Diet Analysis of the Wild Animals of Pachbhaiya Zoological Park

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Thank You.

Rajesh Malla
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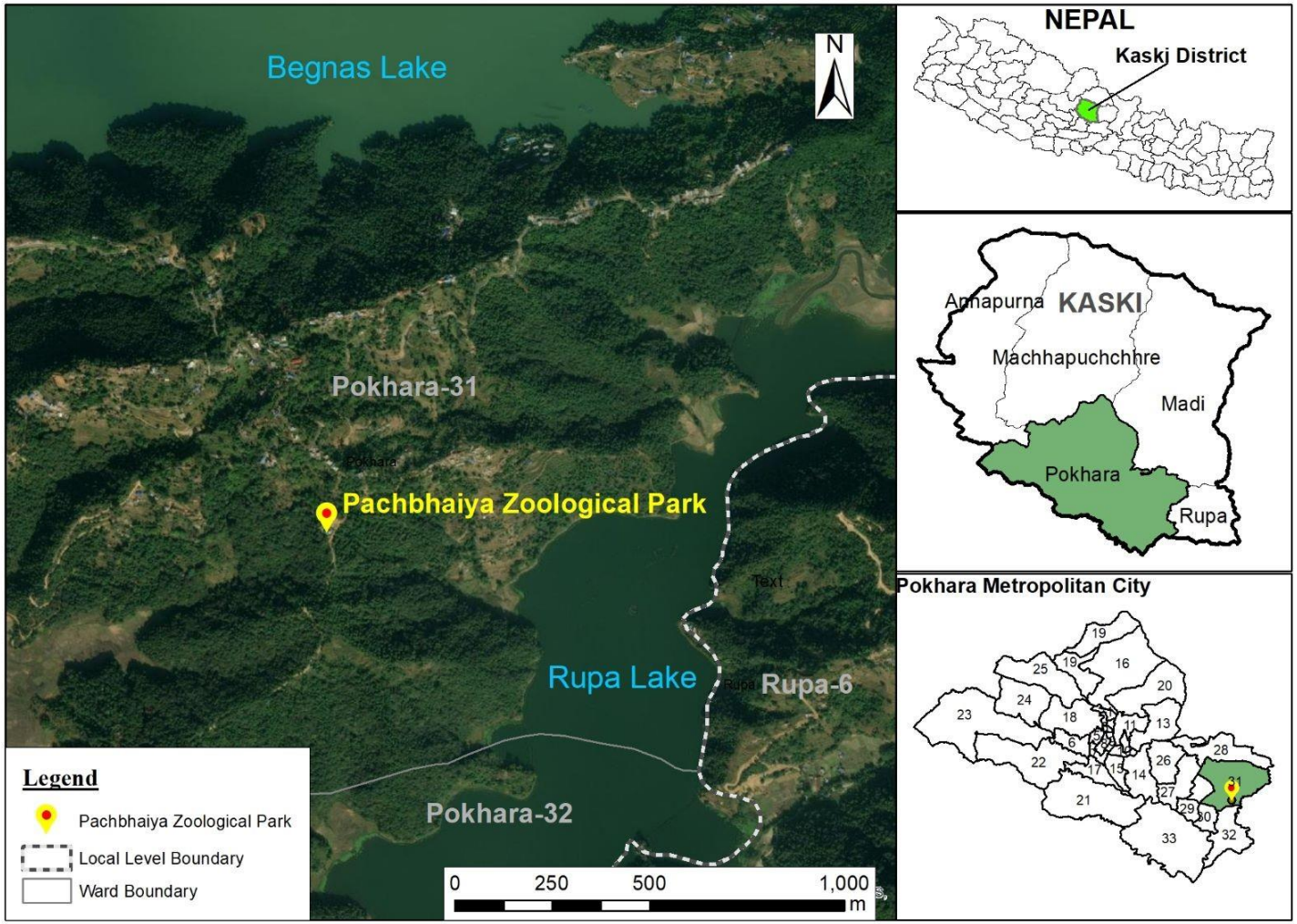
Abbreviations and Acronyms

%	Percentage
ACAP	Annapurna Conservation Area Project
ADF	Acid Detergent Finer
ADL	Acid Detergent Lignin
CP	Crude Protein
DFO	Division Forest Office/ Divisional Forest Officer
DMI	Dry Matter Intake
FRTC	Forest Research and Training Centre
gm	Gram
IOF	Institute of Forestry
Kg	Kilogram
m	Meter
MOITFE	Ministry of Industry, Tourism, Forest and Environment
NARC	Nepal Agricultural Research Council
NDF	Neutral Detergent Fiber
NEC	Net Energy Consumed
NSC	Non Structural Carbohydrate
PZP	Pachbhaiya Zoological Park
RFV	Relative Feed Value
TDN	Total Digestive Nutrient

Location Map of Pachbhaiya Zoological Park



Executive Summary

Introduction

The knowledge of diet and nutrition to captive animals can be used to refine captive-management techniques and may make a substantial influence on the survivorship of animals. The importance of captive animal dietary knowledge for their long-term conservation is highlighted by the fact that interpreting information received in the outdoors can be challenging and can benefit from reasoning with captive feeding studies. It has the ability to be refined and quantified by simplifying the identification of fragments or feeding remains and quantifying differential proportions of fragments as a result of digestion.Most herbivores in a zoo can be fed rather successfully on dry diets formulated for livestock, comprising agricultural grains and supplemental fresh or dried forages. But wildlife and zoo nutrition are naturally linked; therefore, the physiological and biochemical components must be considered as critical as ecological and behavioral considerations of the animals which are under our care**.** This research is not just vital for Pachbhaiya Zoological Park but it is also of national significance and plays a crucial role in park management, particularly for captive species.

Methodology

In this study both the diet provided to captive animals and excreta (fecal) after computation of the given diet was recorded for 41 days in three phases. Therefore, all the diets (composition and weight) provided for respective animals were recorded. The leftover from the given diet was recorded and the weight of excreta produce from the given food was recorded. Diet composition was recorded by ocular observation and confirming with park staff and the weight of food provided and excreta was recorded with the help of digital balance.Diurnal behavior of all available animals was recorded using focal scan sampling at an interval of 5 minutes. The behaviors were recorded in three shifts: morning, day, and evening. Feeding and related behaviors including as resting, sleeping, sitting, standing, walking, grooming, calling, and excretion were recorded.The study also carried a three-day community forest inventory. During the survey, 20m*20m quadrate was plotted for tree species assessment, 5m*5m quadrate for shrubs analysis. A total of 20 random quadrates was plotted in park forest during for inventory.

A sample of 50 gm food provided to respective animals was collected for 10 days in a plastic jar which was later covered by silica crystals and sealed for dehydration. Fodder provided was carefully observed for volume, weight, and species diversity, and 500gm (wet weight) of each were collected and kept for oven dry.The fecal samples depending on food provided were collected respectively. They were collected for 12 -41 days depending upon the weight of defecation by animals since a minimum of 300gm of wet weight is necessary for nutritional analysis. All fecal samples were collected in a plastic jar which was sealed using cotton and silica crystal to remove moisture.

In this study, the collected samples were dried in a hot air oven at 36°C, then grinded and sieved through 1mm sieve size. Nutrients: crude protein, Crude fiber, Cellulose, Hemicellulose, Acid Detergent Lignin, Acid detergent fiber, Neutral Detergent Fiber, and Total energy from all collected samples were further analyzed in the laboratory of Nepal Agriculture Research Council.

Result

Animals in PZP are healthy; they have absorbed enough energy from their meals and are quite active in their behavior. Food is available seven days a week. Except for the Eurasian Eagle and the civet, the amount of meat supplied to carnivores is more than national/international standards. The amount of protein excreted by birds such as Barn Owls, black kites, and Egyptian Vultures is excessive. Except for Egyptian eagles, black kites, and leopard cats, carnivores prefer to feed at night or in the evening. The amount of choker is higher to herbivores than national and international practice, and fodder is insufficient, despite the fact that they leave a large amount of fodder every day. Pacing behavior is prevalent in felid species, indicating that space is insufficient and that they are still not accustomed to living in a cage.

Recommendation This study has four major recommendations based on study finding.

i. The study suggests adjusting the schedule of food distribution.
ii. The study recommends reducing the amount of meat supplied to all carnivores except the civet.
iii. The study recommends providing food to carnivores only six days per week.
iv. Acage size is so small that it is impossible for animals to move freely within it, so we recommend to develop suitable size of the cage. It is also recommended that captive

animals be vaccinated and get frequent medication in accordance with national and international standards.

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Chapter 1: Introduction

Background

Zoo biology is the scientific study of animals in zoos. Captive animals or animals in zoos need survival food. The food and its nutritional composition must be healthier and more or less similar natural diet. Therefore, good zookeeping needs knowledge of nutrition for zoo animals. The discipline of nutrition is a swiftly expanding field of zoo biology and the formulation of suitable, scientifically based diets has become an essential part of animal husbandry. Thoughthe detailed information about the food and diet of the majority of free-ranging mammals and birds does not exist and often only the most comprehensiveestimation of food and dietstuffs consumed areidentifiedand studied (Jordan, 2005, Mench and Kreger, 1996)).The precise and broad knowledge of species' diets, and their variations within them, adds greatly to our understanding of biodiversity(Maranet al., 1998; Barbiers et al, 1982).

People havekeptthe collection of captive animals for thousands of years; the earliest evidence may be dated 2300 BC in Ur city of Sumerian (Koebner, 1994). Proper feeding management of wild animals in captivity includes both husbandry skills and practical nutritional sciences Nutrition management of the animal is integral to longevity, disease prevention, growth, and reproduction, yet has established insufficient attention in the zoological community (Delacour**,** 1947; Marquès and Maslanka, 1999).The major food constituents such as protein, fat, carbohydrate, and fiber were recognized, and mineral nutrition was receiving much attention in the nineteenth century(Dierenfeld, 1997, Rees, 2011).

Captive management of animals can both benefit from and contribute to the nutritional science. Diets or food consumed by animals in the wild represent anopening point thatis used to formulate the diets and feeding directives for captivity. It is not from the perception of trying to copy or emulate wild diets but to enable understanding of the foraging strategy of animals (Allen et al, 1995). It includes the behavioral adaptations and needs of respective animals(Morrison, 1936). Some captive animals may have adapted to less optimal diets for prolonged periods, and such diets became incorporated as a standard without including theadditional nutrient stresses like environmental alterations, disease, reproduction, lactation,or growth that need to be taken into account (Melfi and Feistner 2002). Thus, unsupplemented amountof meat was fed to carnivores, fruits and vegetables to primates and

birds, and agricultural grains and hay to herbivores, even with the gratitude that diets were not conducive to reproduction, or resulted in malformed offspring in captive(Hediger, 2013).

The knowledge of diet and nutrition to captive animals can be used to refine captive-management techniques and may make a substantialinfluenceonthe survivorship of animals (Mitchell, 1929; Bishop et al, 2013**).**Morrison (1936) expressed the importance of the knowledge on the food of captive animals for their sustainable conservation since the interpretation of information collected in the field can be difficult and can benefit from rationale with captive-feeding studies, that can be potentially refined and quantify analyses by simplifying the identification of fragments or feeding remains and quantifying differential proportions of fragments resulting from digestion(Jordan, 2005).Oftedal and Allen (1996) suggested that most herbivores in a zoo can be fed rather successfully on dry diets formulated for livestock, comprising agricultural grains and supplemental fresh or dried forages. But wildlife and zoo nutrition are naturally linked; therefore the physiological and biochemical components must be considered as critical as ecological and behavioral considerations of the animals which are under our care (Morrison, 1936; Hosey, 2008; Hosey et al, 2013).

The nutrition has diverse and different in presence of animals in the zoo. The dietary choices of free-ranging wildlife are complex chemically, temporally, and spatially. We canhardly duplicate components of any animal's diet in a captive feeding situation but can replica, and must focus on nutrients contained within that food (Robbins, 1993; Dierenfeld, 1997). Ratcliff in 1930 prepared the first scientific concept of formulated diet for captive animals at Philadelphia Zoo which was published in 1940, 1947, and 1966 (Ratcliffe, 1937, 1940, 1963, 1966). During a study in the Philadelphia zoo, they found low in protein quality and quantity; low in Protein content; low in fat; very high in soluble carbohydrates; andlow in ash was found in food provided to animals. Ingredients like rice, bread, potato, peanuts, bananas, maize, egg, apple, and onion were given to rats (Sarzac, 2004)**.** There is no single constituent of the monkey's diet that was able to support life and healthin those days (Marquès and Maslanka, 1999). The provided food will impact in digestibility of the animal and its health that impacts in reproduction and other physiological functions (Huang, etal, 2015;McNab et al, 1989; Mills 1980). The total diet generally resulted in good body condition and reproduction, litters were always eaten with some exception, butterfat, carrots, lettuce, and a salt mixture added to the original diet for correction. The exhibition life of primates had increased (Corson-White, 1932, Morris et al, 1974).

In these circumstances, despite the fact that Nepal has a central zoo and 18 mini zoos, there is little or no published information on the food of captive animals. However, few publications on captive animal behavior and other ecological status are published.However, knowing the scientific knowledge on the status of diet for confined wildlife is critical for improved conservation and healthy individuals. As a result, this research is not just vital for Pachbhaiya Zoological Park, but it is also of national significance and plays a crucial role in park management, particularly for captive species.

Objective

1. To identify the preferred diet for captive wild animals
2. To examine the optimal nutrient composition, quantity, and frequency (feeding interval) of food required for wild animals based on sex, age (infant/young/adult), and seasons
3. To recommend the best alternative considering cost and diet analysis for the management of captive animals

Scope of the study

- Thestudy was carried out in the PachbhaiyaZoologicalPark of Gandaki province.
- ThestudycoveredtheanimalpresentinPachbhaiyaZoologicalPark.Thedetailedlistof animalsexisted during this study are as follows:

Table 1: List of animals present in PZP

SN	Species	Number	SN	Species	Number
1	Barking deer	8	9	Eurasian eagle-owl	4
2	Spotted deer	1	10	Egyptian vulture	2
3	Jungle cat	1	11	Python	1
4	Jackal	1	12	Rabbit	11
5	Red Monkey	4	13	Indian flap shell turtle	1
6	Leopard cat	2	14	Barn owl	4
7	Peacock	1	15	Large Indian Civet	1
8	Black kite	5			

Chapter 2: Methodology

Reconnaissance survey and consultation meeting

A reconnaissance survey and consultation meeting was carried on December 12-14, 2020. Aninception cum consultation meeting was held at FRTC Meeting hall, Pokhara in presence of relevant stakeholders listed as following. This session was beneficial in kicking off the study, as it provided substantial feedback on methodology and areas for improvement.

Table 2: Name list of participants during Inception presentation

S.N	Name	Designation
1	Kedar Poudel	Forest Director,Gandaki Province Forest Directorate Office
2	Rajesh Malla	Director, FRTC
3	Kedar Baral	DFO, Kaski
4	Rajkumar Koirala	Associate Professor, IOF, Pokhara,
5	Ganesh Paudel	Assistant Forest Officer, MOITFE
6	Rishi Baral	Conservation Officer, ACAP,
7	Binay Adhikari	Manager, Pachbhaiya Zoological Park
8	Rajesh Poudel	Assistant Training Officer, Officer FRTC, Pokhara
9	Manju KC	Assistant Training Officer, Officer FRTC, Pokhara

Figure 1: Inception cum consultation meeting at FRTC, Pokhara, Gandaki Province

Sample collection for diet and Nutrition composition

At various phases of the feeding process, the diet and nutrient composition can be assessed or calculated. As a general rule, the further food items transit through the digestive process, the greater the possibility of incorrect diet evaluation due to differential digestion of those items (Mills et al, 1980).This can affect both qualitative and, especially, quantitative analyses sincethe digestible food items may be absent or under-represented in post-digestion assessment i.e.faecal analysis (Goszczyński et al., 2000). Analysis of faeces is a common source of evidence on the diet of mammals and birds and has the major advantage that similar samples are potentially available from many different circumstances by usingnon-invasive(Petty, 1999).

Direct observations of what food is consumed, the identification of 'leftover' food, and/or analysis of digesta, faeces or pellets, can all be used to determine the diets of wild mammals and birds. In this study both the diet provided to captive animals and excreta (fecal) after computation of the given diet was recorded for 41 days in three phases:first from January 28-February 2, 2021, second February 15 to March 15, March17 –March 23, 2021. Therefore, all the diets (composition and weight) provided for respective animals were recorded. The leftover from the given diet was recorded and the weight of excreta produce from the given food was recorded. Diet composition was recorded by ocular observation and confirming with park staff and the weight of food provided and excreta was recorded with the help of digital balance.

Figure 2: Collection of the record of provided food, leftover food, and fecal matter

Diurnal behavior

Diurnal behavior of all available animals was recorded using focal scan sampling (Altman, 1974) at an interval of 5 minutes. The behaviors were recorded in three shifts: morning, day, and evening. The morning shift began at 7:00 a.m. and ended at 9:00 a.m., the day shift began at 11:00 a.m. and ended at 13:00 p.m., and the evening shift began at 15:00 p.m. and ended at 18:00 p.m. Feeding and related behaviors including as resting, sleeping, sitting, standing, walking, grooming, calling, and excretion were recorded.

Figure 3: Recording behavior of animals during the survey

Forest inventory study

The study also carried a three-day community forest inventory. The fodder plants for herbivores are listed in section 3.4. During the survey, 20m*20m quadrate was plotted for tree species assessment, 5m*5m quadrate for shrubs analysis. A total of 20 random quadrates was plotted in Pachbhaiya park forest area.

Figure 4: Study on fodder species and their distribution inside the Park area

Nutritional Analysis

A sample of 50 gm food provided to respective animals was collected for 10 days (total 500gm) in a plastic jar which was later covered by silica crystals and sealed for dehydration. Fodder provided was carefully observed forvolume, weight, and species diversity, and 500gm (wet weight) of each were collected and kept for oven dry.

The fecal samples depending on food provided were collected respectively. They were collected for 12 -41 days depending upon the weight of defecation by animals since a minimum of 300gm of wet weight is necessary for nutritional analysis. All fecal samples were collected in a plastic jar which was sealed using cotton and silica crystal to remove moisture. Fecal and food samples were brought to National Animal Science Research Institute(NASRI), Animal Nutrition Division, Nepal Agricultural Research Council (NARC) Khumaltar Lalitpur. During the collection of the sample, both foods provided and fecal matter were collected separately depending on sex and age category of animals.

The field of wildlife nutrition is limited comparatively with domesticated animal commercial nutrition. The basic principle of nutrition of wildlife mammals isthe same as domesticated mammals, both mammals require 45 to 47 known nutrients. Nutrients are water, carbohydrate,protein, fat, minerals (calcium and phosphorus, magnesium, sodium, chlorine, potassium, sulfur, iron, copper, iodine, cobalt, zinc, manganese, selenium), and vitamins (Vitamin A,E,D,K, Thiamin, Riboflavin, Pantothenic acid, Niacin, Folacin, Pyridoxine, Biotin, Cyanocobalamin, Vitamin C(Daset al., 2013). Diet composition and its nutritional value are very important for captive animals since the metabolic spectrum, nutrient requirements metabolic adaptations of the animals will be varied to food and enzymic adaptations might be different to food provided (Klasing and Myers, 1996).This may lead to numerous nutritional deficiency diseases in zoo and wildlife species that have been identified and reported, generally as medical case reports rather than experimentally-controlled studies.Therefore, acombination of basic and applied research is essential, conducted on both free-ranging and captive animals;thus, an across-disciplinaryapproach must continue. Qualitative information on natural feeding habits, in combination with quantitative data on food nutrient composition and utilization, can provide direction for the development of optimal diets for captive animal management (Hatt, 1999)**.**

In this study, the collected samples were dried in a hot air oven at 36°C, then grinded and sieved through 1mm sieve size. Nutrients: crude protein, Crude fiber, Cellulose, Hemicellulose, Acid Detergent Lignin (ADL), Acid detergent fiber (ADF), Neutral Detergent Fiber (NDF), and Total energy from all collected samples were further analyzed in the laboratory of Nepal Agriculture Research Council (NARC).

Total energy

Energy act as a fuel for metabolic processes. All animals have their demand for total energy, depending on their body size and species.The total energy content of a food can be found by burning it and measuring how much heat is released. Energy is delivered to the body through foods. Any energy consumed (in the form of carbohydrates, protein, or fat) and not used for metabolism, growth, or physical activity will be stored as body fat. Foods with fewer calories per gram such as fruits, vegetables, low-fat soups, lean protein, and fiber-rich foods have a relatively low energy density. It is measured in calories or joule (Jiang et al, 2014; Jobling 2017).

Crude protein

Protein is key to good health -- it's involved in immune function, oxygen transport, and maintaining strong muscle tissue. "Crude protein" is a measure of how much protein is in food, based on laboratory tests studying the food's chemical composition. Crude protein is calculated after measuring the nitrogen content of food. Because each amino acid -- the building block used to make protein -- contains nitrogen, looking at the total nitrogen content of food gives some insight into its protein content (Tremblay, 2021).

Carbohydrates and fibers

Carbohydrates contain carbon-hydrogen and oxygen. They are usually divided into structural (fiber) and non-structural (NSC) (predominantly starch and sugars). Structural carbohydrates predominate in the cell wall. Carbohydrates are major energy-providing substrates. Dietary fiber is required to obtain maximum dry matter intake (DMI) and energy intake, maintain normal rumen fermentation and milk fat percentage. The main components of fiber are cellulose, hemicellulose, and lignin.Fiber should have sufficient particle size. A measure for this is the effective NDF content. Insufficient particle size will reduce rumination, saliva production, and buffering of the rumen. End products of fermentation include volatile fatty acids and lactic acid. Hence, insufficient buffering of the rumen results in a drop in rumen pH referred to as ruminal acidosis.Fiber refers to an edible, non-nutrient part of the plant that is an indigestible carbohydrate component that is present in plants. Its primary purpose in plants is to form part of the structure in the cells. Crude fiber is a little-used distinction to differentiate the types of fiber. In the intestinal tract, fiber resists being broken down by enzymes, although part of it may be metabolized by bacteria in the lower gut. Fiber is characterized by low or no nutritional value, but because of its effect on the digestive system, it is thought to help with such problems as diabetes and high levels of blood cholesterol(Jiang et al, 2014, Stutsman, 2021).

Acid Detergent Fiber (ADF)

Acid detergent fiber is the fraction of indigestible plantmaterial in forage, usually cellulose fiber coated with lignin. The ADF value refers to thecell wall portions of the forage that are made up of cellulose and lignin. These values areimportant because they relate to the ability of an animal to digest the forage. As ADFincreases, the ability to digest or the digestibility of the forage will decrease.

Acid Detergent Lignin (ADL)

Acid detergent lignin is the percentage of plant material.Lignin reduces digestibility and has been used to predict digestibility. Therefore, highervalue of NDF, LDF and ADL reduce the value of digestivity of plants. When animalconsumed the plants species with higher value of these components, they had to feed morevolume for better nutrition.

Crude Protein (CP)

The approximate amount of protein, which is calculated from thedetermined nitrogen, contains determined by measuring total nitrogen in a sample andmultiplying by 6.25. CP is a mixture of true protein and non-protein nitrogen.

Neutral Detergent Fiber (NDF)

Neutral Detergent Fiber is the most common measureof fiber used for animal feed analysis. NDF measures most of the structural components inplant cells (lignin, hemi-cellulose and cellulose). The level of NDF in the animal rationinfluences the intake of dry matter and the time of rumination. From all the sample Relative Feed Value index was calculated by a formula RFV index=(120/NDF) ×(88.9-(.779*NDF))/1.29 (Undersander and Moore, 2002). Similarly, TotalDigestive Nutrient (TDN) for grass was calculated by TDN (%)= 105.2-0.667*NDF% andNet Energy Consumed index was calculated by NEc= 1.12-(.0159%*ADF) (Moore andUndersander, 2002).

Figure 5: Photos of laboratory work

Chapter 3: Result

Food provided and they are leftover

During the study period,animals in Pachbhaiya Zoological Park were given different types of food. Generally, carnivore animals were given two types of food: chicken and buff. The meat provided was weighed before giving it to the animal. They were given different weightsconsidering animals and their age group (Table 3). Both Chicken and buff were purchased from local markets and given to animals on alternative days.

Figure 6: Food provided to the animal in PZP

Similarly, all herbivores were given a food combination of chokar and fodder. The “Chokar" is an outer coat of wheat. It is considered one of the best nature's richest sources of natural food fiber. It is an essential part of whole grains and is often formed as a by-product of milling in the production of refined grains. The weight of chokar provided is depending on the animal’s size and age category. Fodders given to herbivores were collected from the forest around the park. They contain seasonal fodderand its weight depends on the animal species and their age group.

Python was given a chicken (the whole body of weight 2-2.5kg) at the interval of 10-15 days. Moreover, the monkey was provided with seasonal fruit like apple, banana, orange, the peacock was given chokar, grains of maize with a piece of meat (both buff and chicken). Turtle received meat buff and chicken on alternative days and all rabbits were given vegetables, local grass, and wet and soaked gram.

All food provided to animals were not consumed completely. The animal left the food were calculated or recorded as leftover food. The amount of leftover food was calculated a day after the food was provided at a time between 7:00-9:00. All remaining food was weighed before cleaning and providing the new food. Left food like chicken and buff from carnivore were separately recorded in respective days. Herbivore left fodder but chokar was most often consumed completely (Table 3) since it is given mixing with water. The record suggested that Eurasian Eagle preferred Chicken to buff, leopard cat and Egyptian Vulture preferred buff than chicken, and civet loves both chicken and buff. Civet was recorded consuming all provided food. There was no leftover by civet.

Table 3: Food provided and they are leftover by respective animals in PZP

SN	Animal	Food type			
		Food provided (gm)	Leftover (gm)	Daily waste %	
1	Barn Owl	110.63	45.38	41.02	Chicken
		118.33	42.88	36.24	Buff
2	Eurasian Eagle	106.5	34.37	32.27	Chicken
		91.25	36.67	40.19	Buff
3	Jungle cat male	106.25	72.5	23.37	Chicken
		254.5	66.65	26.19	Buff
4	Jungle cat female	313.33	97.5	31.12	Chicken
		300.5	74.65	24.84	Buff
5	Black Kite	74	39.3	53.11	Chicken
		73.5	37.2	50.61	Buff
6	Leopard cat female	258.32	46.4	17.96	Chicken
		252.5	16.65	6.59	Buff
7	Leopard cat Juvenile	226.67	30.5	13.46	Chicken
		270	40.67	15.06	Buff
8	Egyptian Vulture	318.12	222.5	69.94	Chicken
		248.5	80.5	32.39	Buff
9	Jackal	362.5	155	42.76	Chicken
		321.67	212.5	66.06	Buff
10	Civet	223.33	0	0.00	Chicken
		185.25	0	0.00	Buff
11	Barking Deer	909.5	0	0.00	Chokar
		771.6	425.25	55.11	fodder
12	Blue Bull	5308		0.00	Chokar
		4000	2312	57.80	fodder
13	Spotted deer	3395		0.00	Chokar
		2000	1274.2	63.71	fodder
14	Peacock	250 (50)	80 (20)	32 (40)	Maize+chokar [chicken)

		250 (50)	75 (25)	30(50)	Maize+chokar (Buff)
15	Rabbit	150	23	15.33	Wet gram +vegetable
16	Python	2200 (10-15 days)	0		Chicken

Fecal record

Every morning between 7:00 and 9:00, the excreta of all animals was recorded. Droppings from the previous day's animals were cleaned before supplying new food. Before being disposed of, all excreta were weighed using a digital balance. A sufficient amount of fecal was collected in a plastic jar containing silica crystal for further laboratory analysis.

Figure 7: Daily excretion by respective animals in PZP

It was quite difficult to collect and record the number of excreta from different bird species. Bird excretion ranges from 1.5 to 3.5 grams per day per individual (Table 4), depending on species and food given. During our field study, we were unable to collect turtle and monkey feces. We observed python droppings that were extremely dry.These dry python droppings were very old and degraded, and the turtle droppings were mixed with water that could not be collected adequately, thus they were not used for laboratory examination.

Table 4: Daily amount of excreta produced by animals in PZP

SN	Animal	Food type	Daily average fecal (gm)
1	Barn Owl	Chicken	1.5
		Buff	1.75
2	Eurasian Eagle	Chicken	2.5
		Buff	2.23
3	Jungle cat male	Chicken	72.5
		Buff	50.12
4	Jungle cat female	Chicken	75.35
		Buff	55.25
5	Black Kite	Chicken	1.32
		Buff	1.45
6	Leopard cat female	Chicken	9.25
		Buff	7.5
7	Leopard cat Juvenile	Chicken	9.75
		Buff	2.25
8	Egyptian Vulture	Chicken	3.2
		Buff	3.5
9	Jackal	Chicken	6.5
		Buff	8.5
10	Civet	Chicken	19.25
		Buff	16.5
11	Barking Deer	Chokar	
		Fodder	788.55
12	Blue Bull	Chokar	
		Fodder	5086.8
13	Spotted deer	Chokar	
		Fodder	1640.2
14	Peacock	Maize+chokar (chicken)	8.5
		Maize+chokar (Buff)	8.0
15	Rabbit	Wet gram +veg	75
16	Python	Chicken	300 (dry/week)

Diurnal behavior of animals in Pachbhaiya Zoological park

i. Spotted deer

The behavior of spotted deer was recorded at a frequency of 686 times (57.17 hr). Feeding, standing, chewing food, walking, grooming, and body part movement without walking were all recorded. It spent the most time (30%) standing, followed by feeding (24%), grooming (21%), strolling (16%), and chewing food (9 %). The least time spent was in moving head and arms without walking. No record of defection and urination was recorded during recording time (Figure 8).

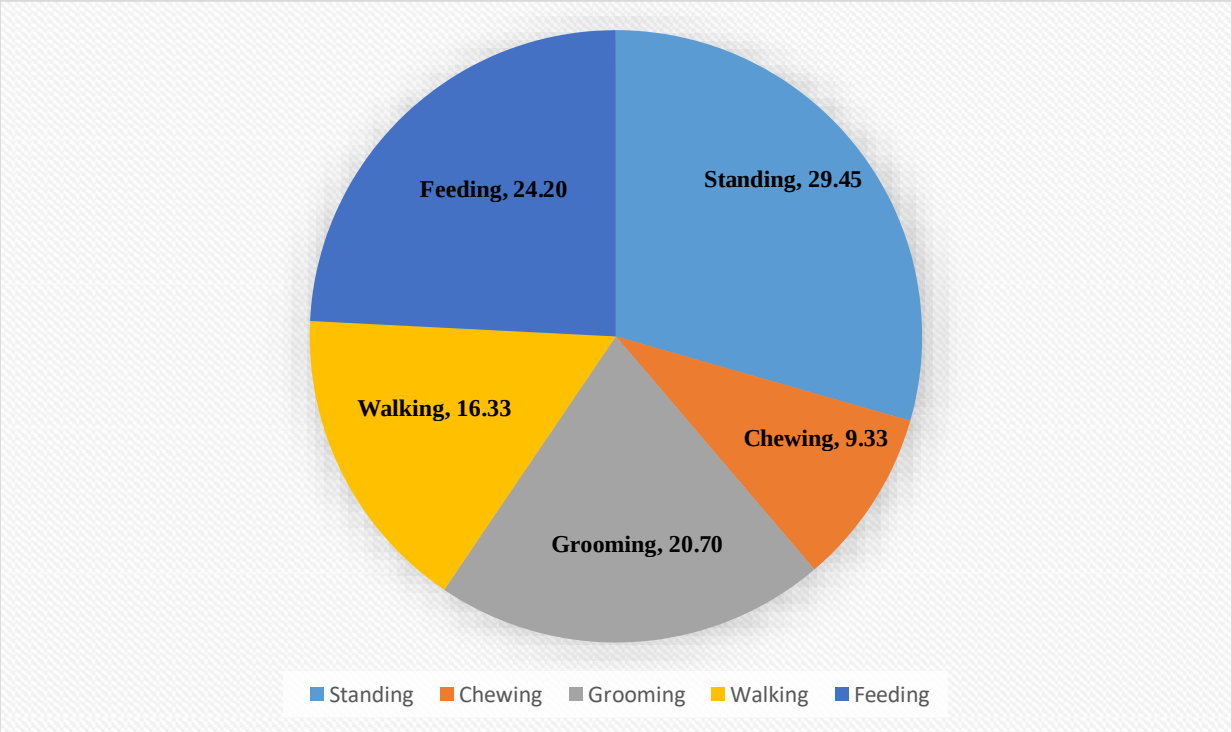

Figure 8: Diurnal behaviour of spotted deer (N=686)

The spotted deer's shift-wise time spent revealed that it continued to feed the fooder throughout the day. The time spent for feeding was greater in the evening and during the day than in the morning. In all shifts, standing was most frequent behaviour at day time. In general, it ate fooder, chokar, and water in the morning and continued to eat fodder throughout the day and evening.Grooming was recorded higher in the morning and evening. Similarly, chewing was recorded inthe morning. Walking and standing were recorded highest at day time (Figure 9).

Figure 9: Shift wise behavior of spotted deer

ii. Peacock

Total 12 behaviors of the peacock were recorded of 960 events (80 hr). Behaviors: walking (12%), standing on the table (16%), standing on the floor (20%, vocalizing (9%), body movement (2%), sitting on floor/resting (4%), sitting atthe table (2%), feeding/drinking water (7%), grooming (12%), foraging (3%), resting on sun/sunbathing and dancing (3%) were recorded. Peacock spent the most time standing, accounting for 36% of total time spent.

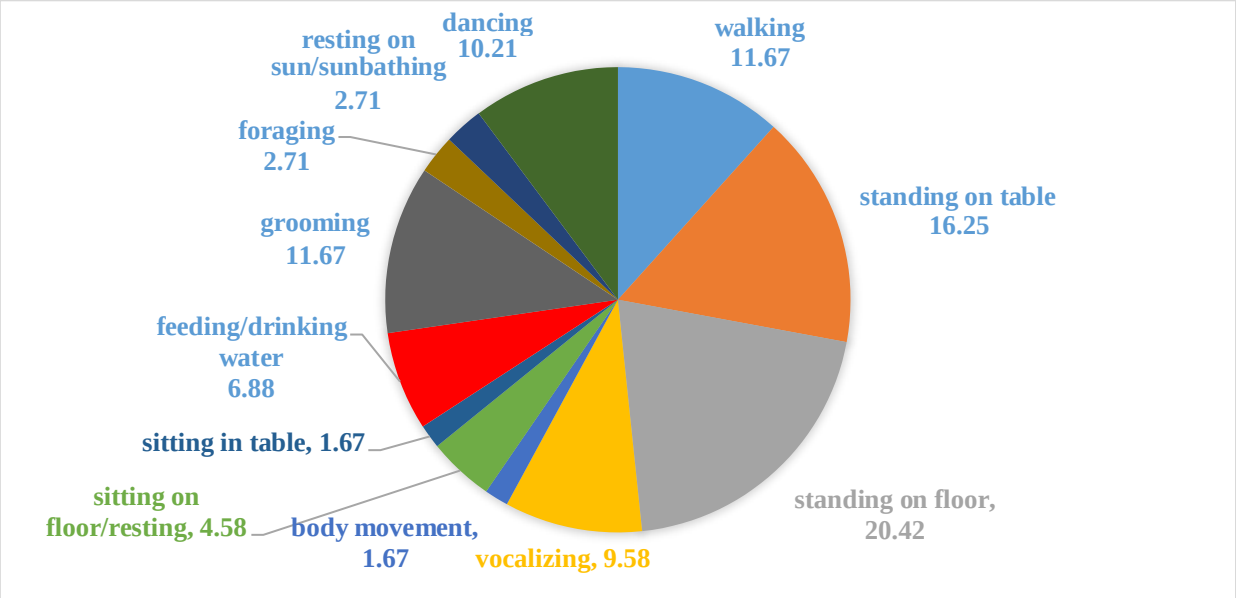

Figure 10: Daily activities of peacock (N=960)

In comparison to all other activities, Peacock spent the most time feeding in the evening. Standing on the floor and standing on the table was the most common behaviour observed

over the entire shift. Sitting at the table is not reported in the morning or evening, but is reported more during the day.Dancing activity was seen to be more prevalent during the day and evening time shifts. It made more calls in the morning and evening (Figure 10).

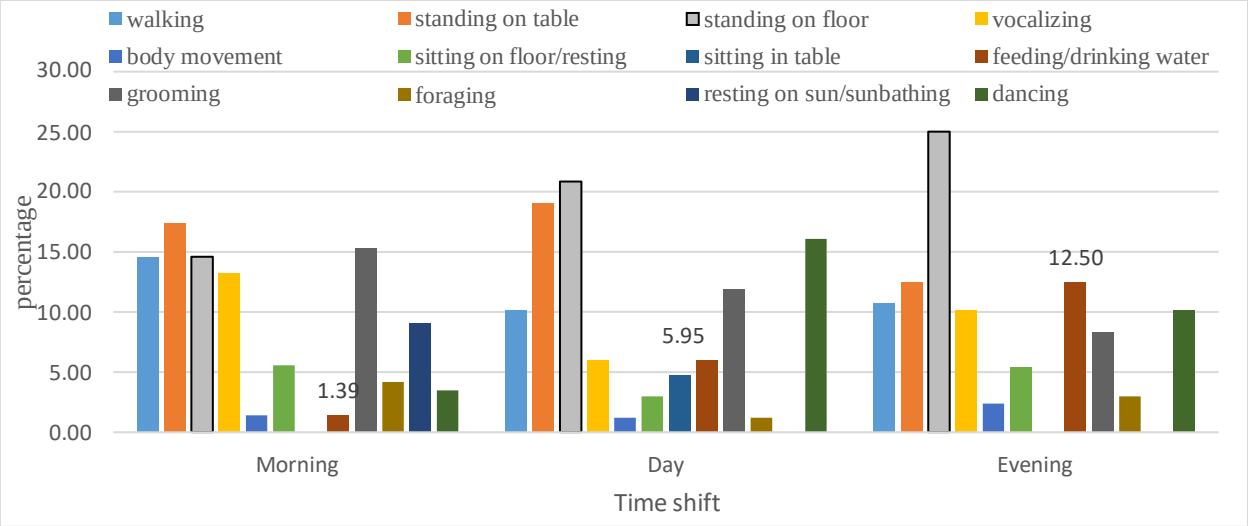

Figure 11: Shift wise activities pattern of peacock

iii. Jungle cat (adult female)

The adult female jungle cat was monitored for 950 events totaling 79.16 hours. The female adult Jungle cat did not prefer to eat during the day. It was observed that 29 % of the time was spent sleeping, 38 % resting, 30 % moving inside the cage, 2% pacing, and 1% grooming (Figure 12).

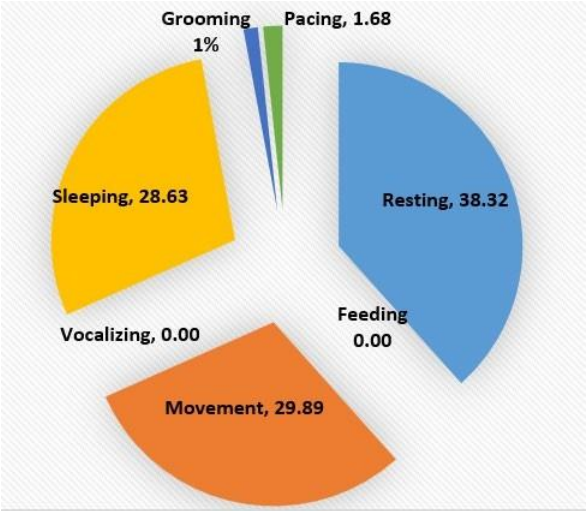

Figure 12: Activities pattern of Adult female Jungle cat

Shift-wise records showed that adult female jungle cats preferred resting inthe morning, sleeping inthe daytime, and movement inthe evening time. Grooming behavior was seen in

day and evening only. It was recorded either sleeping or resting or moving inside the case most of the time in all shifts (Figure 13).

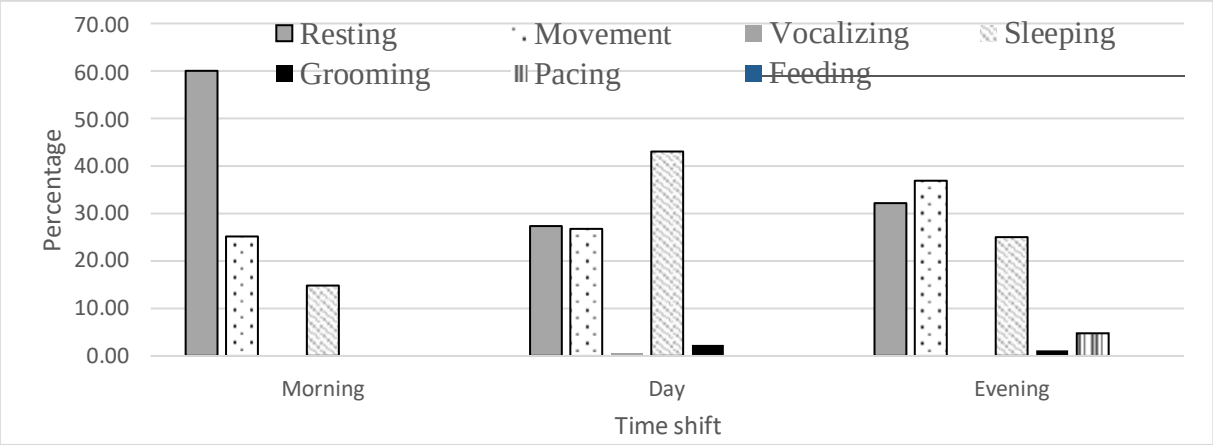

Figure 13: Shift wise daily activities pattern of an adult female Jungle cat

iv. Juvenile Jungle cat

The juvenile female jungle cat was observed 958 times during the course of 79.83 hours. The juvenile female jungle cat behaved differently than the adult female. It was recorded as feeding for 2% of its time budget. It slept (22%) but was more restless than adults (26%) but had approximately the same resting time. It was observed pacing for 4% of its whole time spent and vocalizing for 3%.

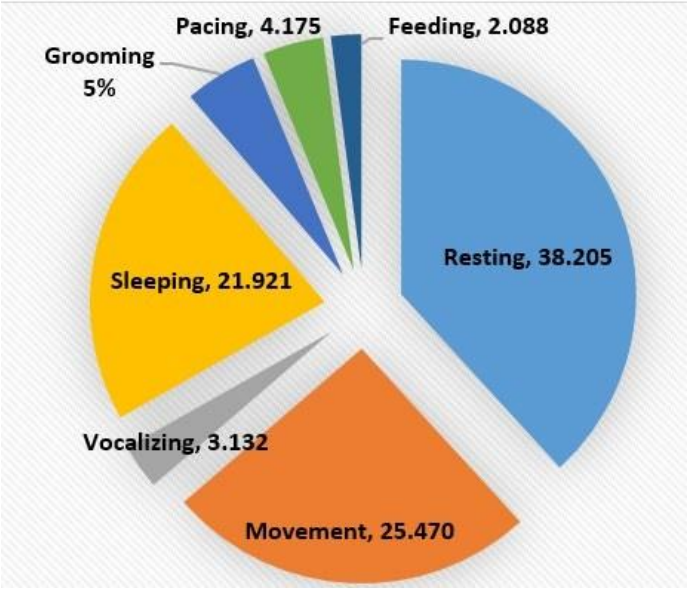

Figure 14: Activities pattern of juvenile Jungle cat

The juvenile Jungle cat was observed resting in all-time shifts: 62.93 %, 26.78 %, and 28.57 % in the morning, day, and evening, respectively. It favored sleeping during the day, and sleeping was the most frequently observed behavior (33.33 %), whereas in the evening it

spent the most time moving around inside the cage (35.11 %).The feeding behavior is different from the adult in juvenile. The juvenile was observed consuming food in a day (1.19%) and evening (4.76%) but was not recorded consuming food inthe morning even though food was provided at morning time.

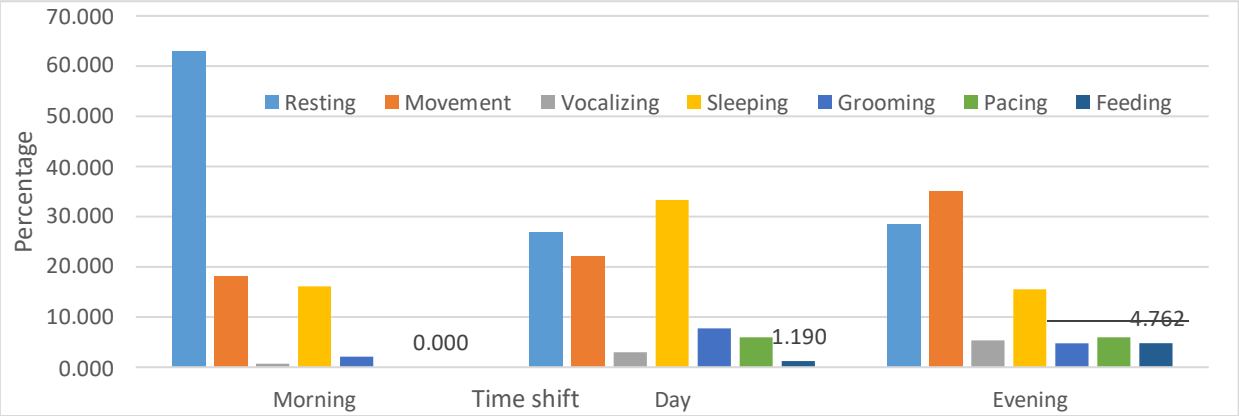

Figure 15: Shift wise daily activities pattern of the juvenile Jungle cat

v. Large Indian Civet

In 80.03 hours, 961 events for eight large Indian civet behaviors were observed. During the research period, the large Indian civet spent the majority of its time resting. Feeding was recorded for 3% of its total time spent, movement for 8%, and resting for 6% (Figure 16).

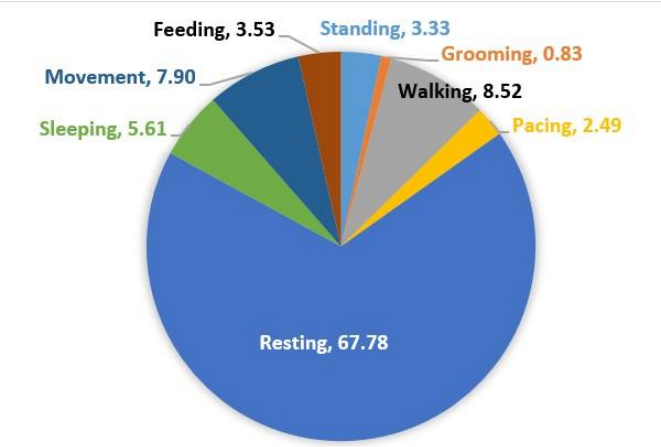

Figure 16: Diurnal Activities pattern of Large Indian Civet

Resting was the most common activity across all time shifts. Even though food was provided in the morning, they were not seen eating during the day. They were observed feeding actively in the evening. Sleeping was not reported in the evening but was reduced in the

morning and during the day, indicating that the civet is a nocturnal species. There are very few behaviors other than resting, sleeping, and walking (Figure 17).

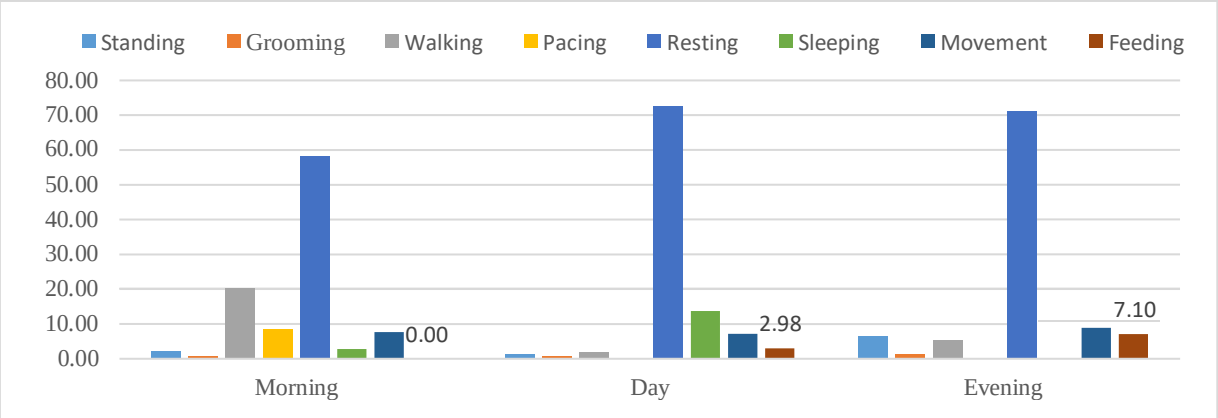

Figure 17: Shift wise daily activities pattern of Large Indian Civet

vi. Leopard cat

During our research, there was an adult and a juvenile leopard cat at the zoo. The adult leopard cat's behavior was recorded for 1041 events in 86.75 hours, and the juvenile's behavior was recorded for 812 events in 67.66 hours. For a whole day, the least recorded behavior of an adult leopard cat was eating and making calls or vocalizations.It ate the meal in the morning, often shortly after it was given the food if it was chicken. It ate the food later in the day if it was given buff, but juvenile did not eat in the morning and preferred eating solely throughout the day. Within the small cage, the leopard cat spent the most time sleeping: 47.98 % as an adult and 35.35 % as a juvenile, followed by strolling (24.18 % adult and 27.75 % juvenile). This animal's cage was deemed too small for a suitable setting.Adults frequently attempted to climb the cage, accounting for 18.71 % of morning time and 7.68 % of overall expenditure. The juvenile spent more time in climbing the case than the adult, accounting for 14.75 % of total time budget, primarily in the morning (22.14 %) and evening (21.95 %) shifts.Adult leopard cats like to groom themselves around dawn (4.32 %), dusk (5.88 percent), and 3.455 % of time. The adult leopard cat preferred to rest throughout the day, although the juvenile was more active than the adult in all shifts. A juvenile walked more than an adult, but the juvenile preferred walking in the morning and afternoon, whereas the adult preferred walking in the evening (Table 5).

Table 5: Daily activities pattern of Adult leopard cat

Behavior	Morning time budget in %		Day time budget in %		Evening time budget in %		Total time budget in %	
	Adult	Juvenile	Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
Climbing cage	18.71	22.14	2.36	0.73	5.29	21.95	7.68	14.75
Walking	27.34	34.29	16.51	26.28	31.18	21.95	24.18	27.75
Feeding	0.72	0.00	0.47	4.38	0.00	0.00	0.38	1.50
Grooming	4.32	5.00	0.94	3.65	5.88	6.50	3.45	5.00
Vocalizing	1.44	0.00	0.00	0.73	0.00	3.25	0.38	1.25
Rest	22.30	18.57	14.62	6.57	12.35	17.89	15.93	14.25
sleeping	20.11	16.67	39.43	36.57	31.17	22.15	47.98	35.50
Total time (%)	100	100	100	100	100	100	100 (N=1041)	100 (N=812)

vii. Eurasian Owl

Four Eurasian Owls were observed for 3820 events (average 947±8/individual) for a total time of 318.33 hr (78.91± 0.16 hr /individual). During diurnal observation, these owls spent 88.01% of the total time budget in resting followed by movement from one place to other for 7.17% and grooming 2.67%. Sleeping, flapping wings, flying inside the case, hooting, and feeding accounted for less than 1% of the total diurnal time budget. Grooming, flying inside the case, and flapping wings were observed more frequently in the morning shift than in the other shifts, and feeding was preferred in the evening over the morning and day shifts (Table 7).

Table 6: Diurnal activities pattern of Eurasian Owl

Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Movement	13.15	3.88	5.29	7.17
Resting	77.16	93.73	91.69	88.01
Sleeping	0.69	0.00	0.00	0.21
Flapping wings	2.08	0.30	0.30	0.84
Flying inside case	0.87	0.00	0.00	0.26
Grooming	5.36	1.49	1.51	2.67
Hooting	0.52	0.45	0.76	0.58
Feeding	0.17	0.15	0.45	0.26
Total (%)	100.00	100.00	100.00	100.00 (N=3820)

viii. Blue bull

The behavior of a male adult blue bull was observed for 981 events (81.75 hours) and eight behaviors were reported. Blue bull walked inside the cage for 44.11 % of its diurnal time budget. A mature blue bull (weighing about 180 kg) has a case size of less than 8 m^2, which is insufficient for free movement.The blue bull spent the most time standing (33.94 %; form of resting), followed by feeding (9.35 %), head movement (could be part of grooming) for (7.32 %), and grooming 1.22 %. It was frequently witnessed striking with the cage wall (iron net wall) for 0.20 % time (Figure 18).

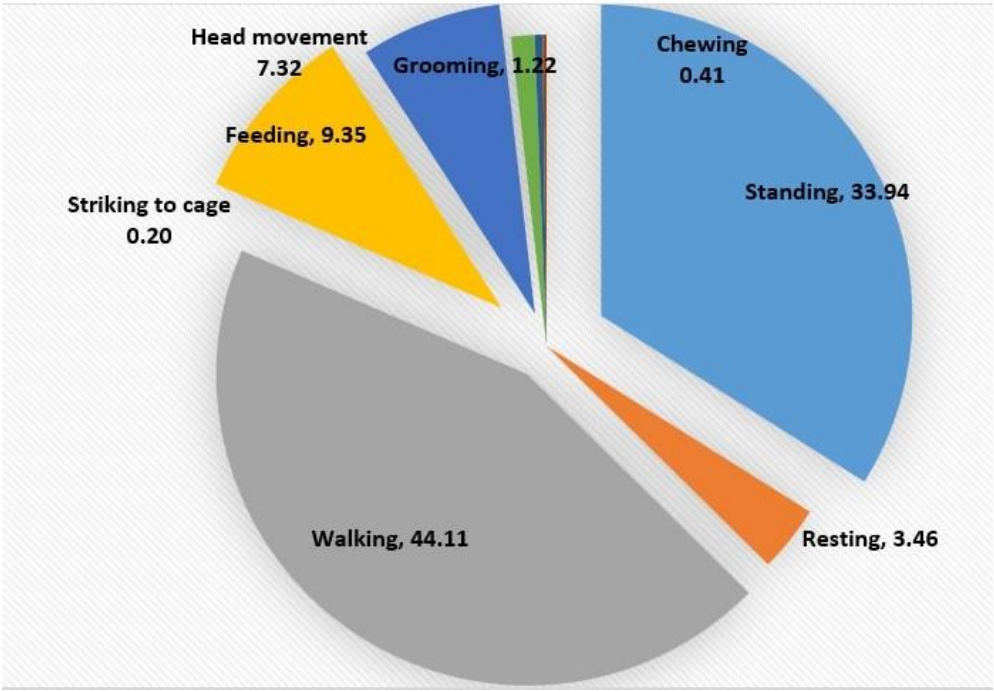

Figure 18: Daily activities pattern of Blue bull

Walking took up the most time in all shifts: 44.91 %, 46.84 %, and 40.72 %, respectively, followed by standing: 36.53 %, 34.81 %, and 30.54 %. The feeding time budget is higher during the day and evening.In general, it feeds on chokar in the morning and continues to feed on fodder offered during the day and nighttime. Resting behavior is only observed in the evening (11.98 % of total evening behavior). Other activities such as grooming, striking the head to the case, and eating were observed in less than 5% of the overall time budget of the respective shift (Figure 19).

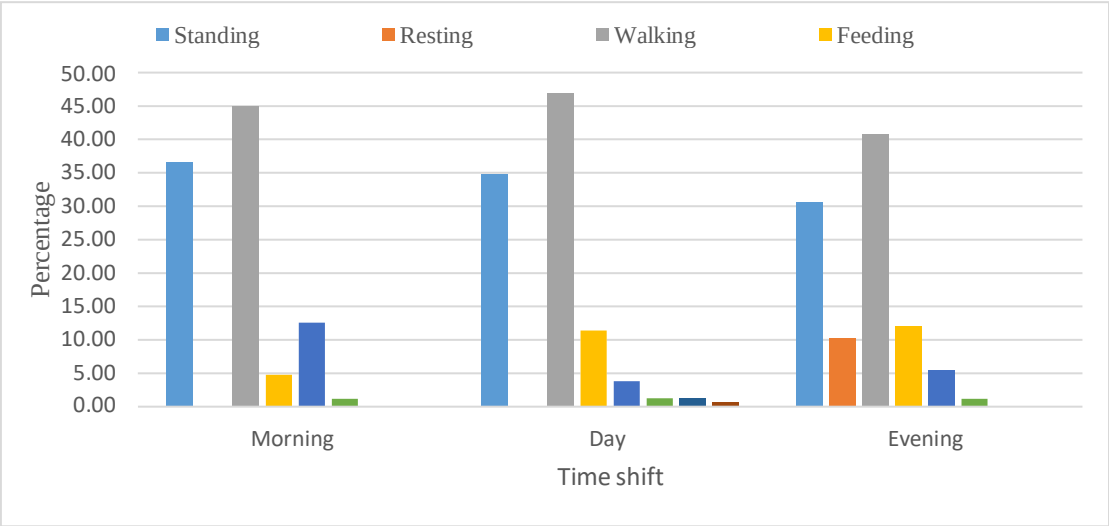

Figure 19:Shift wise daily activities pattern of Blue bull

ix. Barn owl

Four Barn owls were observed for a total of 2490 events, or 207.5 hours (average 622.5 events and 51.87 hours per individual). Barn owls are nocturnal species who spend 93.25 % sleeping.Even activities like as flying within the case, movement by walking, sleeping, and hooting were all recorded for less than 5% of the overall time budget. Barn owls do not feed during the day, and no feeding events were seen during the 207.5-hour observation. Frequent hooting was seen in all time shifts: 0.74 % in the morning, 0.29 % throughout the day, and 0.46 % at night.

Table 7: Diurnal activities pattern of barn owl

Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Resting	92.65	93.74	93.25	93.25
Flying	4.30	5.08	3.00	4.18
Movement	0.90	0.86	0.88	0.88
Sleeping	1.43	1.32	0.90	1.20
Hoot	0.74	0.29	0.46	0.48
Feeding	0.00	0.00	0.00	0.00
Total (%)	100	100	100	100

x. Black kite

Five black kites were observed for 2876 events totaling 239.67 hours (719 events and 59.91 hours/individual). They spent more than 80% of their total time budget standing (60.43%) and resting (20.20 %). Black kites are diurnal birds, however they are kept captive in an 8 m^2 cage, where they have been observed flying for 5.32 % time budget.They were observed

feeding in all shifts: 3.24 % in the morning, 3.56 % during the day, and 3.31 % in the evening, for a total time budget of 3.37 %. They preferred grooming their bodies, on which they spent 3.86 % of their entire time. Grooming was also recorded in all-time shifts: 4.5 % in the morning, 3.67 % during the day, and 3 % at night.During the day, vocalization behavior was extremely rarely recorded (0.1 % of morning behavior). It was also noticed walking within the case for 5.8 % time budget while performing active time awake (Table 8).

Table 8: Diurnal activities pattern of black kite

Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Standing	64.23	58.60	58.49	60.43
Resting	17.47	21.80	21.33	20.20
Headmovement	0.84	0.73	1.14	0.90
Flying	4.50	5.87	5.59	5.32
Grooming	4.92	3.67	3.00	3.86
Walking	4.71	5.77	7.14	5.88
Feeding	3.24	3.56	3.31	3.37
Vocalization	0.10	0.00	0.00	0.03

xi. Golden jackal

The Golden jackal was observed for 867 events during 72.25 hours. It spent the majority of its time budget walking inside the case. The existing case for the golden jackal (about 10 kg) is less than $2m^2$. The cage is quite small for mobility and other activities, however it spent 22.12 % standing and 22.81 % of time sitting.Only during the day (0.87 %) and evening (1.27 percent) were jackals observed feeding. Jackal preferred to sleep in the morning (9.26%) and evening (14.65%) and spent 8.75 % of his entire period budget sleeping (Table 9).

Table 9: Diurnal behavior of Golden Jackal

Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Standing	17.90	27.83	22.29	22.12
Sitting	20.99	27.83	21.02	22.81
walking	50.62	43.48	40.76	45.16
Sleeping	9.26	0.00	14.65	8.75
Headmovement	1.23	0.00	0.00	0.46
Feeding	0.00	0.87	1.27	0.69

xii. Python

In the park, a python is a very inactive animal. During the study period, 932 events were observed for a total of 77.67 hours. The python was hidden in a log or inside the straw 89.06 %, according to the four behaviors observed. It was observed for short periods of time outside the hidden ground (5.36 % time budget) in daylight, where it was recorded moving and crawling in the captive room's walls.

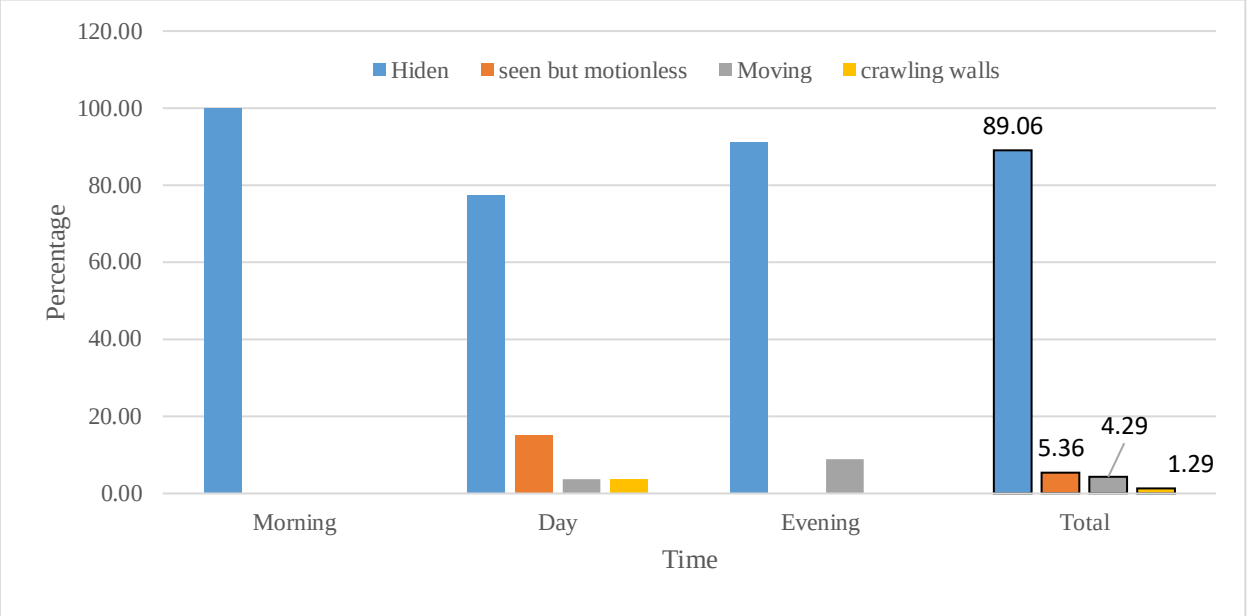

Figure 20:Shift wise daily activities pattern of Python

xiii. Barking deer

One adult pregnant female had 888 events in 74 hours, an adult male had 898 events in 74.83 hours, a juvenile female had 914 events in 71.17 hours, and a juvenile male had 874 events in 72.83 hours for a total of 3578 events in 298.67 hours.They spend 3-10% of their overall time budget on feed. Among them, the juvenile male spent the most time feeding (10.07 %), whereas pregnant females spent the least time feeding (3.38 %). The adult female has the most resting time, followed by the adult male (69.5 %), juvenile female (50.55 %), and juvenile male (28.15 %).

Table 10: Diurnal activities pattern of Barking deer

Category	**Female adult(pregnant)**				**Male(Adult)**			
Behavior	**M%**	**D%**	**E %**	**T %**	**M%**	**D%**	**E %**	**T %**
Stand	20.59	3.07	4.83	9.01	21.71	1.91	12.00	11.76
Walk	9.56	0.00	6.21	4.95	15.79	0.00	3.33	6.32
Feed	2.21	4.91	2.76	3.38	4.61	5.73	4.00	4.79
Caring	0.74	0.00	0.00	0.23	0.00	0.00	0.00	0.00
urinate	0.00	0.61	0.69	0.45	0.00	0.00	0.00	0.00
Play	0.00	0.00	0.69	0.23	0.00	0.00	0.00	0.00
Chew	2.21	1.23	4.14	2.48	2.63	1.27	5.33	3.05
Calling	0.74	0.00	0.00	0.23	0.00	0.64	0.67	0.44
Groom	6.62	1.84	4.14	4.05	5.92	3.18	3.33	4.14
Rest	57.35	88.34	**76.55**	75.00	49.34	87.26	71.33	69.50
Category	**Female (Juvenile)**				**Male (Juvenile)**			
Behavior	**M%**	**D%**	**E %**	**T %**	**M%**	**D%**	**E %**	**T %**
Stand	28.03	17.45	15.23	20.35	31.97	28.89	30.97	30.66
Walk	28.66	7.38	5.96	14.22	21.77	6.67	3.23	10.53
Feed	7.64	6.71	9.27	7.88	10.88	9.63	9.68	10.07
Caring	0.00	0.67	0.00	0.22	0.00	0.00	0.00	0.00
urinate	0.00	0.67	0.00	0.22	0.00	0.00	0.00	0.00
Play	0.00	0.00	0.00	0.00	0.00	0.00	1.94	0.69
Chew	0.64	4.70	5.96	3.72	7.48	5.93	5.16	6.18
Calling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Groom	7	0	1.32	2.85	11.56	14.82	14.84	13.73
Rest	28.03	62.42	62.25	50.55	16.33	34.07	34.19	**28.15**

Few records of caring to juveniles were recorded by an adult female which spent 0.23% of her total time in care. The record of standing, grooming, playing, and chewing food was highest in juvenile males. The grooming behavior is highest in an adult male. Barking or calling behavior was recorded in adult-only: female (0.23%) and male (0.44%). There was no record of playing in adult males and caring character in both males. The record showed juvenile male is very active in different activities and female adult one is least active among them (Figure 21 and Table 10).

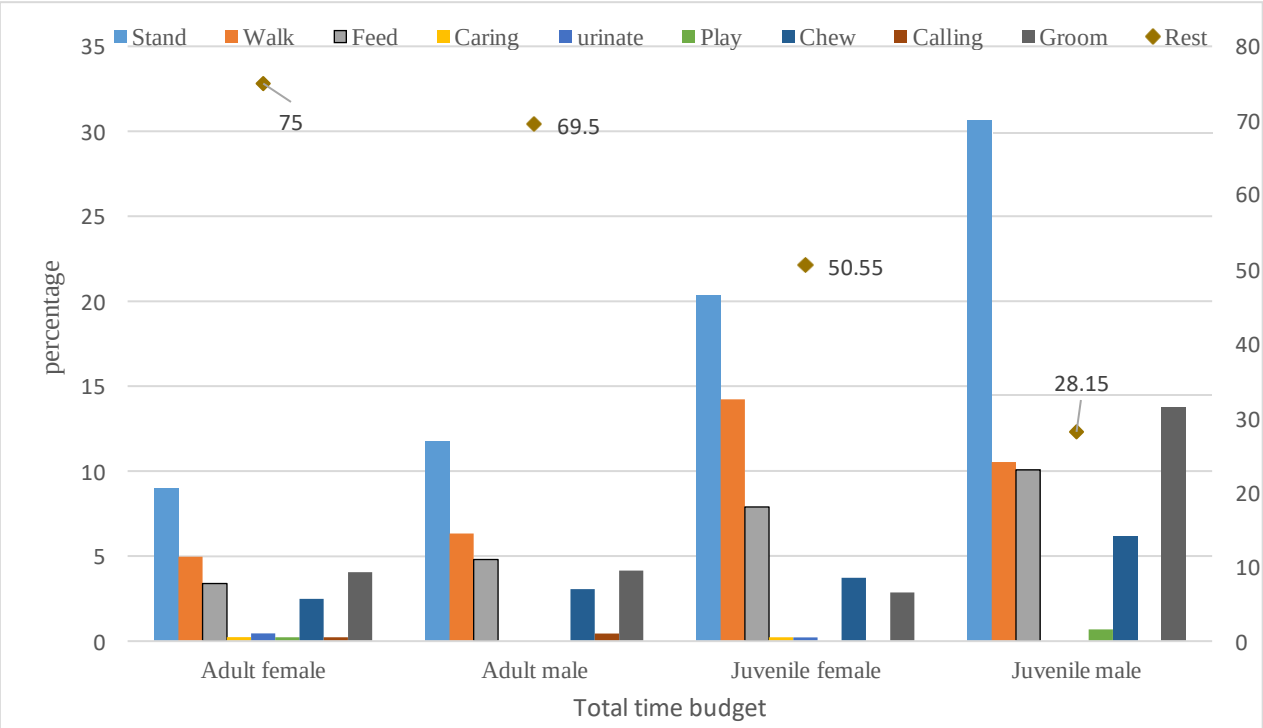

Figure 21: Diurnal time budget of different age and sex of barking deer

xiv. Egyptian vulture

Two Egyptian vultures were observed for 1904 events totaling 158.67 hours. They spent the most time standing (46.67 %), followed by grooming (15.72 %), then walking and flying inside the case (10 % each). It spent 9.66% of its total time feeding and prefers to feed on all shifts. These birds were also vocal, spending 1.95 % daily behavior making calls (Table 11).

Table 11: Diurnal activities pattern of Egyptian vulture

Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Standing in wire	47.21	50.14	40.06	46.66
Resting in ground	7.21	4.48	3.06	4.93
Grooming	24.26	2.80	14.68	15.72
walking	8.85	8.96	13.46	10.59
Feeding	8.85	13.73	5.50	9.66
Flying	3.28	15.97	22.02	10.48
vocalization	0.33	3.92	1.22	1.95

Plants and fodder in Pachbhaiya Zoological Park

The forested vegetation of the area is dominated by Katus *(Castanopsis indica)* associated with other broadleaved tree species listed in following table. Many tree species are used as fodder for herbivore animals except some with toxic latex such as *Sapium insigne*. Among the tree species,*Castanopsis indica* contributes to the major portion of fodder during stall feeding, as it is one of the abundant trees found within the forest.

Table 12: List of tree species found in forests of PZP

S.N.	List of trees	Latin name	Lifeform	Family	Taxonomy
1	Dhale Katus	*Castanopsis indica*	Tree	Fagaceae	Dicot
2	Musure katus	*Castanopsis tribuloides*	Tree	Fagaceae	Dicot
3	Chilaune	*Schima wallichii*	Tree	Theaceae	Dicot
4	Peepal	*Ficus religiosa*	Tree	Moraceae	Dicot
5	Bar	*Ficus benghalensis*	Tree	Moraceae	Dicot
6	Pakhuri	*Ficus glaberrima*	Tree	Moraceae	Dicot
7	Kyamuna	*Cleistocalyx operculatus*	Tree	Myrtaceae	Dicot
8	Kathe Pangra	*Entada phaseoloides*	Woody climber	Fabaceae	Dicot
9	Bot Dhairo	*Lagerstroemia parviflora*	Tree	Lythraceae	Dicot
10	Khanayo	*Ficus semicordata*	Tree	Moraceae	Dicot
11	Chanp	*Michelia champaca*	Tree	Magnoliaceae	Dicot
12	Aanp	*Mangifera indica*	Tree	Anacardiaceae	Dicot
13	Gidari	*Premna integrifolia*	Tree	Verbenaceae	Dicot
14	Phaledo	*Erythrina stricta*	Tree	Fabaceae	Dicot
15	Tooni	*Toona ciliata*	Tree	Meliaceae	Dicot
16	Siris	*Albizia lebbeck*	Tree	Fabaceae	Dicot
17	Phirphire	*Acer oblongum*	Tree	Aceraceae	Dicot
18	Amaro	*Spondias pinnata*	Tree	Anacardiaceae	Dicot
19	Uttis	*Alnus nepalensis*	Tree	Betulaceae	Dicot
20	Saur	*Betula alnoides*	Tree	Betulaceae	Dicot
21	Khanayo	*Ficus semicordata*	Small tree	Moraceae	Dicot
22	Khirro	*Sapium insigne*	Tree	Euphorbiaceae	Dicot

The fodder shrubs herbaceous, climbers and some small tree species used are- Tanki. The Pachabhaiya forest harbors diverse species of shrubs and herbs. The shrubs and herbs species as fodder preference depends upon the season and availability or abundance of these species*Bauhinia purpurea),* Kim kaphal *(Morus serrata),* Banspate (*Rumex dentatus),Bilaune(Maesa chisia),* Kutsimal (*Schefflera venulosa),* Nilobutte ghas (*Scutellaria discolor),* Kutsimal (*Schefflera venulosa),* Ankhtare *(Trichilia connaroides),* Areri *(Acacia pinnata),* Dhurseli *(Colebrookea oppositifolia),* Bantarul *(Dioscorea bulbifera),* Dhairo*(Woodfordia fruticosa),* Baghmukhe*(Caryopteris phoetida),* Bhak amilo *(Rhus javanica),*Hade *(Pilea sp.),* Phulchiso, Charchare, Batuke, Bhote,Banso, Chaichui, Niuro etc.

Table 13: List of fodder species available in forests of PZP

Common Name	***Scientific name***
1. Kutsimal	*Morus australis*
2. Phulchiso	*Rauvolfia serpentina*
3. Hade	*Pilea sp.*
4. Nilobutte ghas	*Scutellaria discolor*
5. Kutsimal	*Schefflera venulosa*
6. Lete/ halhale	*Rumex nepalensis*
7. Kathepangra	*Entada rheedii*
8. Banspate	*Ipomoea hederifolia*
9. Banso	*Axonopus compressus*
10. Charchare	*Cissus repens*
11. Lahare pakhuri	*Jasminium spp.*
12. Batuke	*Boehmeria ternifolia*
13. Kim kaphal	*Morus serrata*
14. Tanki	*Bauhinia purpurea*
15. Chaya	*Cnidoscolus aconitifolius*
16. Hade unyu	*Gleichenia gigantea*
17. Bagh Mukhe Ghans	*Lindenbergia indica*
18. Banspate	*Rumex dentatus*
19. Bhiringi jhar	*Alternanthera sessilis*
20. Titepati	*Artemisia dubia*

Nutritional analysis

Sample collected for nutritional analysis

A sample of the animals' food and feces was collected for nutritional analysis. A wet weight of roughly 300gm and a dry weight of 100gm were gathered in total. The fecal droppings of bird species were difficult to collect in sufficient quantity; thus they were collected over 41 days. Carnivore feces were dried before being sent to the laboratory.For herbivores, 300gm of wet fecal was collected and dried in a laboratory oven. In addition, we collected 100gm of dry barking deer feces and 14.6 gm of dry leopard scat from the community forest for nutritional analysis (Table 14).

Table 14: Sample collected for nutritional analysis from PZP

SN	Animal names (Food)	Weight (Gram)
1.	Black kite (Buff)	80
2.	Black kite (chicken)	95
3.	Jungle cat (chicken)	318
4.	Jungle cat (Buff)	312
5.	Jungle cat (Juvenile) (chicken)	300
6.	Jungle cat (Juvenile)(Buff)	300
7.	Golden Jackal (Buff)	115
8.	Golden Jackal (chicken)	60
9.	Leopard cat (Buff)	110
10.	Leopard cat (chicken)	110
11.	Civet (chicken)	135
12.	Civet (Buff)	80
13.	Eurasian Eagle Owl (chicken)	100
14.	Eurasian Eagle Owl (Buff)	95
15.	Barn owl (chicken)	60
16.	Barn owl (Buff)	70
17.	Egyptian vulture (Buff)	65
18.	Egyptian vulture (chicken)	75
19.	Peacock (chicken)	85
20.	Peacock (Buff)	80

SN	Animal names (Food)	Weight (Gram)
21.	Barking deer (wild)	100
22.	Barking deer (captive)	350
23.	Blue bull	350
24.	Spotted deer	350
25.	Dried buff	185
26.	Fodder (Mixed)	500
27.	Chokar	500
28.	Rabbit	100.5
29.	Leopard (wild)	14.6
30.	Chicken (raw)	200

Report from lab

The nutritional analysis of the food provided and the fecal discharge of the respective food indicated that the animals in the zoological park are well fed. All criteria are normal, except that the protein level in the feces of the Black Kite, Egyptian Vulture, Barn Owl, and Eurasian Eagle Owl is much higher than normal (Table 15). Because fecal/dropping is mixed with urine discharge, the fecal of the bird contains high nitrogen and protein in general, but the very high amount of protein in fecal in these birds may suggest that the protein consumed by these birds is high. The natural amount of protein contained in these birds requires additional investigation utilizing the natural feces of the various birds.Later sections and the recommendation section go into greater detail about the amount of meat supplied and its necessity.

Table 15: The record of DM, CP, CF, NDF, ADF, ADL, HC, and energy present in food and fecal extraction of respective animals in PZP

SN	Name of Sample with code	FDM %	CP%	CF%	NDF %	ADF %	ADL %	HC %	C%	Energy(cal/g)
1.	Spotted Deer (Lens 21)	40.65	9.57	46.62	71.24	52.80	32.92	18.44	19.88	4071.39
2.	Blue Bull (Lens 20)	37.06	9.06	48.89	78.47	66.96	33.65	11.50	33.31	3776.13
3.	Barking Deer (Lens 19)	27.24	13.31	32.59	69.06	49.83	33.73	19.23	16.11	4855.42
4.	fodder (Lens 23)	59.13	7.57	23.32	N/A	N/A	N/A	N/A	N/A	5140.09
5.	Fecal Barking deer Natural habitat (Lens 18)	48.31	14.55	32.31	68.62	51.15	29.90	17.47	21.26	5304.46
6.	Chicken (Lens 27)	24.60	19.00	13.02	14.00	16.00	18.00	N/A	N/A	2190.52
7.	Dried Beef (Lens 22)	77.59	28.14	5.75	51.71	44.19	37.92	7.51	6.27	8216.19
8.	Chokar (Lens 24)	89.91	12.23	18.31	50.21	30.37	13.30	19.84	17.07	1743.47
9.	Civet Buff+Apple (Lens 09)	92.01	17.52	24.52	55.34	35.45	31.71	19.89	3.74	5231.23
10.	Civet chicken + apple (Lens 08)	72.12	15.68	16.88	38.84	31.32	28.47	7.52	2.85	4887.74
11.	Leopard cat (Chicken) Lens 07	88.99	17.61	6.53	39.83	13.85	13.15	25.98	0.70	2597.26
12.	Leopard cat (Buff Lens 06)	81.51	15.02	15.26	49.83	22.51	11.88	27.32	10.63	3199.14
13.	Golden Jackal (Chicken Lens 05)	86.97	15.63	8.36	59.88	24.55	10.13	35.33	14.42	2184.12
14.	Golden Jackal Buff (Lens 04)	44.63	17.11	8.33	21.64	11.00	3.60	10.64	7.40	3372.70
15.	Jungle cat (Chicken Lens 03)	80.20	13.34	4.44	39.10	18.31	6.78	20.80	11.52	1484.14
16.	Black Kite (Chicken Lens 02)	85.92	90.86	3.68	35.69	24.13	4.54	11.57	19.58	963.40

SN	Name of Sample	FDM%	CP%	CF%	NDF %	ADF %	ADL%	HC%	C%	Energy(cal/g)
17.	Black Kite (buffalo Lens 01)	84.41	92.24	0.64	35.56	25.04	1.43	10.52	23.61	3417.52
18.	Peacock (Buffalo Lens 17)	88.03	32.12	14.44	61.73	27.71	9.61	34.02	18.09	4540.48
19.	Peacock (Chicken Lens 16)	69.91	29.36	16.07	62.41	27.80	7.53	34.61	20.27	4051.87
20.	Egyptian Vulture Chicken Lens 15)	64.26	65.36	4.90	43.95	20.82	3.93	23.13	16.89	2825.57
21.	Egyptian Vulture Buff Lens 14)	93.08	107.39	4.09	42.34	32.60	3.62	9.73	28.98	3354.56
22.	Barn owl - B (Buff Lens 13)	91.26	128.31	1.98	72.70	65.11	16.73	7.60	48.38	3334.74
23.	Barn Owl Chicken (Lens 12)	92.37	109.12	3.88	48.02	37.31	5.10	10.71	32.21	4445.56
24.	Eurasian Eagle Owl (Buff Lens 11)	86.94	113.48	3.75	40.37	30.46	3.08	9.91	27.38	3272.19
25.	Eurasian Eagle Owl (chicken Lens 10)	81.08	113.04	5.55	40.12	30.54	2.94	9.58	27.60	3400.22
26.	Rabbit Lens 25)	79.59	19.04	41.26	72.83	65.47	59.69	7.36	5.78	4221.49
27.	Leopard Lens 26	74.91	15.32	14.09	49.58	17.96	17.60	31.61	0.36	3206.08
28.	Jungle cat (Buff) LENS028	76.20	14.44	6.93	39.10	18.31	6.78	20.80	11.52	1504.22
29.	Jungle cat (J) (chicken) LENS029	73.25	10.34	3.49	37.66	17.06	7.41	19.56	12.46	1367.14
30.	Jungle cat (J)(Buff) LENS030	73.75	12.23	3.92	36.22	15.82	8.03	18.32	13.40	1404.41

Note:Abbreviation: FDM= Fresh Drymatter, CP= Crude Protein, CF= Crude Fiber, NDF= Neutral Detergent Fiber, ADF= Acid Detergent Fiber, ADL= Acid Detergent Lignin, HC= Hemi cellulose, C= Cellulose,

Total energy

In the lab, total energy from meals supplied and fecal discharge were separately analyzed. The overall quantity of energy absorbed is computed using information from the amount of food consumed (converting in dry mass), energy in consumed food, and energy contained in fecal discharge. The results indicated that carnivores absorbed (76 % -98 %) higher energy from food than herbivores (26 % -59 %).

Table 16: Amount of energy in food provided, fecal extraction, and energy absorbed by respective animals.

Animal	Energy is consumed food	Energy in excrete	Daily energy absorbed	Absorbed energy %	Food
	142931.43	6668.34	136263.09	95.33	Chicken day
1. Barn Owl	137045.16	5835.80	131209.36	95.74	Buff day
2. Eurasian Eagle	158002.21	8500.53	149501.68	94.62	Chicken day
	99127.65	7296.98	91830.67	92.64	Buff day
3. Jungle cat male	520796.13	107600.15	413195.98	79.34	Chicken day
	341171.29	64471.36	276699.93	81.10	Buff day
4. Jungle cat female	472779.93	111829.95	360949.98	76.35	Chicken day
	410186.51	71070.29	339116.23	82.67	Buff day
	76011.04	1271.67	74739.37	98.33	Chicken day
5. Black Kite	65927.70	4955.40	60972.29	92.48	Buff day
6. Leopard cat female	464215.00	24024.66	440190.34	94.82	Chicken day
	428348.41	23993.48	404354.94	94.40	Buff day
7. Leopard cat Juvenile	429714.31	25323.29	404391.02	94.11	Chicken day
	416506.85	7198.04	409308.81	98.27	Buff day
8. Egyptian Vulture	209457.52	9041.82	200415.70	95.68	Chicken day
	305119.92	11740.96	293378.96	96.15	Buff day
	239139.07	14196.78	224942.29	94.06	Chicken day
9. Jackal	376859.43	28667.87	348191.56	92.39	Buff day
	489208.83	100701.18	388507.65	79.42	Chicken day +apple
10. Civet	336449.20	80647.71	255801.49	76.03	Buff day+ apple
	702103.8	34440.89	667662.90	95.09	Chicken day
11. Peacock	681792.95	36323.83	645469.11	94.67	Buff day
12. Barking Deer	5184943.58	3828981.67	1355961.91	26.15	Regular diet
13. Blue Bull	28546740.72	19209173.31	9337567.41	32.71	Regular diet
14. Spotted deer	16439716.76	6677063.20	9762653.56	59.38	Regular diet

Crude Protein

Table 17: Amount of protein in food provided, fecal extraction, and protein intake by respective animals.

Animal	Protein consumed (gm)	Protein in excreta (%)	Protein in excreta (gm)	Absorbed Protein (gm)	Food
1. Barn Owl	12.92	51.21	6.30	6.62	Chicken day
	21.23	64.16	7.61	13.62	Buff day
2. Eurasian Eagle	14.28	47.10	7.55	6.73	Chicken day
	15.36	51.84	7.40	7.96	Buff day
3. Jungle cat male	47.07	13.34	40.79	6.28	Chicken day
	52.86	13.34	45.81	7.05	Buff day
4. Jungle cat female	42.73	13.34	37.03	5.70	Chicken day
	63.55	13.34	55.07	8.48	Buff day
5. Black Kite	6.87	56.90	2.96	3.91	Chicken day
	10.21	52.04	4.90	5.32	Buff day
6. Leopard cat female	41.96	17.61	34.57	7.39	Chicken day
	66.37	15.02	56.40	9.97	Buff day
7. Leopard cat Juvenile	38.84	17.61	32.00	6.84	Chicken day
	64.53	15.02	54.84	9.69	Buff day
8. Egyptian Vulture	18.93	46.57	10.12	8.82	Chicken day
	47.28	56.66	20.49	26.79	Buff day
9. Jackal	21.62	15.63	18.24	3.38	Chicken day
10. Civet	58.39	17.11	48.40	9.99	Buff day
	44.22	17.52	36.47	7.75	Chicken day +apple
	52.13	15.68	43.96	8.17	Buff day+ apple

Animal	Protein consumed (gm)	Protein in excreta (%)	Protein in excreta (gm)	Absorbed Protein (gm)	Food
	6.58	32.12	4.47	2.11	Chicken day
11. Peacock	16.64	29.18	11.78	4.86	Buff day
12. Barking Deer	112.75	13.31	97.74	15.01	Regular diet
13. Blue Bull	779.48	9.06	708.83	70.65	Regular diet
14. Spotted deer	471.25	9.57	426.14	45.11	Regular diet

The crude fiber in food

Table 18: Amount of crude fiber present in food provided and fecal extraction of respective animals.

Animal	CF in food (gm)	CF % in fecal	CF in waste (gm)	Absorbed CF (gm)	Food
	8.50	1.98	8.33	0.17	Chicken day
1. Barn Owl	13.82	3.88	13.28	0.54	Buff day
	9.39	3.75	9.04	0.35	Chicken day
2. Eurasian Eagle	9.99	5.55	9.44	0.55	Buff day
	30.96	4.44	29.58	1.38	Chicken day
3. Jungle cat male	34.40	4.44	32.87	1.53	Buff day
	28.10	4.44	26.85	1.25	Chicken day
4. Jungle cat female	41.35	4.44	39.52	1.84	Buff day
	4.52	3.68	4.35	0.17	Chicken day
5. Black Kite	6.65	0.64	6.60	0.04	Buff day
	27.59	6.53	25.79	1.80	Chicken day
6. Leopard cat female	43.18	15.26	36.59	6.59	Buff day

Animal	CF in food (gm)	CF % in fecal	CF in waste (gm)	Absorbed CF (gm)	Food
7. Leopard cat Juvenile	25.54	6.53	23.87	1.67	Chicken day
	41.99	15.26	35.58	6.41	Buff day
8. Egyptian Vulture	12.45	4.90	11.84	0.61	Chicken day
	30.76	4.09	29.50	1.26	Buff day
9. Jackal	14.21	8.36	13.03	1.19	Chicken day
	37.99	8.33	34.83	3.17	Buff day
10. Civet	29.08	24.52	21.95	7.13	Chicken day +apple
	33.92	16.88	28.19	5.73	Buff day+ apple
11. Peacock	5.49	14.44	4.70	0.79	Chicken day
	3.26	16.07	2.73	0.52	Buff day
12. Barking Deer	256.99	32.59	142.97	69.12	Regular diet
13. Blue Bull	1332.59	48.89	201.20	192.44	Regular diet
14. Spotted deer	756.90	46.62	90.37	78.93	Regular diet

Comparative study of provided food

Food supplied in PZP was compared to food supplied in Jawalakhel Central Zoo, India, and Pakistan. Table 19 shows the recommended food choices and volume for various species. When compared to other zoos, the majority of the animals in PZP were fed in greater quantities. Except for Civets, all carnivores eat more than the required quantity.

Table 19: Comparative study on food provided to respective animals in different zoos

Animal	Given PZP	Central Zoo	India	Pakistan	Recommended
Barn Owl	110.63 gm chicken or 118gm buff	100gm buff	80 gm meat	80gm meat	*80-100 gm meat*
Eurasian Eagle	91 gm buff or 106gm chicken	150 gm buff	100-150gm meat	50-80 gm meat	*90-100 gm meat*
Jungle cat male	310 gm chicken/54.5gm buff	300gm chicken	250 gm meat	250gm meat	*250-300gm meat*
Black Kite	74 gm chicken/buff	100gm buff	100-120gm chicken/ mutton	100gm beef	*75-100 gm buff*
Leopard cat female	250 chicken/buff	250gm chicken 85gm fish and 85gm buff	250 gm meat	250 gm meat	*220-250 gm meat and often added fish*
Egyptian Vulture	320 chicken or 250 buff	200 gm buff			*300-320 gm buff*
Jackal	320 chicken or 360 buff	350 chicken	750 gms meat with bone		*300-320 gm chicken with bone*
Civet	220 gm chicken/190 gm buff and apple	banana 75gm, apple 50gm, seasonal fruit 50 gm, buff/chicken 150gm	100gm mean, 100gm banana and 100 gm apple		*100-120 gm meat* *50 gm banana, 50 gm apple+ 100gm seasonal fruit*
Peacock	250 maize+chokar and 50 gm meat	maize 20gm, unhusked rice 10gm, peas 25gm, what 25gm , rice 25gm, green	100 gm green leafy vegetables, 50 gm colored vegetables, 5 gm garlic, 50	100 gm green leafy vegetables, 50 gm colored vegetables,	*maize 20gm, unhusked rice 10gm, peas 25gm, what 25gm , rice 25gm, green*

Animal	Given PZP	Central Zoo	India	Pakistan	Recommended
		vegetable 20gm apple 10gm	gm onion, 25 gm boiled egg, 100 gm poultry mash and 100 gm grain is adequate per day	100 gm poultry mash and 100 gm grain and 50 gm meat	*vegetable 20gm apple 10gm and 10-15gm meat*
Barking Deer	900gm chokar and 780gm fodder	maize 175gm, gram 150gm, soya 100gm, chokar 250gm, salt minerals 10gm	2-3 kg quality green fodder with 250 gm concentrate	2-2.5 green fodder, 200gm animal feed	*2-3 kg quality green fodder with 250 gm chocker, 10gm salt/minerals, maize 175gm, gram 150gm, soya 100gm*
Blue Bull	5kg chokar and 5kg fodder	maize 450gm, gram 400gm, soya 300gm, chokar 450gm, salt minerals20gm	Green fodder 9 kg ; tree fodder 2kg; Chokar 7.5 kg	2.5-3.5 kg fruit, 250-350 g Chappati, 20-35 kg Fodder, 0.5-1 kg of Parched grams, 0.5 of chokar	*2.5kg chokar, maize 450gm, gram 400gm, soya 400gm, 9-10kg fodder, and 15-20gm salt*
Spotted deer	3kg chokar and 2-3kg fodder	maize 200gm, gram 200gm, soya 100gm, chokar 500gm, salt minerals 10gm	6 (six)kg quality green fodder with 500 gm Chokar	6 (six)kg quality green fodder with 500 gm Chokar	*6-7kg fodder, maize 200gm, gram 200gm, soya 100gm, 1-500g chokar, and 10gm salt*
Python	1.5-2kg live chicken/two weeks	1.5-2kg chicken/rabbit	1.5-2kg chicken/rabbit	1.5-2kg chicken/rabbit	*1.5-2kg live chicken/two weeks*
Leopard	NA	4-5 kg buff with bone and a chicken with 2-2.5 kg in a week	4-5 kg meat except for Friday	4-5 kg meat and 3 kg milk	*4-5 kg meat for adult and 1-1.5 kg meat for Juvenile*
Reference	Field work	NTNC Central ZOO, 2011	Das et al ,2013	Sikander et al, (2015)	

Chapter 4: Conclusion& Recommendation

Conclusion

Animals in PZP are healthy; they have absorbed enough energy from their meals and are quite active in their behavior. Food is available seven days a week. Except for the Eurasian Eagle and the civet, the amount of meat supplied to carnivores is more than national/international standards. The amount of protein excreted by birds such as Barn Owls, black kites, and Egyptian Vultures is excessive.Except for Egyptian eagles, black kites, and leopard cats, carnivores prefer to feed at night or in the evening. The amount of choker is higher to herbivores than national and international practice, and fodder is insufficient, despite the fact that they leave a large amount of fodder every day. Pacing behavior is prevalent in felid species, indicating that space is insufficient and that they are still not accustomed to living in a cage.

Recommendation

The study has four major recommendations based on finding.

Change in timing of providing food

The study suggests adjusting the schedule of food distribution. The study concluded that carnivores, particularly nocturnal birds and mammals (particularly barn owls, jungle cats, civets, and Jackals), preferring feeding in the evening and at night. As a result, we recommend feeding all carnivores at noon (between 11:00-12:00).We also suggest adjusting the timing and intervals of herbivore feeding. We recommend supplying food twice a day (splitting the allocated food into two parts): morning and evening, as well as green fodder (dry grass or hay, depending on availability) at day and evening.

Change in amount and composition of food

The study recommends reducing the amount of meat supplied to all carnivores except the civet. Similarly, research suggests that vultures and owls prefer buff to chicken, therefore chicken can be removed or reduced for them. Chicken was preferred by small felids and jackals than buff. As

a result, buff must be removed or reduced. We recommend introducing fish on a regular basis for leopard cats and extra fruit for civets.

Herbivores in the park are getting more chokar than they need but less fodder. Because the zoological park has a very nice community forest that can offer enough fodder for the respective herbivores, we recommend reducing the amount of choker and increasing the amount of fodder. For protein, we recommend providing herbivores with foods such as gram and soya on a daily basis, as well as adequate salt and minerals.

Change in number of days providing food

The study recommends providing food to carnivores only six days per week.

Cage and maintain hygiene

The case is insufficient for all caged animals. The blue bull is around 1.6m tall and 1.9m long, although it lives in a cage that is less than $5m^2$. Similarly, the civet, leopard cat, jungle cat, and jackal live in very small cages in comparison to their bodily size. A carnivore's cage is so small that it is impossible for them to move freely within it.As a result, the case area must be expanded as soon as possible for better management. It is recommended that captive animals be vaccinated and get frequent medication, particularly for gastrointestinal parasites (particularly roundworm, hookworm, and tapeworm), in accordance with national and international standards.

It is recommended to clean the case and room of animals using formaldehyde-free surface microbicide disinfectant like "Khorsolin" (composition: Each 100 g contains Glutaraldehyde 10.0 g 1,6- Dihydroxy 2,5- Dioxahexane 10.3 g Polymethylol Urea Derivatives 4.6 g. Glutaraldehyde 10.0 g. 1,6- Dihydroxy 2,5- Dioxahexane 10.3 g.)

The caregivers at the zoological park are working hard despite the fact that they lack gloves, a protective hat, and other protective gear and clothing. It is strongly advised that those working follow established protocol for hygiene maintenance. They should be given gloves, boots, protective clothing, and equipment. They also require regular health checks and vaccinations.

Note: Catalog for the respective animal is provided in Annex I.

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AnnexI: Catalog for individual animal

Blue bull

Food:

Total daily food: 2.5kg chokar, maize 450gm, gram 400gm, soya 400gm, 9-10kg fodder, and 15-20gm salt

Time and pattern: Provide the food in two phases: morning and evening. At day green fodder can be provided as available and necessary.

First phase: Morning 10am -11 am: Mixture of choker, maize, gram, soya, and minerals

Second phase: Evening 3:30pm -4:00 pm Green fodder add carrot, cabbage if they are available

Barking deer and Spotted deer

Food for barking deer: Total daily food: 2-3 kg green fodder with 250 gm chokar, 10gm salt/minerals, maize 175gm, gram 150gm, soya 100gm

Food for spotted deer: Total daily food: 6-7kg green fodder, maize 200gm, gram 200gm, soya 100gm, 500g chokar, and 10gm salt

Time and pattern: Provide the food in two phases: morning and evening. Divide the total daily food into two equal parts. Provide half part of the food inthe morning and a half inthe evening. At day green fodder can be provided as available and necessary.

First phase: Morning 10am -11am, Mixture of choker, maize, gram, soya, and minerals

Second phase: Evening 3:30pm -4:00 pm Green fodder

Hygiene:

Clean the room daily using formaldehyde-free surface microbicide disinfectant ("Khorsolin")

Clean utensils used for water and provided food daily by clean water and once a week by "Khorsolin"

Medication and vaccination:

Medicine for gastrointestinal parasites (especially for intestinal work), Foot mouth disease (FMD) needs to be given on regular basis as per national and international guidelines. Similarly, vaccination for FMD, Hemorrhagic, and Black Quarter needs to be provided as per national and international guidelines.

Predator birds

Barn owl

Food: 80-100 gm meat

Time and pattern:

Barn owl prefers buff than chicken. Buff is given with 20-25% bone of femur and ribs Food will be provided six days in a week. Allocated meat will be provided between 11:00-12:00 time. Rat, chicken with feather and bone will be provided.

Black kite

Food: 80-100 gm meat

Time and pattern:

Black kite prefers buff than chicken. Food will be provided six days in a week. Allocated meat will be provided between 11:00-12:00 time. Rabbit or guinea pig will be provided if they are available.

Eurasian Eagle

Food: 110-120 gm meat

Time and pattern:

Eurasian Eagle prefers buff than chicken. Food will be provided six days in a week. Allocated meat will be provided between 11:00-12:00 time. Rabbit or guinea pig will be provided if they are available.

Egyptian Vulture

Food: 300-320 gm meat

Time and pattern:

Egyptian vulture prefers buff. Buff is given with 40-50% bone of femur and ribs at least twice a week. Food will be provided six days in a week. Allocated meat will be provided between 11:00-12:00 time.

Hygiene:

Clean the room and all utensils using Khorsolin daily

Medication and vaccination:

Medicated and vaccinated following national and international protocol.

Jungle cat

Food: 220-250 gm meat

Leopard cat

Food: 200-250 gm meat

Civet:

Food: 100-120gm meat with 100 gm banana, 100 gm apple, and 50 gm seasonal fruit

Time and pattern: Jungle cat, Leopard cat,and Civet prefer chicken. Better not to provide buff but provide live small chicken (chicks) or guinea pig once a month if available. The meat will be given at time between 11:00-12:00 for six days a week only. No food is provided on a day of a week.

Jackal

Food: 300-320 gm meat

Time and pattern: Allocated amount of meat is provided buff and chicken alternatively between 11:00 -12:00 for six days in a week only. No meat is provided in a day of a week but few fruit, sugarcane and green maize on that day. While providing meat better to scatter them in different corner of the room so that it spends time to search the meat.

Hygiene:

Daily clean the room and all utensils using Khorsolin

These animals are most often infected by ectoparasites like lice and flea. Special care should be taken

Medication and vaccination:

Medicated and vaccinated following national and international protocol.

Leopard

Food: 2-2.5 kg meat (buff) for male adult, 2 kg for female and 800gm-1 kg for Juvenile

Time and pattern: Allocated meat will be provided between 11:00-12:00 for six days only. A live chicken of respective weight can be given once a week. One day a week no food is provided. Live rabbit or guinea pig can be provided once a month if it is available.

Hygiene and Medication and vaccination:

Daily clean the room and all utensils using Khorsolin

Medicated and vaccinated following national and international protocol.

Python

Food: one live local chicken or a rabbit

Time and pattern: Allocated food is provided once a week. Food should not be given during the hibernation period.

Additional work: Cleaning a room once a week. Lukewarm water can be poured intothe body during the skin shedding period. Lukewarm water will help to shed the skin easily.

Peacock

Food: Maize 20gm, unhusked rice 10gm, peas 25gm, what 25gm, rice 25gm, green vegetable 20gm apple 10gm and 10-15gm meat.

Time and pattern: Allocated food is provided daily basis. Sand and smaller size gravel are added to food.

Rabbit

Food: 100gm gram, 20gm carrot, 10gm potato,25gm green vegetable

Time and pattern: Allocated food is provided on the daily basis in two-phase. First phase between 10:00-11:00 and second phase 2:00pm -3:00 pm

Monkey

Food: 150gm Banana, 150Apple, 50Carrot, 30gm egg, 100gm bread,100gm green vegetable,and 25 gm peanuts

Time and pattern:	50 gm banana, 50 gm apple, 50 gm carrot	9:00-10:00am
	Egg, bread, 50gm banana, peanuts	12:00-1:00pm
	Green vegetables, 100gm apple, 50gm banana	3:00-5:00pm

Indian flapshell turtle

Food: 200-250 gm of proportional ratio of Fish, fruits, gram, carrot and green vegetables

Time and pattern: Allocated food is provided daily basis.

Hygiene:

Daily clean the room and all utensils using Khorsolin, change the water for turtle weekly

Medication and vaccination:

Medicated and vaccinated following national and international protocol.

Annex II: Photo plates

Collecting data on food provided and respective fecal dropping

Observing and recording food provided to herbivore and carnivore




Laboratory procedure on nutritional analysis in Lab of the NARC

Scat of leopard inside the forest of PZP

A peacock and Blue bull in PZP

Eurasian Eagle and barking deer in PZP

Cleaning the room and providing food to barking deer

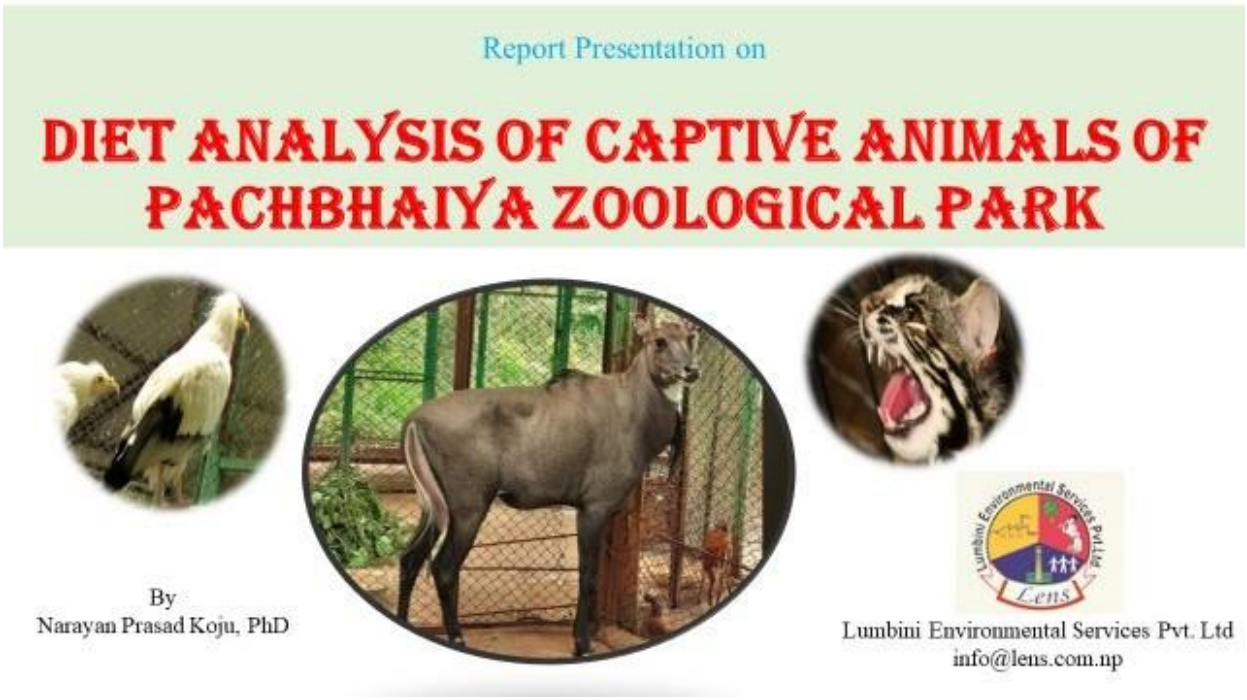
A python and spotted deer in PZP

Egyptian Vulture and Leopard cat in PZP

Measuring and collecting fecal and food sample

Annex III: Presentation slide

The final presentation was carried on Asad 14, 2078 at Forest ResourcesTraining Center, office, Gandaki Province



Introduction

Man has maintained collection of **captive animals for thousands** of years, the earliest evidence may be dated 2300 BC in Ur city of Sumarian (Koebner, 1994)

Proper feeding management of wild animals in **captivity incorporates both husbandry skills and applied nutritional science** (Dierenfeld, 1997).

The **science of nutrition is a rapidly expanding** field of zoo biology and the formulation of appropriate, scientifically based diets has become an integral part of the husbandry of many species (Kruuk et al., 1998).

Dietary choices of free-ranging wildlife are complex, can **rarely duplicate ingredients of any animal's diet in a captive feeding** situation (Robbins, 1993; Dierenfeld, 1997)

In Nepal

There is a **central zoo and a 18 mini zoos** but very few or no publication on diet of captive animals. Very few articles published in behaviors of captive animals and their other ecological status

But it is very important to know the scientific knowledge on status of diet for captive wild life for better conservation and healthy individuals

Therefore, this research is not important for Pachbhaiya Zoological Park (PZP) or the Gandaki Province or Nepal but has global importance and has significance role in park management especially for captive wildlife/ex-situ conservation

Objective

1. To identify the preferred diet for captive wild animals.
2. To examine the optimal nutrient composition, quantity and frequency (feeding interval) of food required for wild animals based on sex, age (infant/young/adult) and seasons.
3. To recommend the best alternative considering cost and diet analysis for the management of captive animals.

Scope and coverage of the study:

- The study shall be carried out in the Pachbhaiya Zoological Park of Gandaki province.
- The study shall cover the animal present in Pachbhaiya Zoological Park.

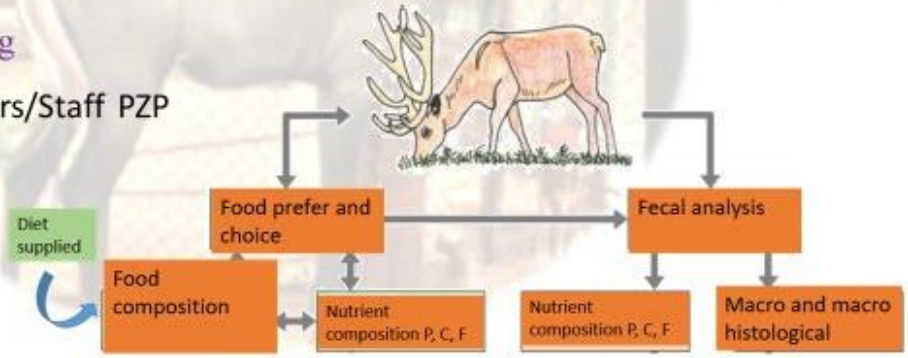
Methods

Desk study

- Diet consumption
- Natural diet (sex, age, seasonal)
- Comparative study in different zoos

Consultation meeting

Relevant stakeholders/Staff PZP



Field observation and sample collection

Behavior study

Scan sampling 5 min interval in three time shifts
(Minimum 10 days observation to each species)

Record on food provided and consumed

Type of food

Feeding/food demand time/interval
Observed and data collected for 10 to 41 days
Preferred food, frequency and amount
Uneaten food analysis
Fecal collection for nutritional analysis

Near by forest inventory

Prepare plant checklist as potential food in forest at PZP

Nutritional Analysis

Total 30 samples were collected for nutritional analysis
(*Dry matter, Protein, Carbohydrate and Fibers*)

- Sample of 50 gm food provided to respective animals was collected for 10 days (total 500gm) in a plastic jar with silica crystals and sealed for dehydration.
- Fodder provided were carefully observed for volume, weight and species diversity and 500gm (wet weight) of each is collected and kept for oven dry.
- Faecal samples depending on food provided were collected respectively. They were collected for 12 - 41 days depending upon the weight of defecation by animals, since minimum 300gm of wet weight is necessary for their nutritional analysis.

Findings

SN	Animal	Daily average per individual				Food type
		Food provided (gm)	Left over (gm)	Consumed /day	Daily waste %	
1		110.63	45.38	65.25	41.02	Chicken
	Barn Owl	118.33	42.88	75.45	36.24	Buff
2	Eurasian	106.5	34.37	72.13	32.27	Chicken
	Eagle	91.25	36.67	54.58	40.19	Buff
3	Jungle cat	310.25	72.5	237.75	23.37	Chicken
	male	254.5	66.65	187.85	26.19	Buff
4	Jungle cat	313.33	97.5	215.83	31.12	Chicken
	female	300.5	74.65	225.85	24.84	Buff
5		74	39.3	34.7	53.11	Chicken
	Black Kite	73.5	37.2	36.3	50.61	Buff
6	Leopard cat	258.32	46.4	211.92	17.96	Chicken
	female	252.5	16.65	235.85	6.59	Buff
7	Leopard cat	226.67	30.5	196.17	13.46	Chicken
	Juvenile	270	40.67	229.33	15.06	Buff
8	Egyptian	318.12	222.5	95.62	69.94	Chicken
	Vulture	248.5	80.5	168	32.39	Buff
9		321.67	212.5	109.17	66.06	Chicken
	Jackal	362.5	155	207.5	42.76	Buff

Findings…

SN	Animal	Daily average per individual				Food type
		Food provided (gm)	Left over (gm)	Consumed /day	Daily waste %	
10		223.33	0	223.33	0.00	Chicken
	Civet	185.25	0	185.25	0.00	Buff
11		909.5	0	909.5	0.00	Chokar
	Barking Deer	771.6	425.25	346.35	55.11	fodder
12		5308		5308	0.00	Chokar
	Blue Bull	4000	2312	1688	57.80	fodder
13		3395		3395	0.00	Chokar
	Spotted deer	2000	1274.2	725.8	63.71	fodder
14		250 [50]	80[20]	170(30)	32 (40)	Maize+chokar [chicken)
	Peacock	250 [50]	75[25]	175(25)	30(50)	Maize+chokar [Buff)
15		150	23	127	15.33	Wet gram +vegetable
16	Rabbit Python	2200 (10-15 days)	0			Chicken

Fecal record

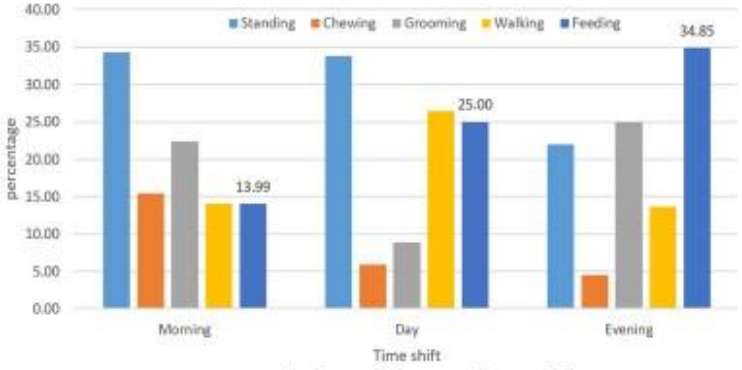
- The record of excreta from all animals were recorded every morning between 7:00 to 9:00
- Excreta were weight in digital balance collected in plastic jar with silica crystal for further laboratory analysis.

SN	Animal	Daily average fecal (gm)	
		Chicken as food	Buff as food
1	Barn Owl	1.5	1.75
2	Eurasian Eagle	2.5	2.23
3	Jungle cat male	72.5	50.12
4	Jungle cat female	75.35	55.25
5	Black Kite	1.32	1.45
6	Leopard cat female	9.25	7.5
7	Leopard cat Juvenile	9.75	2.25
8	Egyptian Vulture	3.2	3.5
9	Jackal	6.5	8.5
10	Civet	19.25	16.5
11	Barking Deer	788.55 (Choker +Fodder)	
12	Blue Bull	5086.8 (Choker +Fodder)	
13	Spotted deer	1640.2 (Choker +Fodder)	
14	peacock	8.5	8
15	Rabbit	75	
16	Python	300 (dry/week)	

Diurnal Behavior of animals in Pachbhaiya zoological park

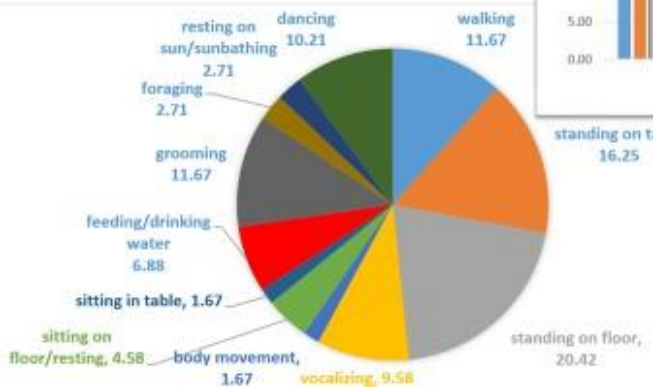
Spotted deer

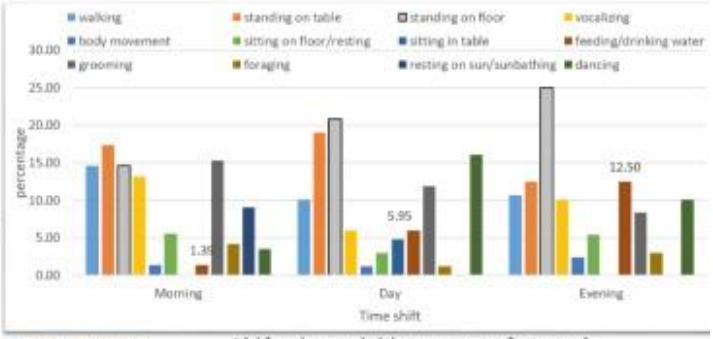
Daily activities of spotted deer (N=686 events, (57.17 hr)



Shift wise behavior of spotted deer

Diurnal Behavior of peacock in Pachbhaiya zoological park

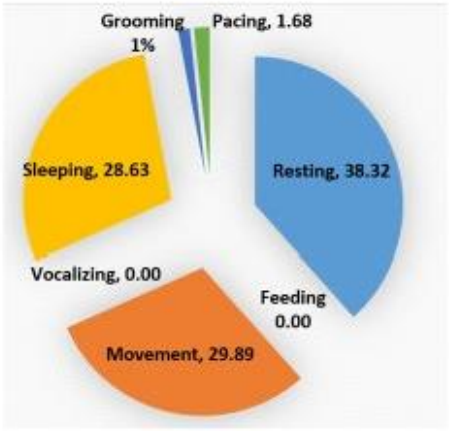




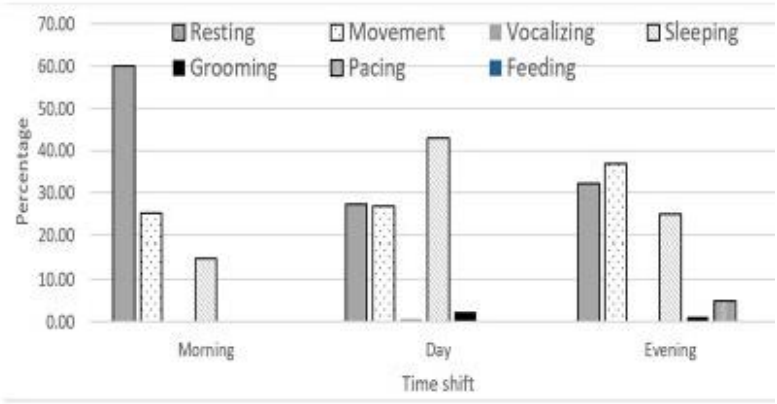
Shift wise activities pattern of peacock

Daily activities of peacock (N=960 events; 80 hr)

Diurnal Behavior of Adult Jungle cat (female)

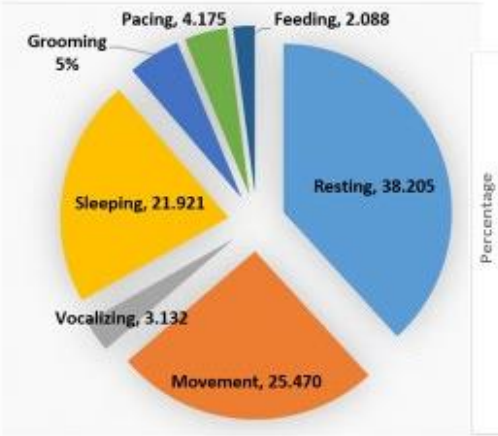


Diurnal activities pattern (N=950 events (79.16 hr)



Shift wise daily activities pattern of adult female Jungle cat

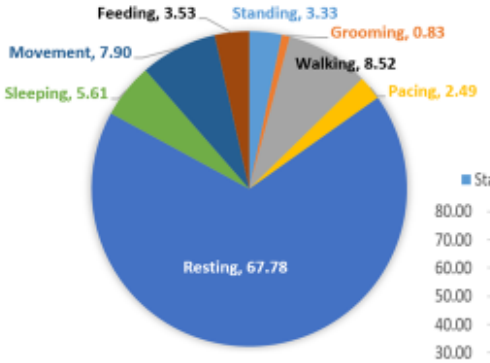
Diurnal Behavior of Juvenile Jungle cat (female)



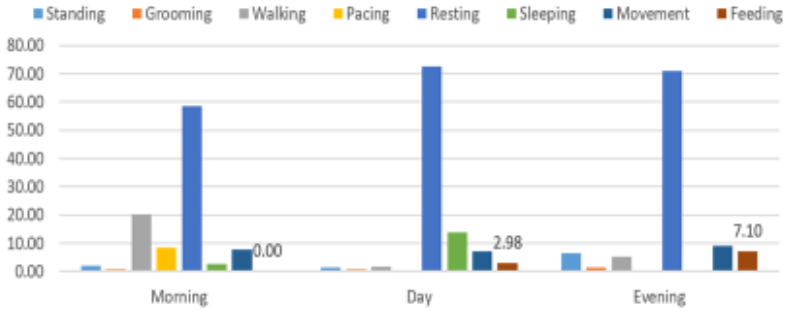
Diurnal activities pattern (N=958 events, 79.83 hr).

Shift wise daily activities pattern of juvenile Jungle cat

Diurnal Behavior of Indian civet



Diurnal Activities pattern (N=961; 80.03hr)



Shift wise daily activities pattern of Large Indian Civet

Diurnal Behavior of Leopard cat

Behavior	Morning time budget in %		Day time budget in %		Evening time budget in %		Total time budget in %	
	Adult	Juvenile	Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
Climbing cage	18.71	**22.14**	**2.36**	0.73	5.29	**21.95**	7.68	**14.75**
Walking	27.34	**34.29**	16.51	**26.28**	**31.18**	21.95	24.18	**27.75**
Feeding	**0.72**	0.00	0.47	**4.38**	0.00	0.00	0.38	**1.50**
Grooming	4.32	5.00	0.94	**3.65**	5.88	6.50	3.45	5.00
Vocalizing	**1.44**	0.00	0.00	0.73	0.00	**3.25**	0.38	1.25
Rest	22.30	18.57	**14.62**	6.57	12.35	17.89	15.93	14.25
sleeping	20.11	16.67	39.43	36.57	31.17	22.15	**47.98**	35.50
Total time (%)	100.	100.00	100.00	100.00	100.00	100.	100 (N=1041)	100 (N=812)

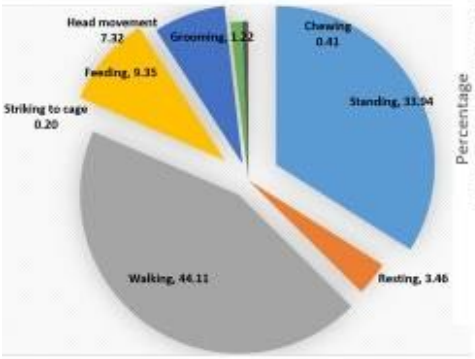
Daily and shift wise activities pattern of leopard cat

Diurnal Behavior of Eurasian Owl

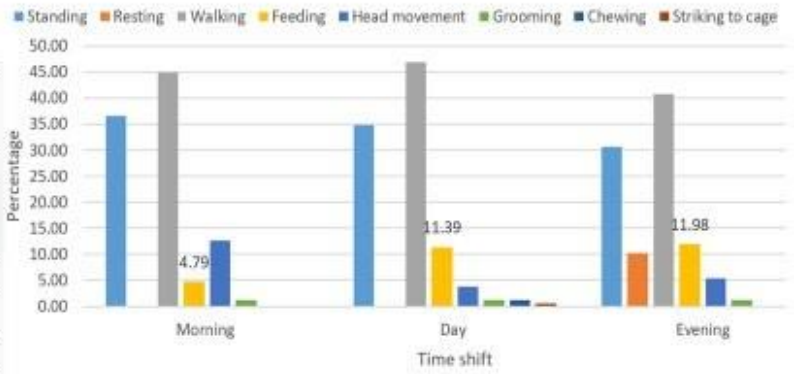
Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Movement	13.15	3.88	5.29	7.17
Resting	77.16	93.73	91.69	88.01
Sleeping	0.69	0.00	0.00	0.21
Flapping wings	2.08	0.30	0.30	0.84
Flying inside case	0.87	0.00	0.00	0.26
Grooming	5.36	1.49	1.51	2.67
Hooting	0.52	0.45	0.76	0.58
Feeding	0.17	0.15	0.45	0.26
Total (%)	100.00	100.00	100.00	100.00 (N=3820)

Daily and shift wise activities pattern of Eurasian Owl

Diurnal Behavior of Blue bull



Daily activities pattern of Blue bull (N=981 events; 81.75hr)



Shift wise daily activities pattern of Blue bull

Diurnal Behavior of Barn owl

Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Resting	92.65	93.74	93.25	93.25
Flying	4.30	5.08	3.00	4.18
Movement	0.90	0.86	0.88	0.88
Sleeping	1.43	1.32	0.90	1.20
Hoot	0.74	0.29	0.46	0.48
Feeding	0.00	0.00	0.00	0.00
Total (%)	100	100	100	100

Diurnal activities pattern of barn owl

Diurnal Behavior of Black kite

Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Standing	64.23	58.60	58.49	60.43
Resting	17.47	21.80	21.33	20.20
Head movement	0.84	0.73	1.14	0.90
Flying	4.50	5.87	5.59	5.32
Grooming	4.92	3.67	3.00	3.86
Walking	4.71	5.77	7.14	5.88
Feeding	3.24	3.56	3.31	3.37
Vocalization	0.10	0.00	0.00	0.03

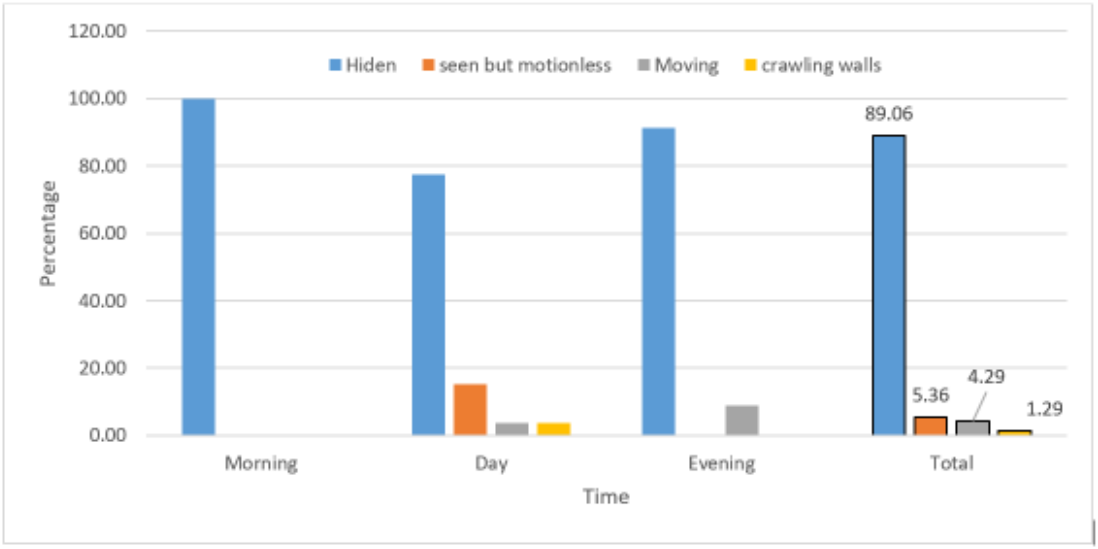
Diurnal and shift wise activities pattern of black kite (N=2876 events; 239.67 hr)

Diurnal Behavior of Golden Jackal

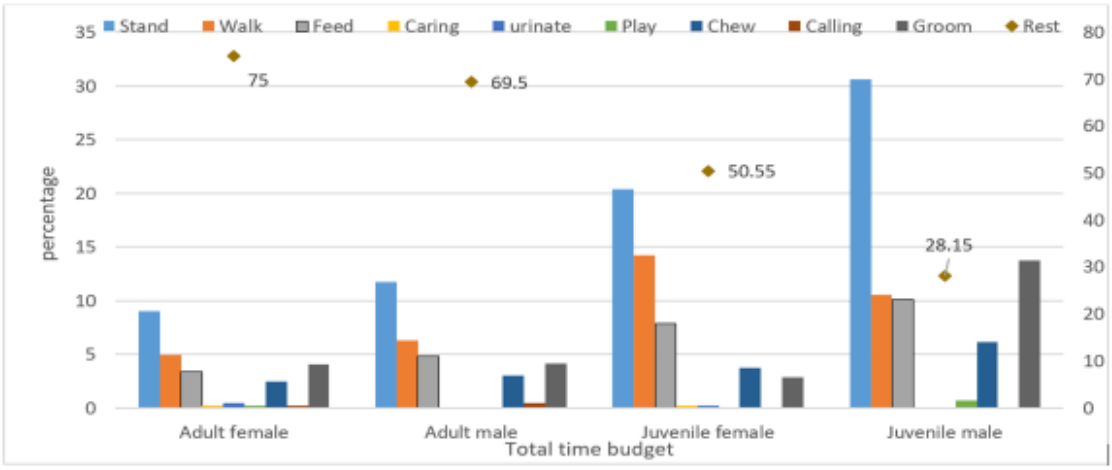
Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Standing	17.90	27.83	22.29	22.12
Sitting	20.99	27.83	21.02	22.81
walking	50.62	43.48	40.76	45.16
Sleeping	9.26	0.00	14.65	8.75
Head movement	1.23	0.00	0.00	0.46
Feeding	0.00	0.87	1.27	0.69

Diurnal and shift wise behavior of golden Jackal

Diurnal Behavior of Python



Diurnal Behavior of Barking deer



N= adult female, 888 event, 74 hr), adult male (898 events, 74.83 hr) juvenile female (914 events, 71.17 hr) and juvenile male (874 events, 72.83 hr)

Barking deer

Category	Female adult(pregnant)				Male(Adult)			
Behavior	M%	D%	E %	T %	M%	D%	E %	T %
Stand	20.59	3.07	4.83	9.01	21.71	1.91	12.00	11.76
Walk	9.56	0.00	6.21	4.95	15.79	0.00	3.33	6.32
Feed	2.21	4.91	2.76	3.38	4.61	5.73	4.00	4.79
Caring	0.74	0.00	0.00	0.23	0.00	0.00	0.00	0.00
urinate	0.00	0.61	0.69	0.45	0.00	0.00	0.00	0.00
Play	0.00	0.00	0.69	0.23	0.00	0.00	0.00	0.00
Chew	2.21	1.23	4.14	2.48	2.63	1.27	5.33	3.05
Calling	0.74	0.00	0.00	0.23	0.00	0.64	0.67	0.44
Groom	6.62	1.84	4.14	4.05	5.92	3.18	3.33	4.14
Rest	57.35	88.34	**76.55**	75.00	49.34	87.26	71.33	69.50
Category	Female (Juvenile)				Male (juvenile)			
Behavior	M%	D%	E %	T %	M%	D%	E %	T %
Stand	28.03	17.45	15.23	20.35	31.97	28.89	30.97	30.66
Walk	28.66	7.38	5.96	14.22	21.77	6.67	3.23	10.53
Feed	7.64	6.71	9.27	7.88	10.88	9.63	9.68	10.07
Caring	0.00	0.67	0.00	0.22	0.00	0.00	0.00	0.00
urinate	0.00	0.67	0.00	0.22	0.00	0.00	0.00	0.00
Play	0.00	0.00	0.00	0.00	0.00	0.00	1.94	0.69
Chew	0.64	4.70	5.96	3.72	7.48	5.93	5.16	6.18
Calling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Groom	7	0	1.32	2.85	11.56	14.82	14.84	13.73
Rest	28.03	62.42	62.25	50.55	16.33	34.07	34.19	**28.15**

Diurnal Behavior of Egyptian Vulture

Behavior	Morning time budget in %	Day time budget in %	Evening time budget in %	Total time budget in %
Standing in wire	47.21	50.14	40.06	46.66
Resting in ground	7.21	4.48	3.06	4.93
Grooming	24.26	2.80	14.68	15.72
walking	8.85	8.96	13.46	10.59
Feeding	8.85	13.73	5.50	9.66
Flying	3.28	15.97	22.02	10.48
vocalization	0.33	3.92	1.22	1.95

Diurnal and shift wise activities pattern of Egyptian Vulture (N=1904 events; 158.66hr)

Plants and fodder in Pachbhaiya zoological park

The forested vegetation of the area is dominated by Katus *(Castanopsis indica)* associated with other broadleaved tree species.

Many tree species are used as fodder for herbivore animals except some with toxic latex such as *Sapium insigne.*

Among the tree species *Castanopsis indica* contributes to major portion of fodder during stall feeding, as it is one of the abundant tree found within the forest.

S.N.	List of trees	Latin name	Lifeform	Family	Taxonomy
1	Dhale Katus	Castanopsis indica	Tree	Fagaceae	Dicot
2	Musure katus	Castanopsis tribuloides	Tree	Fagaceae	Dicot
3	Chilaune	Schima wallichii	Tree	Theaceae	Dicot
4	Peepal	Ficus religiosa	Tree	Moraceae	Dicot
5	Bar	Ficus benghalensis	Tree	Moraceae	Dicot
6	Pakhuri	Ficus glaberrima	Tree	Moraceae	Dicot
7	Kyamuna	Cleistocalyx operculatus	Tree	Myrtaceae	Dicot
8	Kathe Pangra	Entada phaseoloides	Woody climber	Fabaceae	Dicot
9	Bot Dhairo	Lagerstroemia parviflora	Tree	Lythraceae	Dicot
10	Khanayo	Ficus semicordata	Tree	Moraceae	Dicot
11	Chanp	Michelia champaca	Tree	Magnoliaceae	Dicot
12	Aanp	Mangifera indica	Tree	Anacardiaceae	Dicot
13	Gidari	Premna integrifolia	Tree	Verbenaceae	Dicot
14	Phaledo	Erythrina stricta	Tree	Fabaceae	Dicot
15	Tooni	Toona ciliata	Tree	Meliaceae	Dicot
16	Siris	Albizia lebbeck	Tree	Fabaceae	Dicot
17	irfire	Acer oblongum	Tree	Aceraceae	Dicot
18	Amaro	Spondias pinnata	Tree	Anacardiaceae	Dicot
19	Uttis	Alnus nepalensis	Tree	Betulaceae	Dicot
20	Saur	Betula alnoides	Tree	Betulaceae	Dicot
21	Khanayo	Ficus semicordata	Small tree	Moraceae	Dicot
22	Khirro	Sapium insigne	Tree	Euphorbiaceae	Dicot

Shrubs and herbs species as fodder

The shrubs and herbs species as fodder preference depends upon the season and availability or abundance of these species

1. *Bauhinia purpurea),*
2. Kim kaphal *(Morus serrata),*
3. Banspate (*Rumex dentatus),*
4. *Bilaune(Maesa chisia),*
5. Kutsimal (*Schefflera venulosa),*
6. Nilobutte ghas (*Scutellaria discolor),*
7. Kutsimal (*Schefflera venulosa),*
8. Ankhtare *(Trichilia connaroides),*
9. Areri *(Acacia pinnata),*
10. Niuro etc.

1. Dhurseli *(Colebrookea oppositifolia*
2. Bantarul *(Dioscorea bulbifera),*
3. Dhairo*(Woodfordia fruticosa),*
4. Baghmukhe*(Caryopteris phoetida),*
5. Bhak amilo *(Rhus javanica),*
6. Hade *(Pilea sp.),*
7. Phulchiso,
8. Charchare,
9. Batuke,
10. Bhote,
11. Banso,
12. Chaichui,

Nutritional status

Total Energy

Animal	Energy in consumed food	Energy in excrete	Daily energy absorbed	Absorbed energy %	Food
1. Barn Owl	142931.43	6668.34	136263.09	95.33	Chicken day
	137045.16	5835.80	131209.36	95.74	Buff day
2. Eurasian Eagle	158002.21	8500.53	149501.68	94.62	Chicken day
	99127.65	7296.98	91830.67	92.64	Buff day
3. Jungle cat male	520796.13	107600.15	413195.98	79.34	Chicken day
	341171.29	64471.36	276699.93	81.10	Buff day
4. Jungle cat female	472779.93	111829.95	360949.98	76.35	Chicken day
	410186.51	71070.29	339116.23	82.67	Buff day
5. Black Kite	76011.04	1271.67	74739.37	98.33	Chicken day
	65927.70	4955.40	60972.29	92.48	Buff day
6. Leopard cat female	464215.00	24024.66	440190.34	94.82	Chicken day
	428348.41	23993.48	404354.94	94.40	Buff day
7. Leopard cat Juvenile	429714.31	25323.29	404391.02	94.11	Chicken day
	416506.85	7198.04	409308.81	98.27	Buff day
8. Egyptian Vulture	209457.52	9041.82	200415.70	95.68	Chicken day
	305119.92	11740.96	293378.96	96.15	Buff day
9. Jackal	239139.07	14196.78	224942.29	94.06	Chicken day
	376859.43	28667.87	348191.56	92.39	Buff day
10. Civet	489208.83	100701.18	388507.65	79.42	Chicken day +apple
	336449.20	80647.71	255801.49	76.03	Buff day+ apple
11. Pencock	702103.8	34440.89869	667662.9013	95.09	Chicken day
	681792.95	36323.8335	645469.1165	94.67	Buff day
12. Barking Deer	5184943.58	3828981.67	1355961.91	26.15	Regular diet
13. Bule Bull	28546740.72	19209173.31	9337567.41	32.71	Regular diet
14. Spotted deer	16439716.76	6677063.20	9762653.56	59.38	Regular diet

Protein

Nutritional status

Animal	Protein consumed (gm)	Protein in excreta (%)	Protein waste (gm)	Absorbed Protein (gm)	Food
1. Barn Owl	12.92	51.21	6.30	6.62	Chicken day
	21.23	64.16	7.61	13.62	Buff day
2. Eurasian Eagle	14.28	47.10	7.55	6.73	Chicken day
	15.36	51.84	7.40	7.96	Buff day
3. Jungle cat male	47.07	13.34	40.79	6.28	Chicken day
	52.86	13.34	45.81	7.05	Buff day
4. Jungle cat female	42.73	13.34	37.03	5.70	Chicken day
	63.55	13.34	55.07	8.48	Buff day
5. Black Kite	6.87	56.90	2.96	3.91	Chicken day
	10.21	52.04	4.90	5.32	Buff day
6. Leopard cat female	41.96	17.61	34.57	7.39	Chicken day
	66.37	15.02	56.40	9.97	Buff day
7. Leopard cat Juvenile	38.84	17.61	32.00	6.84	Chicken day
	64.53	15.02	54.84	9.69	Buff day

Protein

Nutritional status

Animal	Protein consumed (gm)	Protein in excreta (%)	Protein waste (gm)	Absorbed Protein (gm)	Food
8. Egyptian Vulture	18.93	46.57	10.12	8.82	Chicken day
	47.28	56.66	20.49	26.79	Buff day
9. Jackal	21.62	15.63	18.24	3.38	Chicken day
	58.39	17.11	48.40	9.99	Buff day
10. Civet	44.22	17.52	36.47	7.75	Chicken day +apple
	52.13	15.68	43.96	8.17	Buff day+ apple
11. Peacock	6.58	32.12	4.47	2.11	Chicken day
	16.64	29.18	11.78	4.86	Buff day
12. Barking Deer	112.75	13.31	97.74	15.01	Regular diet
13. Blue Bull	779.48	9.06	708.83	70.65	Regular diet
14. Spotted deer	471.25	9.57	426.14	45.11	Regular diet

Crude fiber

Nutritional status

Animal	CF in food (gm)	CF % in fecal	CF in waste (gm)	Absorbed CF (gm)	Food
1. Barn Owl	8.50	1.98	8.33	0.17	Chicken day
	13.82	3.88	13.28	0.54	Buff day
2. Eurasian Eagle	9.39	3.75	9.04	0.35	Chicken day
	9.99	5.55	9.44	0.55	Buff day
3. Jungle cat male	30.96	4.44	29.58	1.38	Chicken day
	34.40	4.44	32.87	1.53	Buff day
4. Jungle cat female	28.10	4.44	26.85	1.25	Chicken day
	41.35	4.44	39.52	1.84	Buff day
5. Black Kite	4.52	3.68	4.35	0.17	Chicken day
	6.65	0.64	6.60	0.04	Buff day
6. Leopard cat female	27.59	6.53	25.79	1.80	Chicken day
	43.18	15.26	36.59	6.59	Buff day
7. Leopard cat Juvenile	25.54	6.53	23.87	1.67	Chicken day
	41.99	15.26	35.58	6.41	Buff day

Crude fiber

Nutritional status

Animal	CF in food (gm)	CF % in fecal	CF in waste (gm)	Absorbed CF (gm)	Food
8. Egyptian Vulture	12.45	4.90	11.84	0.61	Chicken day
	30.76	4.09	29.50	1.26	Buff day
9. Jackal	14.21	8.36	13.03	1.19	Chicken day
	37.99	8.33	34.83	3.17	Buff day
10. Civet	29.08	24.52	21.95	7.13	Chicken day +apple
	33.92	16.88	28.19	5.73	Buff day+ apple
11. Peacock	5.49	14.44	4.70	0.79	Chicken day
	3.26	16.07	2.73	0.52	Buff day
12. Barking Deer	256.99	32.59	142.97	69.12	Regular diet
13. Blue Bull	1332.59	48.89	201.20	192.44	Regular diet
14. Spotted deer	756.90	46.62	90.37	78.93	Regular diet

Discussion

Animal	Given PZP	Central Zoo	India (IZA)	Pakistan (Lahor)	Bangladesh	Recommended	Remark
Barn Owl	110.63 gm chicken or 118gm buff	100gm buff	80 gm meat	80gm meat	NA	80-100 gm meat	Six days in a week only
Eurasian Eagle	91 gm buff or 106gm chicken	150 gm buff	100-150gm meat	50-80 gm meat	NA	90-100gm meat	Six days in a week only
Jungle cat male	310 gm chicken/54.5gm buff	300gm chicken	250 gm meat	250gm meat		250-300gm meat	Six days in a week only
Black Kite	74 gm chicken/buff	100gm buff	100-120gm chicken/mutton	100gm beef		75-100 gm buff	Six days in a week only
Leopard cat	250 chicken/buff	250gm chicken/85gm fish and 85gm buff	250 gm meat	250 gm meat		220-250 gm meat and add fish often	Six days in a week only
Egyptian Vulture	320 chicken or 250 buff	200 gm buff				300-320gm buff	Six days in a week only
Jackal	320 chicken or 360 buff	350 chicken	750 gm meat with bone			300-320 gm with bone chicken	Six days in a week only
Civet	220 gm chicken/190 gm buff and apple	banana 75gm, apple 50gm, seasonal fruit 50 gm, buff/chicken 150gm	100gm mean, 100gm banana and 100 gm apple			100-120 gm meat+ 100 gm banana and 100gm apple and seasonal fruit	Six days in a week only

Discussion

Animal	Given PZP	Central Zoo	India (IZA)	Pakistan (Lahor)	Bangladesh	Recommended
peacock	250 maize+chokar and 50 gm meat	maize 20gm, unhusked rice 10gm, peas 25gm, what 25gm , rice 25gm, green vegetable 20gm apple 10gm	100 gms green leafy vegetables, 50 gms coloured vegetables, 5 gms garlic, 50 gms onion, 25 gms boiled egg, 100 gms poultry mash and 100 gms grain is adequate per day	100 gms green leafy vegetables, 50 gms coloured vegetables, 100 gms poultry mash and 100 gms grain and 50 gm meat		maize 20gm, unhusked rice 10gm, peas 25gm, what 25gm , rice 25gm, green vegetable 20gm apple 10gm and 10-15gm meat
Barking Deer	900gm chokar and 780gm fodder	maize 175gm, gram 150gm, soya 100gm, choker 250gm, salt minerals 10gm	2-3 kg quality green fodder with 250 gms concentrate	2-2.5 green fodder, 200gm animal feed		2-3 kg quality green fodder with 250 gms chocker, 10gm salt/minerals, 100gm soya and 100gm maize
Blue Bull	5kg chokar and 5kg fodder	maize 450gm, gram 400gm, soya 300gm, choker 450gm, salt minerals20gm	Green fodder 9 kg ; tree fodder 2kg; Chokar 7.5 kg	2.5-3.5 kg fruit, 250-350 g Chappati, 20-35 kg Fodder, 0.5-1 kg of Parched grams, 0.5 of choker	20-30 kg Chara, 1/2 kg wheat straw, 1/2 kg Wanda, Vitamin mineral iodine salt	5kg chokar, 9-10kg fodderand 15-20gm salt
Spotted deer	3kg chokar and 2-3kg fodder	maize 200gm, gram 200gm, soya 100gm, choker 500gm, salt minerals 10gm	6 (six)kg quality green fodder with 500 gm Chokar	6 (six)kg quality green fodder with 500 gm Chokar		6-7kg fodder, 1-1.5kg chokar, 200gm soya and 10gm salt
Python	1.5-2kg live chicken/two weeks	1.5-2kg chicken/rabbit	1.5-2kg chicken/rabbit	1.5-2kg chicken/rabbit		1.5-2kg live chicken/two weeks

Potential guest in PZP

Animal	Central Zoo	India	Pakistan	USA	Canada
Adult male	4-5kg buff with bone and 2-2.5 chicken once a week	**4 – 4.5 kg beef with bone/ day except on Fridays**	4-5 kg beef,3 half kg packets of milk	**4-5 kg beef or mutton**	**4-5 kg meat diet every day, except Tuesday 1 shank bone- Thursday 1 rabbit- Tuesday**
Adult female	4-4.5 kg buff with bone and 2-2.5 chicken once a week	**4 kg beef with bone/ day except on Fridays**	4 kg beef, 3 half kg packets of milk	**4-4.5 kg beef or mutton**	**4-4.5 kg meat diet every day, except Tuesday 1 shank bone- Thursday 1 rabbit- Tuesday**
Juvenile/infant	1.5 kg buff and 1 kg chicken once a week	**1.5 kg beef**	1.5 kg beef and half kg milk		

Sample	**DM**	**CF**	**CP**	**Energy**
Leopard Lens 26	74.91	15.32	14.09	3206.08
Prey	Barking deer–28.55%, monkey 15.32%, goat 12.28%, Rat/nivi̇venter–2.3%, yellow throated Marten 9.8%, bird 8.63% unknown 23.05%			

Collected fecal sample =2

Comparison on wild and captive barking deer

Comparative		DM %	CF%	CP%	Energy (cal/gm)
1	Barking Deer (Lens 19)	27.24	13.31	32.59	4855.42
2	Fecal Barking deer Natural habitat	48.31	16.55	32.31	5504.46

Fiber in fecal of wild barking deer is high since it feed natural food with higher fiber
Energy present in fecal of wild barking deer is higher since energy in plant/fodder is difficult to absorb than choker
DM% suggest that barking deer in captive have plenty of water to drink.

Conclusion

- Animals in PZP are healthy, they absorbed sufficient energy from food and are good active in behavior.
- Food is providing for all seven days in a week. Amount of meat providing to carnivore except Eurasian Eagle and civet is higher that national/international practice. The amount of protein excretion in birds: Barn Owl, black kites, Egyptian Vulture is too high.
- Carnivore except Egyptian eagle, black kites and leopard cat prefer feeding at night or evening.
- Amount of choker is higher to herbivore than national and international practice and fodder is less enough though they left over high volume of fodder daily.
- Pacing behavior is common in felid species suggesting space is to small and they are still not habituated to live in cave.

Recommendation

- Change in timing of providing food
  - Carnivore prefer evening
  - Herbivore: at least twice a day: Morning and evening
- Change in amount and composition of food
  - Carnivore: reduce meat weight and vulture, owl prefer buff and small felids and jackal prefer buff, better to add fish often for leopard cat, add more fruit for civet.
  - Increase fodder amount for herbivore, reduce choker, add protein content food and salt/minerals
- Change in number of days providing food
  - Six days per week for all carnivore
- Increase the area of case
- The case size is too small for all captive animals must be increased soon as possible.

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