



## Food Compositions of the Indian Fox (*Vulpes bengalensis*) in the Desert Region of Rajasthan, India

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### ABSTRACT

The study on food compositions of the Indian fox (*Vulpes bengalensis*) was carried out in Balotra (Barmer) in hot desertic land. This threatened species listed with Schedule II of Wildlife (Protection) Act 1992. This opportunistic and omnivorous animal feeds upon small rodents, birds, eggs, snake, lizards and insects. It also feeds upon seed and seasonal fruits of *Capparis decidua*, *Acacia tortilis*, *Acacia senegal*, *Aerva javanica*, *Prosopis cineraria*, *Prosopis juliflora*, *Salvadora persica*, *Ziziphus* species, *Cucumis melo*, *Citrullus lanatus*, *Cordia myxa*, *Punica granatum*. Direct observation technique and scat analysis were used to recognize the diet compositions. In total, 202 scats were collected across the study sites during the year of 2015 to 2018. Scats are analyzed to categorize the prey species of the fox. Seasonal variations were found in fox's diet. During winter season the fox mostly depended upon ber, aves and mammals while in summer it mostly likes *Prosopis juliflora*, *Acacia tortilis*, *Prosopis cineraria*, hair and bones of animals. During monsoon season it feeds on *Ziziphus* and small mammals.

**Keywords:** Indian fox, food composition, scat analysis, prey, desert.

### INTRODUCTION

The *Vulpes bengalensis* is a mammal from the order Carnivora, Caniformia suborder and Canidae family. It is locally known as lokri or lomri. The Indian fox is endemic species in India and spread from the lower regions of the Himalaya to the Southern tip of the Indian Peninsula and extends from Sindh Province of Pakistan east to Bangladesh (Pocock, 1936; Prater, 1980; Gompper and Vanak, 2006; Johnsingh and Jhala, 2004). The range of *Vulpes bengalensis* is restricted to the Indian subcontinent (Gompper and Vanak, 2006). The species is comparatively abundant in the biogeographically zones of the desert, semi-arid and also the Deccan Peninsula of India (Rodgers *et al.*, 2002). It is threatened species because of the loss of habitat and hunting its habitat (Vanak *et al.*, 2008).

The Indian fox prefers relatively parched areas, short grasslands, deciduous forests and scrub-thorn forests (Rodgers *et al.*, 2000). Indian foxes are generally observed in protected grasslands habitat compared to the agricultural scenario that reports in Southern India's survey (Vanak, 2005). The home ranges are calculated at approximately

2 km<sup>2</sup> (Maurya, 2012). The number of the Indian fox is rarely in abundance in its range and it may be absent from many places within its range (Vanak, 2005).

*Vulpes bengalensis* is opportunistic feeder (Johnsingh, 1978). The foxes are nocturnal in habit and eating regimen includes arthropods, small mammals, birds, reptiles, and different vegetative parts (Johnsingh, 1978; Johnsingh and Jhala, 2004; Manakadan and Rahmani, 2000; Cavallini and Lovari, 1991; Vanak, 2003). The presence of many types of vertebrates and invertebrates prey species were isolated by the fecal examination in southern Tamil Nadu (Johnsingh, 1978). Hairs of rodent were commonly reported in the scats of pups (Manakadan and Rahmani, 2000).

### MATERIAL AND METHOD

**Study area:** Research of the diet composition of Indian foxes was conducted in the different intensive study sites, which is situated near Balotra in Barmer district. It is the north-west part of the Rajasthan and falls in the hot desert region. It lies between 24° 58' to 26° 32' north latitudes and 70° 05' to 72° 52' east longitudes. The western

Rajasthan encompasses a diffusion of habitats such as flats, rocky plateaus, mountains and sand dunes. This place is characterized by excessive temperature, violent wind and extreme aridity. Block Balotra and nearby locations are partially desert, partly hilly terrain and agricultural land.

The study was carried out in three different sites for studying diet composition of Indian fox is divided into- (1) Plane ground with hillocks (hilly terrain) laying near Nakoda, Mewa Nagar and Asada (2) Irrigated areas are Tapra, Jagsa, Budiwada and (3) Sandy area with Sand-dunes portions is Manchhanio ki Dhani (Kaludi) and Bhukhan.

Various types of floral and faunal species are found in these regions. The vegetation of the study areas are mainly included *Capparis deciduas* (Kair), *Calotropis procera* (Aak), *Prosopis juliflora*, *Prosopis cineraria* (Khejri), species of *Zizyphus* (Bordi), *Euphorbia caducifolia* (thor), *Commiphora wightii* (guggal), *Colligonum polygonides* (Phog), *Datura stramonium*, *Leptadenia pyrotechnica* (kheep) etc. and various vegetables are cultivated over areas of irrigated land.

Several species of rodents, snakes and lizards are seen in study area. Among mammals *Gazella Bennettii* (Chinkara), *Boselaphus tragocamelus* (Nilgai), *Canis aureus* (Golden jackal), *Felis s. ornate* (Desert cat), *Vulpes vulpes pusilla* (Desert fox), *Vulpes bengalensis* (Indian fox), *Herpestes edwardsi* (Mongoose), *Hystrix indica* (Porcupine), *Hemiechinus auritus collaris* (Hedgehog), *lepus nigricollis* (Desert hare), *Tatera indica* (Indian gerbil) etc.

**Scat collection and Scat analysis:** For studies, the direct observation techniques, survey, questionnaires and interviews of local people including villagers and shepherds, photography were followed. During the survey pugmark and scat sample was also photographed and find out the remaining of undigested food in the scat by Korschgen (1980) and Putman (1984) methods. Scats were collected from study sites and near the den site then transfer into plastic bags. Thereafter, they were kept in an oven at 60<sup>0</sup> C for 48 hours in the laboratory. After dehydrated scats were drenched in water and dismembered by the help of the forceps and needle. Undigested remains such as insect, feathers, hairs, bones, seeds, skin, egg shells etc. were separated from each sample separately and they were divided into groups.

## RESULT AND DISCUSSION

Both plant and animal remains were found in the scats of Indian fox.

**Scat analysis of Indian Fox:** Scat analysis data showed diet and provided data about habitat use, den site location, marking of territories. Fox droppings vary in their appearance and consistency according to what the animal was eaten. Total of 202 identifiable scats were collected from all the tree intensive study sites and analyzed. Out of these scats, 95 were collected in summer season, 37 were collected in monsoon and 70 were collected in winter. Information's about results of scat analysis of Indian Fox, collected seasonally from selected study sites are represented in given table-1, 2, and 3.

**Table- 1: Scat Analysis of Indian Fox collected seasonally from Hilly area**

Intensive study area	Season	Total scats	Frequency	Hairs	bones	Feathers	Arthropods	Vegetable material	Other
Hilly area	Summer	45	F	32	23	12	14	24	7
			%	71.11	51.11	26.67	31.11	53.33	15.56
	Monsoon	20	F	11	8	4	19	15	5
			%	55	40	20	95	75	25
	Winter	32	F	20	24	14	1	15	0
			%	62.5	75	43.75	3.125	46.88	0

**Table- 2: Scat Analysis of Indian Fox collected seasonally from Irrigated area**

Intensive study area	Season	Total scats	Frequency	Hairs	bones	Feathers	Arthropods	Vegetable material	Other
Irrigated area	Summer	10	F	7	5	3	7	8	3
			%	70	50	30	70	80	30
	Monsoon	5	F	3	2	2	4	4	1
			%	60	40	40	80	80	20
	Winter	15	F	10	9	8	1	13	0
			%	66.67	60	53.33	6.67	86.67	0

**Table- 3: Scat Analysis of Indian Fox collected seasonally from Sand Dune area**

Intensive study area	Season	Total scats	Frequency	Hairs	bones	Feathers	Arthropods	Vegetable material	Other
Sand dune area	Summer	40	F	26	20	9	12	22	9
			%	65	50	22.5	30	55	22.5
	Monsoon	12	F	7	4	3	11	10	4
			%	58.33	33.33	25	91.67	83.33	33.33
	Winter	23	F	14	12	12	0	6	0
			%	60.87	52.17	52.17	0	26.09	0

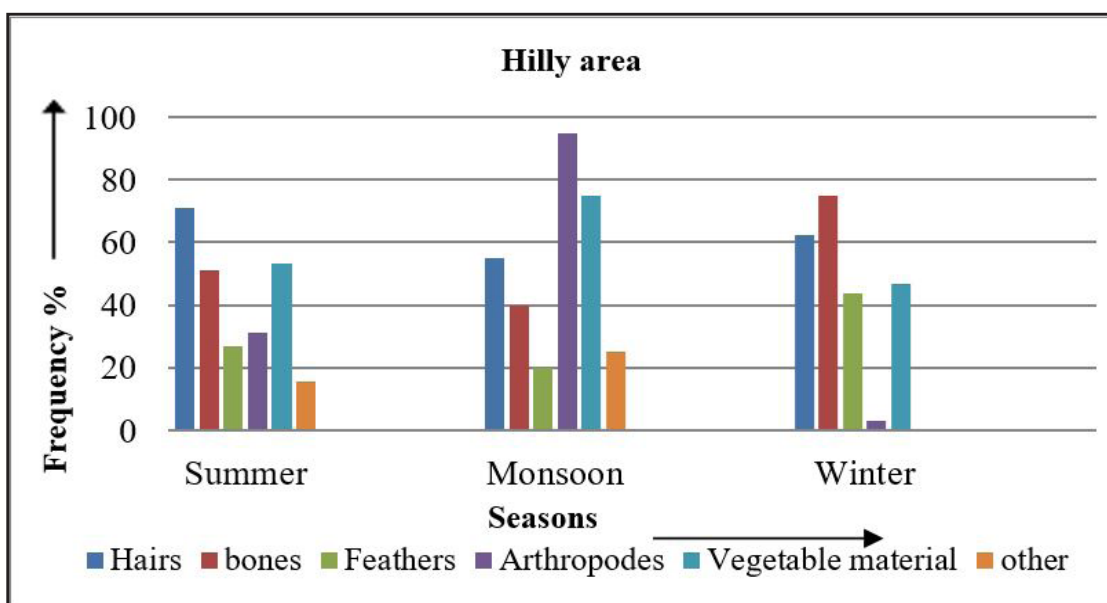


Figure-1: Frequency percentage of food compositions of Indian fox which found seasonally at Hilly area

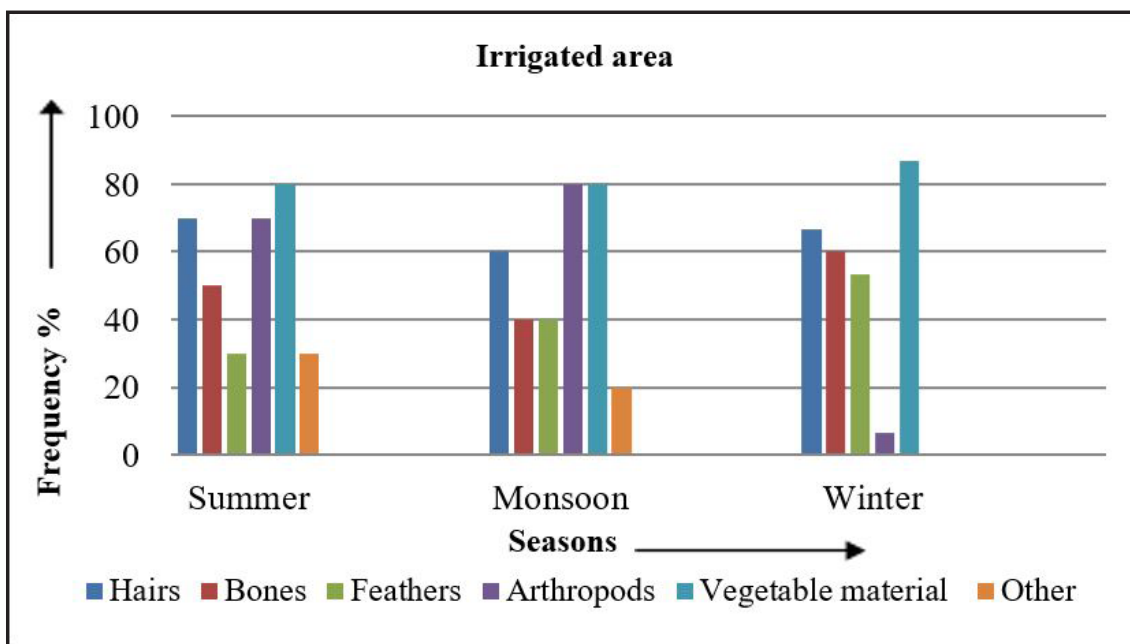


Figure-2: Frequency percentage of food compositions of Indian fox which found seasonally at Irrigated area

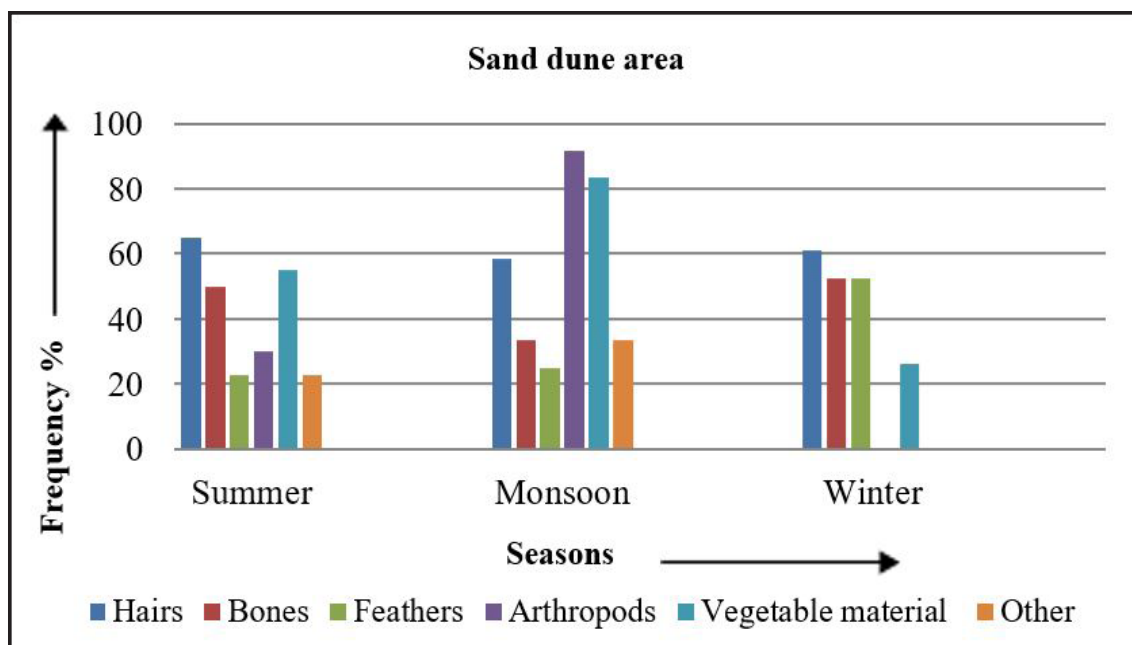


Figure-3: Frequency percentage of food compositions of Indian fox which found seasonally at Sand Dune area

Within each intensive site, significant differences in diet composition were detected during scat analysis. During the summer season, diet rich in fruits, vegetable matter such as Khejri fruits were higher in percentage and then Babool fruits and Ker. Grasses are commonly found in the scats of foxes.

Overall 97 samples of scat were collected from the plane ground with hillock area. Out of them, 45 scats were collected during summer, 20 scats recorded in monsoon and 32 scats were collected during the winter. In this study site occurrence of hair (71.11%) found higher than all other items during summer. It shows that flesh material was preferred by the foxes. Similarly, the occurrence of seeds and plant materials (53.33%), bones (51.11%), insects (31.11%), feathers (26.67%) and other (15.56%) recorded during this season. In monsoon season, the arthropods (95%) were found higher followed by vegetation (75%), hair (55%), bones (40%), other items (25%) and feathers (20%). During winter season, the occurrence of bones (75%) was the highest followed by hair (62.50%), plant materials (46.88%), feathers (43.75%). No other item was recorded that was collecting during the winter (Table-1).

Table- 2 showing in the irrigated study site, total of 30 scats were collected in all three seasons, out of them 10 scats in summer, 5 scats in monsoon and 15 scats collected throughout the winter season. The percentage of seeds and plant materials (80%) was observed higher than hairs and arthropods were found equal (70%) followed by bones (50%) and feathers and others were noted in

equal percentage (30%) during summer. In monsoon, the occurrence of arthropods and plant materials were found at the highest (80%) followed by hairs (60%), bones and feathers were found in equal percentage (40%) and others (20%).

At irrigated area, the cultivated crops (pomegranate) were the primary component of the diet during the winter season. Foxes were also observed in crop fields to damage the fruits of Pomegranate, Matira, Kachri and Melons.

In the sandy area with sand dune sites, 75 identifiable scats were collected from this site, out of them 40 scats in summer, 12 scats in monsoon and 23 scats were collected throughout winter.

Seasonally frequency of occurrence of seeds and plant material in Indian fox's scat was recorded highest in monsoon season (79.44%) than in summer (62.77%) and winter (53.21%). Different categories and their respective food items observed during scats analysis. According to Table-3 during summer season hairs (65%) were found as the major category followed by plant material (55%), bones (50%), arthropods (30%), feathers and other observed in equal percentage (22.50%). During monsoon season, major components recognized were arthropods (91.67%) followed by vegetable materials (83.33%), hairs (58.33%), bones and other material (skin, eggshell, wick of lamp, coconut covering etc.) found in same percentage (33.33%) and feather (25%). For winter season, hairs (60.87%) were higher followed by bones and feather in equal percentage (52.17%) and plant material (26.09%).

No other item and arthropods were recorded that were collecting during the winter.

Gerbils, rabbits and birds were major prey of the Indian fox diet and insects were found frequently in the scat of the fox.

**Changing in feeding behavior:** During the study period, the Indian fox was observed to feed on deferent items and scat analysis were also showed that feeding behavior is different from the natural food. The Indian fox was found eating artificial food near small temple locally known as 'Than'.

During scat analysis, cotton, wick of lamp, polythene, coconut pieces and bread were also obtained in the remains of its feces collected from Kaludi, Mewa Nagar and Nakoda.

The results indicate that Indian foxes are opportunistic feeder and depend on the availability of the food in that habitat. They prey on available animals which are found within their territory. This study shows the ability of the foxes to adapt to different situations in the field.

In resemblance, the noticeable parallel prevalence was also reported by Home and Jhala (2009) that *Ziziphus nummularia* was the major portion of Indian fox's fruit diet and also reported the least quantity of the pods of *Prosopis juliflora* in scats.

The present study supports the earlier studies (Johnsingh, 1978; Manakadan and Rahmani, 2000 and Home and Jhala, 2009, Jaipal, 2015) have emphasized the general strategy of the Indian foxes in terms of food procurement. The overall prevalence of food habits of Indian foxes recorded in the present study is in close proximity with the observations of Mukherjee *et al.* (2004) who reported small mammals are high energy food resources, Williams *et al.* (2002) reported small mammals are an important source of water for a wide variety of small carnivore inhabitants of arid habitats, Home and Jhala (2009) who reported that 83% of the total mammalian diet of the Indian fox was formed by the rodents.

## ACKNOWLEDGEMENT

We would like to thank Head, Department of Zoology, Jai Narain Vyas University, Jodhpur for providing facilities during study. We would like to thank local people and shepherd for their assistance with field work.

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