Original Article
DOI: https://doi.org/10.70749/ijbr.v3i9.2630

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Study on Jackals Egesta Inhabiting District Karak, Khyber Pakhtunkhwa in Perspective of Their Future Abundance

Mansoor Ullah[1], Asfandyar Alam[2], Ijaz Ahmad[1], Aleem Ullah[3], Hafiz Anwar Ullah[4], Mohammad Salim[5], Wajahat Ali[5], Zafar Ali Khan[2]

[1]Department of Zoology, Government Post Graduate College Karak, Khyber Pakhtunkhwa, Pakistan.
[2]Department of Zoological Sciences, University of Science and Technology, Bannu, Khyber Pakhtunkhwa, Pakistan.
[3]Department of Microbiology, Kohat University of Science and Technology, Kohat, Khyber Pakhtunkhwa, Pakistan.
[4]Department of Zoology, The University of Lahore, Punjab, Pakistan.
[5]Department of Forestry and Wildlife Management, The University of Haripur, Khyber Pakhtunkhwa, Pakistan.

ARTICLE INFO

Keywords: Asiatic Jackals Diet, Scat Analysis, Feeding Ecology, Plant and Animal Matter, Anthropogenic Food, Composition of Prey, District Karak, Khyber Pakhtunkhwa, wildlife Ecology.

Correspondence to: Asfandyar Alam, Department of Zoological Sciences, University of Science and Technology, Bannu, Khyber Pakhtunkhwa, Pakistan.
Email: asfiizoologist83@gmail.com

Declaration
Authors' Contribution
The first two authors are joint first authors and contributed equally to the study. All authors participated actively in the research process, manuscript preparation, and final approval of the submitted version.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History
Received: 01-07-2025 Revised: 09-09-2025
Accepted: 21-09-2025 Published: 30-09-2025

ABSTRACT

The goal of the current study was to determine the diet ecology of the population of jackal's residing in various areas of the district Karak. It was carried out at the GPGC Karak Zoology Department. Total 96 scats samples were gathered from various locations. The purpose of this study was to learn more about the district Karak Asiatic jackal population's dietary preferences and projected abundance. Each and every sample from the scats was examined in a lab. The current study's findings suggested that the average percent volume composition (N=96) of scats samples from each of the three sites (Tehsils) in the district of Karak showed that this sample constitutes 48%plant matters, 42.22%animal matters, and 4.12% soil, while average anthropogenic materials recovered from all scats samples were 5.7% by volume. Particularly, the plant materials include seeds, grass, tiny leaves and stems, wheat (*Triticumaestivum*), Bair (*Zizyphus spp.*), Bajra (*Pennisetumglaucum*), zheera (*Cuminumcyaminum*), chana (*Cicerarietinum*), orange (*Citrus sinensis*), melon (*Cucumismelo*), water melon (Citruluslanatus). Similar to the animal matter, which consists of bones, scat analysis also revealed the presence of house rats (Rattusrattus), dogs (Canisfamiliaris), rabbits (*Oryctolaguscuniculus*), goats (*Capra hircus*), sheep (*Ovisaries*), cows (*Bos Taurus*), reptiles and some invertebrates. The soil and anthropogenic elements, in addition to plant and animal material, altered the food preferences of Asiatic jackals.

INTRODUCTION

Jackals are medium sized omnivorous predators that are widely distributed throughout the world, from the Arctic to tropical forests. They are belonging to the Canidae family, which is divided into five major genera: dogs, wolves, coyotes, foxes, and jackals [1]. There is currently 13 species of jackals known to exist worldwide [2] out of which four are particularly well-known: the golden jackal (Canis aureus), the black-backed or silver-backed jackal (Canis mesomelas), the side-striped jackal (Canis adustus), and the uncommon Simien jackal (Canis simensis) [3]. The adult jackals normally have a body length of 70–105 cm, a tail about 25 cm, a shoulder height of 38–50 cm, and a weight of 7–15 kg. The Males jackels are noticeably sexually dimorphic and weighing around 15% more than females. Additionally, the social organization of jackals varies according on the availability of food and habitat [4]. In addition to having well-developed smell glands on their faces, anuses, and genital areas, jackals have comparatively long legs, slender feet with short pads, and four to eight mammae for nursing young [5]. The Different species and seasons have different coat colors, ranging from pale creamy yellow to deeper yellow, with populations living in hilly areas typically displaying greyer tones [6]. The unique patterns which is found on the throat and chest further coibute to a jackal uniqueness, and the pair bond between male and female jackals typically lasts a lifetime. The both parents provide care for the young while the males

frequently take on additional parenting responsibilities [7]. The Jackals utilize howling to strengthen pair bonds and locate one another across great distances. The fundamental social unit is a monogamous pair that protects a common area from the encroaching competitors. The territories are preserved by an active chasing and scent marking with urine and feces which sustains the young until they reach adulthood and establish their own ranges [8]. The groups of jackals frequently exhibit the affiliative behaviors such grooming, coordinated vocalizations, and welcome rituals [9].

The Jackals mostly consume gerbils, lizards, snakes, fish, muskrats, and a variety of fruits, such as wild olives, mulberries, apricots, watermelons, muskmelons, tomatoes, and grapes, in habitats like the Karakorum valley borders and desert regions [10]. In terms of a ecology the jackal are opportunistic foragers, scavengers, and predator. Their diet fluctuates seasonally and geographically, and diet investigations reveal that fruits, birds, and rodents make up more than 60% of their diet [11]. Additionally, they also eat arthropods, beetles, plants, and larvae like dragonflies and In many areas, jackals frequently scavenge carcasses left by wolves, lions, tigers, leopards, and dholes. They also live off of anthropogenic resources like trash and carrion, and they may bury extra food to store it [12].

When a jackal's prey on game species like roe deer fawns, hares, coypu, pheasants, francolins, bustards, and waterfowl as well as domestic animals like turkeys, lambs, goats, sheep, and calves, they can become a dangerous pest. They can also harm crops like grapes, maize, sugarcane, and different fruits [13]. In southern Bulgaria almost 1,000 jackal attacks on sheep and lambs were reported between 1982 and 1987 with extra losses of newborn deer on game farms [14]. The jackals are less dangerous than wolves and foxes in Greece, they can have a significant impact on small livestock as their number grows.

Poor management and increased food availability from illegal rubbish dumps are blamed for the high predation rates in Bulgaria and Israel, which have led to the development of the jackal population. Jackals may also operate as limiting factors for the population densities of certain animal species [15]. Jackals are also found throughout Pakistan plains and deserts area and are ideally suited to a dry, open environments it is often travel to cities and villages in search of food, particularly in the vicinity of waste sites, where they may harm crops, kill chickens, and occasionally carry diseases like rabies, resulting in financial losses so despite these problems, jackals play a beneficial role by decreasing rodent numbers and spreading seeds [16].

The food of the omnivorous opportunistic Asiatic jackal varies and depending on the season and location. The groups of jackals might pursue larger or weaker ungulates many times their body weight, individual jackals usually seek tiny prey like rodents, birds, and hares.

Although the species is widespread throughout Pakistan little which is known about its ecology, particularly with regard to seasonal and location-specific eating habits. The diet which is often consists of birds, snakes, hares, and various small animals in addition to fruits and invertebrates. The understanding its ecological function, interspecific competition, and consequences for wildlife management all depend on this information [17].

The Asiatic jackal Is regarded a generalist feeder that can take a variety of advantage of a variety of environments and food sources [18]. The species can flourish in a variety of ecological settings and landscapes thanks to its versatility [19]. The fact that jackals eat a wide range of foods, European farmers and hunters frequently assume that they mostly hunt roe deer and domestic animals. However, research from the Balkans reveals that jackals mostly rely on a manmade resource like animal corpses and hunter-left viscera. The Small mammals particularly such as rodents it will form a significant element of the golden jackal's year-round diet, especially in areas with intense agriculture, according to study from Hungary [20].

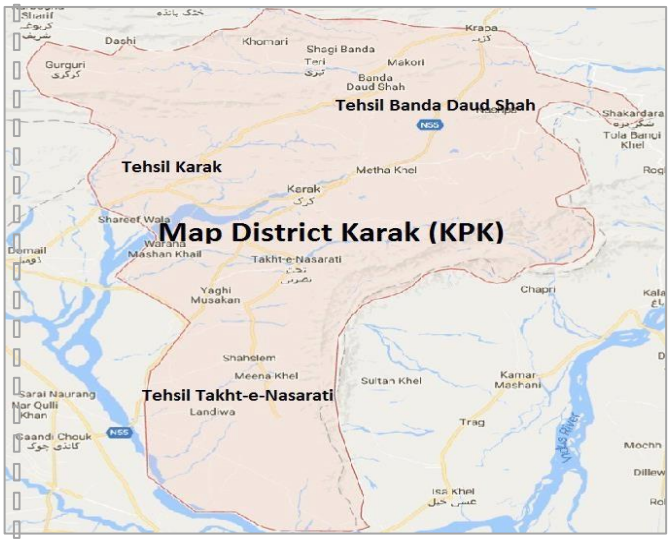
The IUCN Red List which has been designated a jackal as "Least Concern." It is also included in a number of international conventions, such as the Bern Convention (1979) and the Convention on Biological Diversity (1992) [21]. In India the jackals are included in Schedule III of the Wildlife Protection Act of 1972 and Appendix III of CITES [22]. The possible implications on a ecological balance and predator prey dynamics, the species' growing range in Europe has created management concerns. In Hungary the stakeholders frequently believe that a golden jackals have a significant negative influence on major game species like fallow deer and roe deer [23]. The cervid species like red deer, roe deer, and fallow deer are also Identified in jackal diets, while a Serbian study discovered that a domestic animal remains predominated in winter diets [24].

2. MATERIAL AND METHOD

2.1 Study Area

The study was carried our in district Karak which is located on the Indus highway N-55 (from Peshawar to Karachi) in Khyber Pakhtunkhwa, Pakistan, 150 kilometers from Peshawar, the temporary capital. Karak is a desert area with 330 mm of yearly precipitation. In certain places, rugged terrain and a lack of water are the main obstacles to business. In the towns where the facilities are available, some macro and micro livestock may be created. Only 2.1% of the district of Karak has xerophytic vegetation due to its arid and semi-arid climate, which prevents it from supporting a wide variety of green plants. The Distract Karak is a divided into three Tehsil which include Tehsil Karak, Tehsil Banda Daud Shah, and Tehsil Takht-e-Nasrati. There three tehsils in distract Karak were the sites of the study. The jackals in Distract Karak often inhabit steep regions during the day and migrate to plain areas at night in a pursuit of food.

Figure 2.1
Study area Map of District Karak Khyber Pakhtunkhwa, Pakistan



2.2 Sample Collection

The Samples were collected from all scheduled/fixed sites in three Tehsils in the Karak district: Tehsil Takht e Nasrati, Tehsil Karak, and Tehsil B.D. Shah. Nevertheless, we only examined 12 sites for jackal scat collection. These localities are shown in table 2.2 below. A total of 96 scat samples are provided by the twelve locations. 35 scat samples were collected from Tehsil Takht e Nasrati, 40 from Tehsil Karak, and 21 from Tehsil B.D. Shah, according to Table 2.2 Every fecal sample was safely placed in a separate zipper lock bag and appropriately labeled with the location's name and the date of collection. The Government Post Graduate College Karak's Zoology department laboratory received all of the items for additional processing.

Table 2.2
Sample collecting localities

Name of Tehsils	Localities	Number of scats sample	Total no of scats collected
Tehsil Takht-e- Nasrati	Sarkilawagher	11	35
	Sirajkhel	09	
	Kanda	08	
	Lora Banda	07	
Tehsil Karak	ShahidanJandri	09	40
	Sabir Abad	15	
	EsakChontra	07	
	Toordhand	09	
Tehsil B.D.Shah	Jhatta Ismail Khel	08	21
	NariPanos	06	
	Gurguri	05	
	Dagarnari	02	
Grand total			96

2.3 Analysis of Scat

The collected scats were placed in a warm, dry position in the sun which prevent bacterial or fungal damage to their contents and to dry them for further processing. After the scats when it is completely dried, their physical attributes, including length, width, and weight, were recorded. Before being thoroughly cleansed under running tap water to remove mucus and superfluous dust particles, the scats were submerged in warm water for at least 24 hours. Their contents were meticulously separated after going through a fine-mesh sieve, and any hair, bones, feathers, and plant material that had been gathered were inspected (first with the naked eye and then with a 10X hand lens).The recovered food items were categorized into multiple groups based on whether they were "plant based" or "animal based" after the separated contents were sun-dried for two to three days on paper. Each was weighed independently using an electronic weighing balance [25].

2.4 Reference Materials Collection from Scats Collected Localities

The Hair samples of potential mammalian prey species (both domestic and wild) of Asiatic jackals found in the study area were collected in order to develop a hair identification key. The domestic animals whose hair samples were used as reference materials included goats (Capra hircus), sheep (Ovisaries), cows (Bostaurus), buffalo (Bubalisbubalis), and dogs (Canisfamiliaris); the wild animals included foxes (Vulpesvulpes), house rats (Rattusrattus), and house mice (Musmusculus). A photographic reference key of potential prey species was developed in order to identify the material recovered from the analysis of Asiatic jackal scat samples.

2.5 Preparation of Whole Mount

Light microscope slides were used to process the prey species' hairs that were extracted from the scats. The hairs were initially submerged in carbon tetrachloride for 15 to 20 minutes in order to prepare the complete mount. The hair was then evenly distributed and placed on a pristine glass slide with DPX mountant. According to [26], the medullary pattern of the hair and the cuticle cast pattern were used to identify the species of prey. Long hairs were cut into two or more small pieces, and jumbled hairs were separated from one another to place a single hair on the slide. Scat hair slides were compared to reference hair slides. Plant objects, feathers, and bones recovered from scats were similarly classified and identified. The medullary patterns of the hairs were initially studied under a microscope at a lower magnification (10x) and then at a higher magnification (40x and 100x, respectively).

2.7 Identification of hairs obtained from scats

Mammalian hair cuticular scale patterns were studied using the Lavoie technique (1971) [27]. This is required when mixing 3 ml of glycerin with 94 ml of warm water in a beaker and then adding 3 g of gelatin to create a 3 percent solution of glycerin jelly. The beaker was then heated in a pan of boiling water to prevent the medium from jelling. Two or three droplets of medium were placed on a glass slide with clean hair arranged vertically to the long axis. One end of the hair stuck out from the edge of the slide, making it easy to pluck in a single attempt.The slide was then permitted to solidify for a period. In order to prevent hair from sticking to the media, it was swiftly removed from the slide using forceps. Under a microscope, the hair cast, an exact duplicate of the scales of the hair, was evident.

2.8 Identification of seeds obtained from scats analysis

To identify the plant components, the seeds extracted from the scats were grown in several pots. Their identification

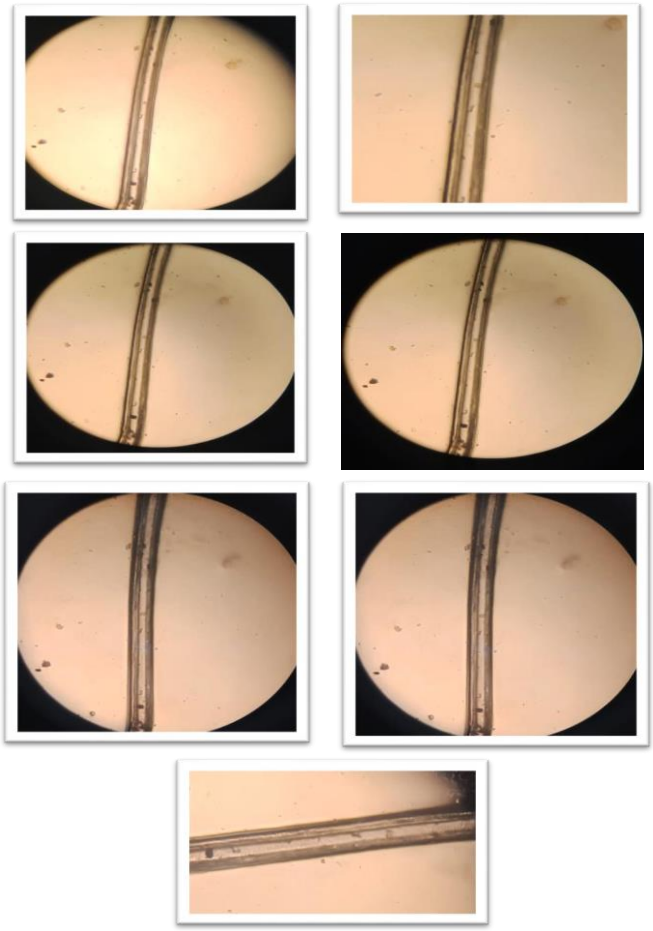
was eventually confirmed. This is how the seeds that were taken out of the scats were identified.

2.9 Microphotographs

Microphotographs of the reference hairs and scale patterns of the representative medulla were taken along the length of the hair using an XSZ 107BN microscope. A 10.2 mm x 10.2 mm DCE-2 electronic eyepiece was installed on an XSZ 107BN microscope in order to capture images.

Figure 2.9

Photograph of some of the reference hair slides under microscope (100X)



3 Results

Ninety-six scat samples were collected from different parts of the Karak district. After analysis we found that on average, the Jackals' diet included soil, anthropogenic items, and more plant matter than animal stuff. Following the measurement and weighing of these samples, the following findings were presented.

Table 3

Detail of morphometric characteristics of scats collected from different localities of District Karak.

S. No	Study Site	Sample Size (N=96)	Average Weight (g)	Average Length (cm)	Average Width (cm)
1.	Takht e Nasrati	35	8.89 ±0.50	5.63±0.13	1.34±0.03
2.	Karak	40	8.76±0.52	5.37±0.16	1.25±0.05
3.	Banda Daud Shah	21	8.19±0.50	5.18±0.16	1.3±0.05

3.1 Analysis of Diet from undigested material

The analysis of the scat samples from the species of Asiatic jackal revealed 29 distinct food types that were often found in both plant and animal remains. Nonetheless, certain anthropogenic and soil materials were also identified, and the fraction of plant matter was marginally higher than that of animal matter.

3.2 Result of scats samples from site-I (Tehsil Takht-e-Nasrati)

The analysis of scat samples from site-I (Tehsil Takht-e-Nasrati) (N=32) revealed four the main groups of materials such as animal matter, plant matter, soil, and anthropogenic elements (table 3.2). Seventy-nine percent of the recovered remains from study site I were seeds. Scats gathered from this area contained plant residues (50.35% by volume) in the form of wheat and grass leaves (about 64% by volume) and seeds (18.79%) of a variety of plants, including tomatoes, berries, melon, water melon, and oranges. The percentage of animal remains from scats, including both domestic and wild animals, was 38.27%. Goats, sheep, and poultry fowl (2.94% F) were among the domestic food that jackals from this area consumed, while rodents were among the wild prey species. 5.45% of the anthropogenic materials and 5.53% of the soil were recovered (Table 3.2).

3.3 Result of scats samples from site-II (Tehsil Karak)

Results (N=32) from study site-II (Tehsil Karak) revealed that less plant matter (36.11% by volume) was consumed compared to site-I, while more animal matter (50.01%) was consumed. Soil (3.10%) and anthropogenic material (5.99%) recovered from scats did not differ significantly from site-I. 48% of samples had hairs, but 96% of scats (%F) had bones. In addition to feeding on other wild (rodents) and domestic prey species (goat, sheep, poultry birds) in study site II, Asiatic jackals also scavenged on cows (Bostaurus; 33.33% F) (Table 3.2).

3.4 Result of scats samples from site-III (Tehsil Banda Daud Shah)

N=32 scat samples from site-III (Tehsil Banda Daud Shah) revealed that while animal matter (38.37%), soil (3.33%), and anthropogenic elements (5.56%) were consumed at the lowest rates across all three study sites assessed, plant matter (57.53% by volume) was consumed at the highest rate. The bones constituted upto 86% (by frequency) of the animal detritus retrieved whereas hairs made up roughly 37% (by volume). At this site, different rodent species made up 18.2% of the total volume and were the Asiatic Jackal's main natural prey. Goats (1.19% V) and poultry fowl (1.22%) were among the domestic prey species. The plant matter included small grass and wheat leaves and stems, as well as seeds from various domestic and wild fruits, such as water melon (1.12%), tomato (13.83%), bajra (0.43%), and some unidentified plant material (UPM; 2.96%). The average volume composition of (N=96) scat samples from all three Distract Karak locations was composed of 48% plant materials, 42.22% animal matter, and 4.08% dirt. So from all the samples collected, an average of 5.7% by volume of anthropogenic material was recovered Fig. 3.2.

Table 3.2

Percent frequency of occurrence (%F) and percent volume occurrence (%V) of food items in the scat samples of Asiatic jackal collected from three selected sites of district Karak.

S. No	Diet Contents		Site 1		Site 2		Site 3	
			F%	V%	F%	V%	F%	V%
1.	Plant matter	Seeds	79.41 (27)	18.79	96.29 (26)	22.49	86.20 (25)	17.97
		Grass	14.70(5)	4.93	7.40(2)	1.25	3.44(1)	1.65
		Small leaf, stems	17.64(6)	5.92	3.70(1)	0.37	0	0
		Triticumaestivu m (Wheat)	11.76(4)	5.79	0	0	0	0
		Lycopersicumes culentum (tomato)	2.94(1)	0.49	3.70(1)	1.18	20.68 (6)	13.83
		Zizyphusspp (Bair)	5.88(2)	1.66	14.81(4)	3.69	6.89(2)	3.01
		Pennisetumglauc um (Bajra)	5.88(2)	1.53	0	0	3.44(1)	0.43
		Cucumismelo (melon)	0	0	7.40(2)	0.95	0	0
		Citruluslanatus (W.melon)	0	0	3.70(1)	0.63	3.44(1)	1.12
		Citrus sinensis (Orange)	2.94(1)	0.96	0	0	3.44(1)	2.82
		Cuminumcyami num (Zeera)	0	0	3.70(1)	0.9	0	0
		Cicerarietinum (Chana)	8.82(3)	2.12	3.70(1)	0.55	31.03 (9)	13.74
		UPM	8.82(3)	8.16	25.92(7)	4.1	27.58 (8)	2.96
		Total	**50.35**		**36.11**		**57.53**	
2.	Animal matter	Bones	32.35 (11)	3.25	37.03 (10)	4.09	41.37 (12)	5.91
		Bos Taurus (Cow)	23.52(8)	4.91	33.33(9)	3.48	17.24 (5)	1.96
		Feliscatus (cat)	8.82(3)	3.77	7.40(2)	3.78	6.89(2)	2.74
		Capra hircus (Goat)	14.7(5)	2.55	11.11(3)	1.41	10.34 (3)	1.19
		Ovisaries (Sheep)	2.94(1)	1.52	1.99	0	0	1.15
		Rattusrattus (House rat)	12.14 (12)	2.50	3.45(6)	1.25	6.89(2)	0.73
		Oryctolaguscuni culus(rabbit)	8.96(8)	3.12	21.35	4.05	3.44(1)	0.35
		Musmusculus (House mouse)	2.94(1)	0.42	0	0	12.45 (9)	2.59
		Canisfamiliaris (Dog)	2.94(1)	0.58	19.30(9)	2.85	12.15 (8)	1.26
		Vulpesvulpes (fox)	2.55(3)	0.32	12.4(7)	1.11	2.51(9)	0.05
		Reptails	4.32(2)	1.25	12.65(4)	4.30	16.32 (5)	2.92
		Invertebrates	15.22(8)	3.25	12.24(9)	2.33	18.22 (11)	5.65
		Birds	2.94(1)	0.09	0	0	0	0
		UAM	17.64(6)	10.74	55.55 (15)	21.36	27.58 (8)	11.87
		Total	**38.27**		**50.01**		**38.37**	
3.	Others	Soil	55.88 (19)	5.93	59.25 (16)	3.10	55.17 (16)	3.33
		Anthropogenic items	32.35 (11)	5.45	51.85 (14)	5.99	41.37 (12)	5.56
		Total	**11.38**		**9.09**		**8.89**	

The graphic representation of the diet composition of jackals shows all the three tehsils of district Karak.

Figure 3.1

Graphical representation of Volume percentage of diet composition of Jackals scats collected from all tehsils of district Karak

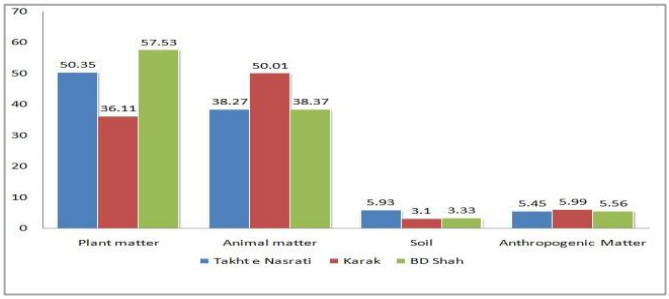
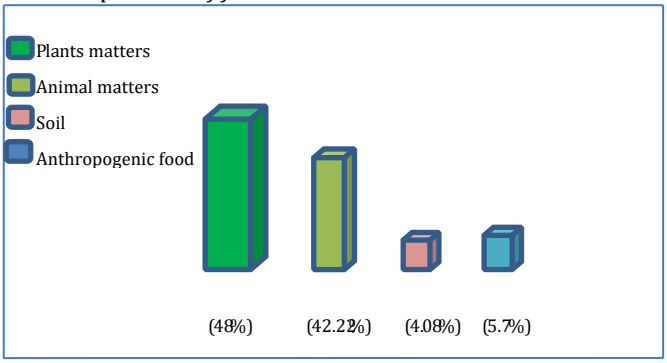


Figure 3.2

Diet composition of jackals in district Karak.



3 DISCUSSION

According to Hungarian Red Book Data from the early 20th century, the golden jackal was formerly believed to be extinct because of habitat deterioration, population fragmentation, a shortage of food, etc. Although the jackal's range was extended in 1980 to include Italy, Hungary, Slovenia, Austria, Serbia, Germany, and Slovakia, it is today found throughout central Asia and the whole Indian subcontinent [28]. In this study, we looked at the feeding patterns and dietary preferences of the jackal population in several areas of the Karak district.The diet consisted of both plant and animal components. Even yet, plant materials were consumed at a little higher rate than animal materials. The higher prevalence of a plant matter (46.33%) compared to animal matter (36.40%) indicates that jackals are primarily dependent on leaves, flora, crops, and plant seeds. The jackals also consumed soil (11.60%) and anthropogenic detritus (5.67%). Another similar investigation was carried out in Pakistan's Potohar belt. The results of their study support our conclusions. Using 98 scats that were gathered from several places in Potohar, Pakistan, between January 2009 and March 2010 So 2009-2010 examined the dietary patterns of the Asiatic jackal. Animal prey items were discovered 46.2% of the time, but plant things were detected 54.0% of the time. Ziziphus was a year-round plant food, but wheat, grasses, and wild olives were the staples of the diet outside of the summer. Carcasses from animals can be used to make animal food all year long. Though less commonly than animal corpses, small creatures, especially mice, were also consumed all year long. The study's findings demonstrate that golden jackals can adapt to a variety of environments, including forests and agricultural and arable regions. Furthermore, it was discovered that the grasslands were utilized during the day while the village's fields were typically employed at night [29]. The species' diverse adaptability and evolutionary trends as a successful opportunistic hunter and scavenger may be explained by this. Asiatic jackals in the current study enhanced their diet by eating a range of fruits and seeds. These foods are all very significant in terms of nutrition because they are rich in key vitamins and energy. Similarly, in compliance with the International Union for the Conservation of Nature 2004 by IUCN. Additionally, the jackal eats a lot of vegetables, and during India's The animal species also eats a lot of Bair (Zizyphus spp.) during the fruiting season. Vilayati Kikar, orange (Citrus sinensis), Bajra (Pennisetum glaucum), and Syzigium cuminii Pods of (Prosopisjuliflora) by IUCN 2004. Our findings are supported by the aforementioned published research, which claim that there are a few more resources relating to plants rather than those related to animals, which is also the current examine.

Our results are supported by the previously stated published publications, which assert that there are somewhat more things associated with plants than with animals. The current study's findings indicate that 5.39% of Asiatic jackals' food in district Karak areas consisted of birds. Because it is difficult for Asiatic jackals to catch birds, even though they typically fail, the frequency of bird remains in their scats depends on the availability and accessibility of their carcasses [1].The percentage of birds that Asiatic jackals consume varies widely, ranging from somewhat high in protected areas in India (Mukherjee et al., 2004) to a protected wetland in Greece [12]. According to a comparison of multiple published research. According to studies done in portions of Hungary in 2002 by Lanszki and Heltai, small rodents such as bank voles (Clethrionomys glareolus) and common voles (Microtus arvalis) dominated golden jackals' diet in the spring and winter (43.1% of occurrence and 55.3% of biomass). The ungulate corpses made up a significant component of the spring and winter diet and accounting for 41.1% of biomass and 23.5% of occurrence. The remnants of red deer (Cervuselaphus), fallow deer (Cervusdama), and roe deer (Capreoluscapreolus) were the most significant Cervidae species detected in the jackals' diet based on occurrence; however, wild boar (Susscrofa) was determined to be significant based on biomass [12]. Mole crickets (Gryllotalpagryllotalpa) and arthropods from the Carabidae family (frequency of occurrence 15.3%) were occasionally consumed by jackals [30]. Despite the discovery of plant materials such as grasses and corn, their quantities were considered negligible [26]. According to research on the rats and other small mammals make up the majority of the Golden Jackal's diet. Similarly, Khan discovered that birds, a few cold-blooded animals, and rodents such the bandicoot rat, house mouse, Indian gerbil, and soft-furred field rat made up the majority of the diet of an Asiatic jackal (Canisaureus) in central Punjab (Pakistan). Nonetheless, the findings of certain other research, including those by also conflict with those of the current study . This can be the result of their habitat having more food than usual. There is a significant amount of green vegetation and plant seed in the egesta material that was gathered from the scats of the jackal population living in the Karak district. From the analysis and contrast of the findings of our study with pertinent research carried out in Pakistan and other nations. While some of the past research supported our assertion, most of the preceding findings were in conflict with our findings. The data variability and a poor agreement with earlier research demonstrate how variable jackals eating habits are as so the Karak receives very little rainfall, making it unsuitable for extensive cultivation and lush vegetation. Because of the small number of plants in this area, there is no forestation. As a result, the diversity of the wild animal fauna has drastically declined. As a result, the foliage and other living things provide the jackals with the sustenance they require. In the Karak district, jackals usually look for food at night by prowling the village fields. They consume dropping plant seeds and vegetative crops. The self-care of domestic animals and the decline in wild fauna are the reasons for the decreased usage of animal products relative to plant products.

CONCLUSION

The results of the study show that the jackal in District Karak has been successfully evolved into a meso-carnivore with a range of adaptations and feeding preferences. The study also find and highlight the species' scavenging and opportunistic eating habits. To further understand how the jackal impacts Karak environment conservation management so here it will need more research on the species' feeding ecology is needed. In order to settle

disagreements between stakeholders like game managers and livestock/poultry farmers, the results of scientific studies like this one should also be shared and made public. In conclusion, this study was successful in providing a scientific explanation and result to its initial goals, hypothesis, and objectives.

REFERENCES

1. Kaunda, S. K., & Skinner, J. D. (2003). Black-backed jackal diet at Mokolodi nature reserve, Botswana. *African Journal of Ecology*, *41*(1), 39-46. https://doi.org/10.1046/j.1365-2028.2003.00405.x
2. Ćirović, D., Penezić, A., Milenković, M., & Paunović, M. (2014). Winter diet composition of the golden jackal (Canis aureus L., 1758) in Serbia. *Mammalian Biology*, *79*(2), 132-137. https://doi.org/10.1016/j.mambio.2013.11.003
3. Van de Ven, T. M., Tambling, C. J., & Kerley, G. I. (2013). Seasonal diet of Black-backed jackal in the eastern Karoo, South Africa. *Journal of Arid Environments*, *99*, 23-27. https://doi.org/10.1016/j.jaridenv.2013.09.003
4. Lange, P. N., Lelieveld, G., & De Knegt, H. J. (2021). Diet composition of the golden jackal *Canis aureus* in south-east Europe – a review. *Mammal Review*, *51*(2), 207-213. https://doi.org/10.1111/mam.12235
5. Markov, G., & Lanszki, J. (2012). Diet composition of the golden jackal,*Canis aureus*in an agricultural environment. *Folia Zoologica*, *61*(1), 44-48. https://doi.org/10.25225/fozo.v61.i1.a7.2012
6. Stoyanov, S. (2012). Golden jackal (Canis aureus) in Bulgaria: Current status, distribution, demography and diet. In Proceedings of the 2nd International Symposium on Hunting: Modern Aspects of Sustainable Management of Game Population, Zemun-Belgrade, Serbia.
7. Lanszki, J., Kurys, A., Heltai, M., Csányi, S., & Ács, K. (2015). Diet composition of the golden jackal in an area of intensive big game management. *Annales Zoologici Fennici*, *52*(4), 243-255. https://doi.org/10.5735/086.052.0403
8. Borkowski, J., Zalewski, A., & Manor, R. (2011). Diet composition of golden jackals in Israel. *Annales Zoologici Fennici*, *48*(2), 108-118. https://doi.org/10.5735/086.048.0203
9. Aleksandra, P., & Duško, Ć. (2015). Seasonal variation in diet of the golden jackal (Canis aureus) in Serbia. *Mammal Research*, *60*(4), 309-317. https://doi.org/10.1007/s13364-015-0241-1
10. Rowe, D. (1983). Black-backed jackal diet in relation to food availability in the Natal Drakensberg. South African Journal of Wildlife Research, 13(1), 17–23. https://hdl.handle.net/10520/AJA03794369_3646
11. Jaeger, M. M., Haque, E., Sultana, P., & Bruggers, R. L. (2007). Daytime cover, diet and space-use of golden jackals (Canis aureus) in agro-ecosystems of Bangladesh. *mammalia*, *71*(1/2), 1-10. https://doi.org/10.1515/mamm.2007.016
12. Lanszki, J., & Heltai, M. (2002). Feeding habits of golden jackal and red fox in south-western Hungary during winter and spring. *Mammalian Biology*, *67*(3), 129-136. https://doi.org/10.1078/1616-5047-00020
13. Kamler, J. F., Klare, U., & Macdonald, D. W. (2012). Seasonal diet and prey selection of black-backed jackals on a small-livestock farm in South Africa. *African Journal of Ecology*, *50*(3), 299-307. https://doi.org/10.1111/j.1365-2028.2012.01324.x
14. Yarnell, R. W., Phipps, W. L., Burgess, L. P., Ellis, J. A., Harrison, S. W., Dell, S., MacTavish, D., MacTavish, L. M., & Scott, D. M. (2013). The influence of large predators on the feeding ecology of two African Mesocarnivores: The Black-backed jackal and the Brown hyaena. *South African Journal of Wildlife Research*, *43*(2), 155-166. https://doi.org/10.3957/056.043.0206
15. Hayward, M. W., Porter, L., Lanszki, J., Kamler, J. F., Beck, J. M., Kerley, G. I., Macdonald, D. W., Montgomery, R. A., Parker, D. M., Scott, D. M., O'Brien, J., & Yarnell, R. W. (2017). Factors affecting the prey preferences of jackals (Canidae). *Mammalian Biology*, *85*, 70-82. https://doi.org/10.1016/j.mambio.2017.02.005
16. Lanszki, J., Hayward, M. W., & Nagyapáti, N. (2018). Feeding responses of the golden jackal after reduction of anthropogenic food subsidies. *PLOS ONE*, *13*(12), e0208727. https://doi.org/10.1371/journal.pone.0208727
17. Humphries, B. D., Ramesh, T., & Downs, C. T. (2016). Diet of Black-backed jackals (Canis mesomelas) on farmlands in the KwaZulu-Natal Midlands, South Africa. *Mammalia*, *80*(4). https://doi.org/10.1515/mammalia-2014-0103
18. Negi, T. (2014). Review on current worldwide status, distribution, ecology and dietary habits of golden jackal, Canis aureus. *Octa Journal of Environmental Research*, *2*(4). https://sciencebeingjournal.com/sites/default/files/10-0204_Tripti.pdf
19. Mahmood, T., Niazi, F., & Nadeem, M. (2013). Diet composition of Asiatic jackal (Canis aureus) in Margallah Hills National Park, Islamabad, Pakistan. *The Journal of Animal and Plant Sciences, 23*(2), 444–456. https://www.thejaps.org.pk/docs/v-23-2/20.pdf
20. Grafton, R. N. (1965). Food of the Black-backed jackal: A preliminary report. *Zoologica Africana*, *1*(1), 41-53. https://doi.org/10.1080/00445096.1965.11447298
21. Majumder, A., Sankar, K., Qureshi, Q., & Basu, S. (2011). Food habits and temporal activity patterns of the golden jackal canis aureus and the jungle cat felis chaus in Pench tiger reserve, Madhya Pradesh. *Journal of Threatened Taxa*, *3*(11), 2221-2225. https://doi.org/10.11609/jott.o2713.2221-5
22. Merwe, I. V., Tambling, C. J., Thorn, M., Scott, D. M., Yarnell, R. W., Green, M., Cameron, E. Z., & Bateman, P. W. (2009). An assessment of diet overlap of two Mesocarnivores in the north west province, South Africa. *African Zoology*, *44*(2), 288-291. https://doi.org/10.3377/004.044.0217
23. Stuart, C. (1976). Diet of the Black backed Jackal*Canis Mesomelas*in the central Namib desert, South West Africa. *Zoologica Africana*, *11*(1), 193-205. https://doi.org/10.1080/00445096.1976.11447524
24. Tsunoda, H., & Saito, M. U. (2020). Variations in the trophic niches of the golden jackal canis aureus across the eurasian continent associated with biogeographic and anthropogenic factors. *Journal of Vertebrate Biology*, *69*(4). https://doi.org/10.25225/jvb.20056
25. Kamler, J. F., Minge, C., Rostro-García, S., Gharajehdaghipour, T., Crouthers, R., In, V., Pay, C., Pin, C., Sovanna, P., & Macdonald, D. W. (2021). Home range, habitat selection, density, and diet of golden jackals in the eastern plains landscape, Cambodia. *Journal of Mammalogy*, *102*(2), 636-650. https://doi.org/10.1093/jmammal/gyab014
26. Ćirović, D., Teodorović, V., Vasilev, D., Marković, M., Ćosić, N., Dimitrijević, M., Klun, I., & Djurković-Djaković, O. (2015). A large-scale study of the trichinella genus in the golden jackal

(Canis aureus) population in Serbia. *Veterinary Parasitology*, *212*(3-4), 253-256. https://doi.org/10.1016/j.vetpar.2015.07.022
27. Loveridge, A. J., & Macdonald, D. W. (2002). Habitat ecology of two sympatric species of jackals in Zimbabwe. *Journal of Mammalogy*, *83*(2), 599-607. https://doi.org/10.1644/1545-1542(2002)083<0599:heotss>2.0.co;2
28. Bacci, F., & Lunghi, E. (2022). The golden jackal canis aureus L. 1758 (Carnivora: Canidae) on the tuscan Apennines. *Natural History Sciences*. https://doi.org/10.4081/nhs.2022.614
29. Moehlman, P. D., & Hayssen, V. (2018). Canis aureus (Carnivore: Canidae). *Mammalian Species*, *50*(957), 14-25. https://doi.org/10.1093/mspecies/sey002
30. Namroodi, S., Milanlou, D., & Rezaei, H. (2017). Heavy metal bioaccumulation and its potential relation with incidence of canine parvovirus infection in golden jackals, North Iran. *Iranian Journal of Veterinary Medicine, 11*(2), 113–125.