the feeding time preference during a day is the predictability of the food supply. The study will assist the conservation and management of a healthy Egyptian Vulture population. The study recommends the protection of the legal slaughterhouses and dumping sites in the region where Egyptian Vultures still exist and establishment of 'Vulture restaurants' for providing the safe and healthy food for vultures.*

*Keywords: Egyptian Vulture, Foraging, Population, Behaviour, Conservation.*

Received 24.05.2023

Revised 01.06.2023

Accepted 11.06.2023

**How to cite this article:**

Shivangi Mishra, Adesh Kumar and Amita Kanaujia- Observations on the Foraging Behaviour and Activity Patterns of Globally Endangered Egyptian Vulture, *Neophron Percnopterus* in Uttar Pradesh, India. Adv. Biores., Vol 14 (5) September 2023: 44-53.

**INTRODUCTION**

Egyptian Vultures are most seen vulture species in Uttar Pradesh at present after the plight of vultures in India. The basic concern for species survival is the food availability; consequently, it is a fundamental component to identify the habitat preference, population density and endurance of the species. Naturally-occurring food varieties for Egyptian Vultures are vertebrate carcasses, small mammals, reptiles, sometimes small live caught birds, and a wide species of arthropods or even on the faeces of different mammals [19,21,4,47]. Additional food is obtained from road kills, dump grounds near slaughterhouses, agro based factories, and food materials near the human settlements [51]. Vultures are the obligate and primary scavengers and their diet consists of carcasses of various sizes. It can also feed upon domestic refuse, excrement, eggs, and even small animals that it captures alive [58,32]. They are different from animals that opportunistically feed on carrion (secondary scavengers) as their many adaptations are specialized towards finding and consuming carcasses in a very efficient manner – long and bald head, exceptional soaring flight, and low stomach pH – [35, 67]. The Egyptian Vulture is the smallest of all the species of vultures and the most opportunistic species. The availability of food resources is key to understand the ecology of any organism [41]. The major challenge currently facing by conservationists is

the management of the feeding of threatened avian scavengers [23, 24]. It is one of only a few bird species that uses tools, throwing stones at eggs to break their shell to feed upon them [77,75]. Foraging in groups or social foraging is a behaviour observed in many species. Social foraging is a well-known phenomenon, and has its selective advantages as compared to the solitary foraging including, reduction of uncertainty regarding food location and quality [30]. There are different foraging tactics employed by various species. Egyptian Vultures are most often found in groups of 20 to 40 birds at foraging sites [55]. Social feeding provides information about the position of food and this behaviour is widespread in animals. The Egyptian Vultures are highly specialized opportunistic and social scavengers [57] and it has diverse feeding habits. Social foraging behaviour is a type of learning to forage in groups and it is important, even in two different species that have quite different foraging niches [42]. In the present study, our goals were to assess the foraging behaviour and other activity patterns of Egyptian Vulture at their selected feeding sites and thus provide recommendations for the establishment and management of vulture restaurants for this species in Uttar Pradesh. However, for management to be effective, both the breeding range (as discussed here) and foraging range of the population must be considered [27, 17].

## MATERIAL & METHODS

### Identification of active feeding sites

Active feeding sites were identified as the specific sites where the food availability was high due to rubbish dumps of slaughterhouses and Egyptian Vultures were found in large numbers in Uttar Pradesh. For identifying active and ingenious feeding sites five different districts were monitored seasonally between January 2014 - December 2016. The feeding sites (chosen randomly) were monitored by the observers and the photographs were taken at the distance of >500 m so that the individuals feeding there could be studied and counted without any disturbance. Distance of feeding sites from nearest waterbody, roosting site, slaughter house, bone mills and dumping site was measured to explore any possible link with foraging population size.

### Feeding time and behavior

The focal animal sampling method described by Altman (1974) was followed for recording the time-budget and activity pattern of Egyptian Vulture during feeding. Data on various activities were recorded at the prominent feeding site in Unnao from January 2016- January 2019. Various foraging activities were followed keenly throughout the day. All the activities were carefully observed with the help of the binocular. The activities were timed with the help of a stop watch. The activities were recorded during day light hours from sunrise to sunset with the help of binocular. For recording time budget-activities the feeding site was observed once a month every year. Following the techniques adopted by Kambale [39], the day was divided into three-time frames to observe various behavioral activities of the Egyptian Vulture throughout the day. Each time frame was comprised of two hours of observations. Morning 10:00 a.m. to 12:00 a.m., afternoon 12:00 p.m. to 2:00 p.m. and evening 3:00 p.m. to 5:00 p.m. This was done to get maximum behavioral activities during feeding and to know about the most preferred time of feeding during a day. In one day all the time frames were chosen. 17 different types of behavioural activities were studied at the feeding site at Unnao from January 2016 to January 2019. The behaviours were identified as described in Table 1.

**Table.1. The foraging behaviour exhibited by Egyptian Vulture**

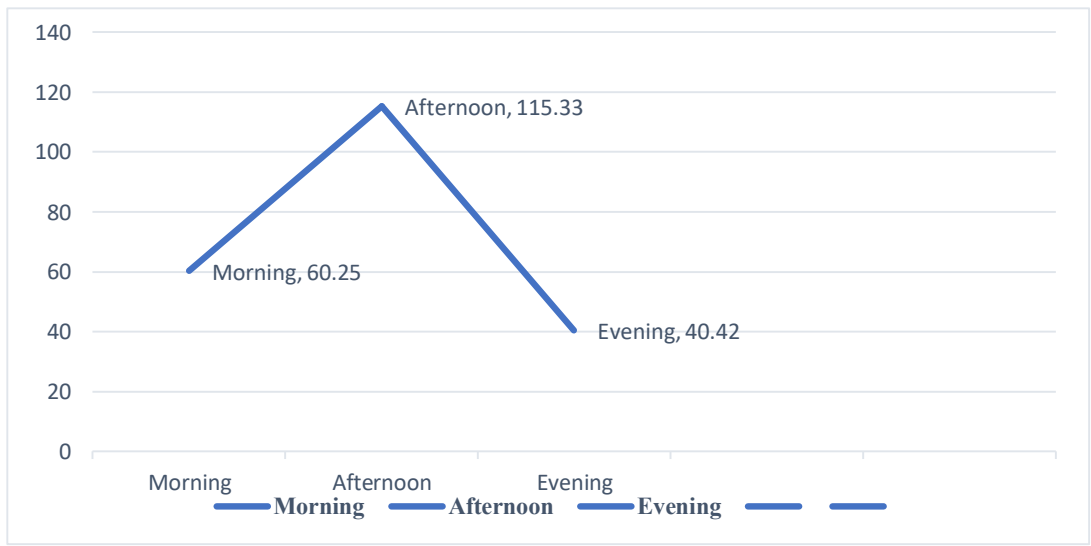
Behaviour	Description
Coprophagy	Feeding upon its own faecal matter [58].
Sunning	Basking in sunlight during afternoon
Stand still	Standing still at feeding site doing nothing
Tool using	Egyptian Vultures are among the very few tools using wild birds of the world [11-14].
Roost	Sitting and relaxing on ground or tree after feeding
Preen	Activity from beak to clean the feathers
Allopreening	A pair of individuals cleaning(preening) each other
Ground scratch	Scratching the ground to find anything
Look	Looking in the surroundings and scanning if there is any threat or adverse situation
Pecking meat	Digging in the carcass through beak or talons
Walk	Walking around at the feeding area
Social interaction	Interaction with other species like Black kites, Cattle egrets and Dogs
Dustbathing	Maintenance behaviour of rolling around in dust to remove ectoparasites [71]
Circling & soaring	Flying in circle over the feeding site
Fallen angel display	Display during the threat [65]
Parental care	Taking the food in beak for the young one
Formation flying	One individual little over the other and shifting delicately as they fly in line/ formation. This arrangement might be broken by unexpectedly tumbling together and occasionally talon-hooking. This display has been portrayed well and deciphered in the Egyptian Vulture (Cramp & Simmons 1980,

**RESULTS AND DISCUSSION**

**Feeding time preferred:** Egyptian Vultures spent maximum time for foraging during afternoon (115h 33min.) followed by morning (60h 25min.) and evening(40h 42min.) hours (Fig. 1). The major factor in predicting the feeding time preference during a day is the predictability of the food supply. Foraging has been observed to be terminated before sunset as by that time they get satisfied of feeding and reach a threshold level.

**Foraging behavior**

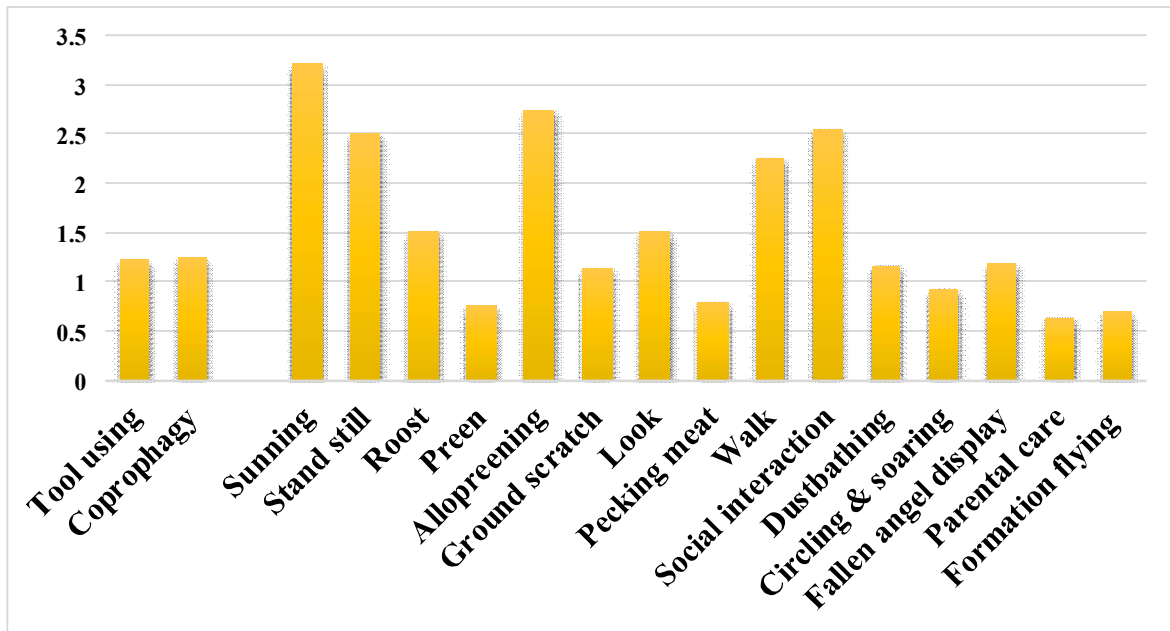
Seventeen types of foraging behaviors have been observed to be displayed by the Egyptian Vultures in Unnao, of which maximum time spent in performing sunning and least time spent in Parental care. Sunning >Allopreening>Social interaction > Stand still >Walk> Look> Roost >Coprophagy> Tool using> Fallen angel display> Dustbathing> Ground scratch> Circling &Soaring >Pecking meat >Preen >Formation flying> Parental care (Table 2, Fig.2).



**Fig.1. Graph showing Feeding time preferred during the day**

Behaviour	Total Time spent (Hours)
Tool using	1.23
Coprophagy	1.25
Sunning	3.21
Stand still	2.5
Roost	1.5
Preen	0.75
Allopreening	2.75
Ground scratch	1.13
Look	1.5
Pecking meat	0.8
Walk	2.25
Social interaction	2.53
Dustbathing	1.16
Circling & soaring	0.91
Fallen angel display	1.18
Parental care	0.63
Formation flying	0.7

**Table 2. Time spent in different Foraging Behavioural activities**



**Fig.2. Time spent in different Foraging behavioural activities**



Egyptian Vultures foraging with cattle egrets, Aligarh



Adults, subadults and Juveniles Ground roosting & Dustbathing at an agricultural field, Aligarh



Adults Roosting on a Bare/dead tree, Raebareli



A pair standing still near the waterbody, Unnao





Permanent feeding site at rubbish dump, Unnao



At the dump ground of a slaughterhouse, Bareilly



The alert parent in the active nest



Egyptian Vulture with a stick in its mouth to open the carcass



Egyptian Vulture feeding on faeces



Parent feeding the young one



**Fig.3 (A-L). Showing different foraging behavioural activities by Egyptian Vultures in Uttar Pradesh, India**

The present study identifies the importance of feeding sites and their management for the persistence and productivity of the Egyptian Vultures. Rubbish dumps and slaughterhouses are the driving force for the presence of Egyptian Vultures in Uttar Pradesh, India. This study is in concordance [49] which they have inferred that movements and home ranges of Egyptian Vultures have a relation with the rubbish dumps in Oman and the Horn of Africa. In comparison to other vulture species, the population of Egyptian Vulture is comparatively higher in Uttar Pradesh. The reason behind this is probably because there are several agro-based factories and slaughterhouses. The dump ground of slaughterhouses has been recorded for being the active and ingenious feeding sites for Egyptian Vultures. This study corresponds to the study [49] where they have described about the utilization of dump sites by Egyptian Vultures through radio tracking technique at northern Oman. Also, it has been observed that there is enough population of livestock and mammals especially in rural areas in Uttar Pradesh. People throw their dead cattle at a specific site in a village and those sites serve as the active feeding grounds for Egyptian Vultures and the Egyptian Vultures are in large numbers at those sites. This study is in accordance with the study [50], in which they have identified the relationship of livestock population with Egyptian Vulture diet. Moreover, Egyptian Vulture is an opportunistic feeder and the feeding points are more in number in Uttar Pradesh, such as slaughterhouses, bone mill factories, dumping sites etc. Every year thousands of animals are slaughtered at slaughterhouses running there. These species feed on carrion, eggs, bones and even on faeces. They are fond of crushed bones in the bone mill factories and therefore very often seen near the bone mill factories [70]. They are very often seen near human dwellings and are not adversely affected by human settlements [72]. They preferred an open environment to forage at all the study sites which is in agreement with the study which suggested that old world vultures do use odour to locate carcasses, and they forage primarily in open environments rather than in forests [34, 6]. Several works in past have also pointed out the importance of feeding points and their management for the persistence and productivity of the species [18, 22, 24-27, 46, 48, 69, 76]. The monitoring of the active feeding sites is being continued for further studies. The active feeding stations for Egyptian Vulture have been proved to improve their survival rates and stabilise their demography [44]. Foraging occupies a substantial amount of the daily time budget of every animal species. In our study it has been observed that Egyptian Vultures spent maximum time during foraging in afternoon, followed by morning and evening hours. There are different causes which influence the foraging behaviour of birds, such as time of the day, optimum temperature, season, prey availability, presence of predators and breeding season [2]. In such cases, for a foraging animal, the optimal behaviour may vary both with the quality of the foraging patch and with the internal state of an individual [52]. Individuals spend a portion of their time "foraging" activities [28, 36]. During the study period, the maximum Egyptian Vultures counted at the prominent feeding site was in winter season and minimum in Monsoon season. This seasonal variation is in correspondence to the study [5] suggested that birds forage more intensively on winter season because more energy is required to maintain their body temperature during colder days and more amount of energy should be stored for the upcoming colder night. A few investigations have discovered temperature-related changes in the scavenging conduct of birds. Food accessibility, territory structure, and interspecific rivalry are likewise liable for variety in the foraging habits of a bird [32]. According to Lange's study in which the intraspecific differences related to social hierarchies may also be revealed by identifying the influence of social status on feeding behaviours [43]. It has also been reported that the young followed their parents during their visits to feeding places; this behaviour is unusual among raptors and may be related with maturation of social foraging strategies [38].



Food is a limited resource for birds, affecting survival, breeding and behaviour [40, 60]. The behavioural reaction to variation in food supply has been documented for several bird species [15,66] and is related to predation risk [62]. However, until now few studies have assessed vulture behaviour in relation to food availability. During the present study different behaviours like tool using behavior, coprophagy, sunning, standing still on one leg, roosting preening, allopreening, ground scratching, looking, pecking the meat, walking, social interaction, dustbathing, circling and soaring, fallen angel display, parental care, Formation flying behaviour have been observed and recorded at the feeding site. Birds for the most part scatter over large areas and scan the landscape while at the same time observing each other's activity and behaviour [33]. In the bird species, the joined impact of scanning and other foraging activities determines the selection of feeding habitat [61]. Their foraging actions are greatly facilitated by their soaring flight which limits the energetic expenses of food searching and empowers them to broaden their range of foraging [63,64, 56,35].

The connections of foraging habitat accessibility, food plenitude, and other foraging behavioural activities are known to influence the size and the utilization of area [3,7,9,59]. In Unnao maximum number of Egyptian Vultures were observed due to the food availability from the rubbish dump ground of the agro-based industries. Our results correspond to the study which reported that changes in the abundance of vultures in an area also might have been caused by movement of individuals in response to changes in food availability [74]. Therefore, such sites must be protected and any modification in management of slaughterhouse refusals, carrion and feeding points would affect the species that are relied on them. In case of scavenger birds, a rapid significant reduction in food availability can have a negative impact on population parameters, since these are K-selected species characterized by low fecundity rates and long-life cycles [27, 53]. In Spain, the implementation of strict public health regulations has led to a reduction in the availability of livestock carcasses [16, 54]. This has resulted in an increase in the number of malnourished young ones being taken to wild. The management of trophic resources is of great importance for the conservation of threatened species (8,37). Studies proved that of all the threats observed for vultures, some of the main threats come from the lack of natural food availability and its poor quality [68]. During the study period it has been observed that, Egyptian Vulture is not dominant when feeding on carrion together with other species. Generally, after a long wait for its turn, it only feeds upon various remnants of meat left from carcasses [29]. They have relatively weak bill which cannot tear up the skin of a large carrion and is more adapted for the softer tissues [19]. Due to this limitation, Egyptian Vultures have adapted to feed on various organic material within its feeding range and to congregate on big rubbish dumps [19]. Its main diet item can vary from rabbits to pigs or to slaughtered sheep or cattle, depending on the sites they select for roosting [18]. They are Opportunistic feeders [32]. Their feeding habits also vary with their local fauna and depending on the presence and the contents of a rubbish dump, but in general it might be concluded that the preference is usually near small bird and mammal remains [79,32]. During the study different other species were also observed feeding with Egyptian Vultures. Therefore, it can be inferred that there is an overall feeding relationship in a guild and research [65], also suggests that there may be some positive and some negative effects of social feeding with regards to Egyptian Vultures. Social foraging behaviour may be a part of social learning which is widely used in vertebrates to acquire information about the changing environment [10, 78]. Social foraging may also be important for the habitat selection [20,73]. Some species of the vulture populations are already so critically endangered that they are becoming extinct in the wild very fast, and are dependent on various programmes as captive breeding aiming for their reintroduction back into the wild. Likewise, Egyptian Vultures are globally endangered species and knowing their foraging behaviour emphasises on various other management programmes for their conservation.

## CONCLUSIONS

The study will assist the management of a healthy Egyptian Vulture population This study recommends the protection of the legal slaughterhouses and dumping sites in the region where Egyptian Vultures still exist and establishment of 'Vulture restaurants' for providing the safe and healthy food for vultures. The application of measures for the management of food resources through different feeding stations may constitute an effective conservation tool. This will enhance the feeding population of the globally endangered Egyptian Vultures. Further studies are being taken up to study the foraging success of Egyptian Vulture.

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