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# Biochemical Profiling of Captive and Rescued Black Kites (*Milvus migrans govinda*) in Central India

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## ABSTRACT

The Black kite (*Milvus migrans govinda*), a common resident raptor of the Indian subcontinent, plays a vital ecological role in scavenging and waste degradation across urban habitats. Despite its abundance, limited scientific information is available on its normal haemato-biochemical profile in India, which is essential for clinical evaluation and health monitoring of rescued and captive birds. The present study was carried out at the School of Wildlife Forensic and Health (SWFH), Nanaji Deshmukh Veterinary Science University, Jabalpur, from July to December 2023, with the objective of establishing baseline biochemical values for apparently healthy Black kites maintained in captivity. Blood samples were aseptically collected from six clinically healthy individuals housed at the SWFH aviary. Serum biochemical parameters including total protein, calcium, phosphorus, uric acid, alkaline phosphatase (ALP), liver enzymes (AST, ALT), creatinine, and blood urea nitrogen (BUN) were analysed using an automated biochemical analyser. The mean serum values remained within normal physiological ranges reported for raptors, suggesting stable hepatic and renal function under captivity. Normal calcium-phosphorus ratio indicated appropriate mineral metabolism and nutritional status. The findings serve as valuable reference standards for clinical assessment, disease diagnosis and health management of Black kites maintained in captivity or rehabilitation centres in India.

## Introduction

The Black Kite is a medium-sized raptor belonging to the family *Accipitridae* and the order *Accipitriformes*. Although populations of many species within the family *Accipitridae* are declining globally, the Black Kite remains one of the most widespread and common raptor species in the world (Ferguson-Lees & Christie, 2001). The resident subspecies, *Milvus migrans govinda*, is non-migratory and breeds throughout the Indian subcontinent, extending from eastern Pakistan to the Malay Peninsula (Schneider et al., 2004). This medium-sized, dark-brown subspecies is commonly found in urban and semi-urban environments, where it frequently forages on offal from slaughterhouses, fish and meat markets, and garbage dumps, and often roosts in communal spaces (Naoroji et al., 2007). The species is easily identified by its pale-yellow legs, long black talons, yellow cere, and yellow gape (Fig. 01). Formerly

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known as the Pariah Kite, the Black Kite comprises several subspecies that exhibit distinct morphological characteristics, including: *Milvus migrans migrans* (European Black Kite) with a whitish head; *Milvus migrans lineatus* (Black-eared Kite) with a large pale carpal patch; *Milvus migrans formosanus* (Taiwan Kite); *Milvus migrans govinda* (small Indian Kite); *Milvus migrans affinis* (Fork-tailed Kite); *Milvus migrans aegyptius* (Egyptian Kite); and *Milvus migrans parasitus*. Blood parameters have long been recognized as valuable tools for health assessment and physiological monitoring in wild birds (Balbontín and Ferrer, 2002); however, limited research has focused on the use of haemato-biochemical parameters of wild avian species as indicators of environmental conditions. Recent studies have expanded the understanding of the ecological and environmental significance of Black Kites beyond basic natural history. For example, analyses of kite feathers have demonstrated the species' potential as a bio indicator of heavy metal contamination near landfill sites, highlighting its usefulness in environmental monitoring programs (Pourkhabbaz et al., 2021). Other investigations have documented disease prevalence, such as oral trichomoniasis in wild Black Kites, and have addressed its clinical management, underscoring emerging health challenges in urban raptor populations (Pandya et al., 2025). Urban ecological studies have also reported changes in population dynamics and habitat use; declines in local Black Kite populations in parts of northeastern India have been linked to food scarcity and habitat modification (Bhowmik and Paul, 2025), while seasonal abundance patterns appear strongly influenced by anthropogenic food availability and environmental variables along urban gradients (Rashid et al., 2025). Additionally, research on nesting site selection in *Milvus migrans govinda* has provided insights into the influence of urban features on reproductive ecology (Mehta and Ilyas, 2018), as well as the role of offal disposal and waste management practices in shaping roosting and foraging behavior in metropolitan landscapes.

# Materials and Methodology

## Location of Work

The samples were collected from Black kites maintained at the aviary in SWFH and from the rescued cases that are presented from time to time for treatment. The samples were brought to the laboratory at the School of Wildlife Forensic and Health, N.D.V.S.U., Jabalpur for haemato-biochemical analysis and culture of aerobic bacteria.

**Fig. 1 : Picture of Black kite (Milvus migrans govinda)**

## Duration of Work

The study was conducted for a period of six months from July 2023– December 2023.

## Sources of samples

A total of 6 blood samples as given in (Table 1), were collected from captive Black kites maintained at the aviary in SWFH and from the rescued cases that are presented from time to time for treatment.

## Collection of samples

Blood (1.5-2ml) was collected aseptically in the vials coated with Ethylenediamine Tetra Acetic Acid (EDTA) and vials without anticoagulant for serum separation from the wing vein of Black kites (Fig. 2). Samples were kept in the ice box with ice packs. The collected blood samples were transported to the laboratory as soon as possible under a cold chain throughout the route strictly.

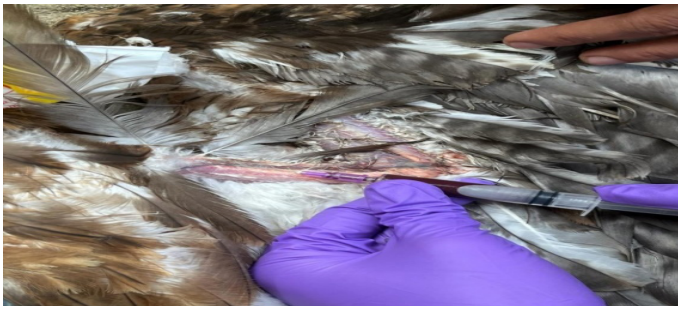

**Fig. 2: Blood sample from the wing vein of black kite**

## Biochemical examination

Blood samples were centrifuged at 2500rpm for 10 minutes to separate serum under the aseptic conditions. Biochemical parameters such as Total Protein (TP), Calcium, Phosphorus, Uric acid, Serum Aspartate Aminotransferase (AST), Serum Alanine Transaminase (ALT), Alkaline Phosphatase (ALP), BUN and Creatinine were estimated using automatic biochemical analyzer using biochemical test kit (ERBA Diagnostics, India).

## Results and Discussion

Standard biochemical parameters were evaluated in six captive Black Kites (*Milvus migrans govinda*) at the School of Wildlife Forensic and Health, Madhya Pradesh, India, to assess their health status under captive conditions. Black Kites play a significant ecological role as scavengers, contributing to waste management and disease control within ecosystems. The ongoing destruction of their breeding and feeding habitats is considered a major factor contributing to the decline of avian populations in India. Despite their ecological importance, limited baseline data are available on the haemato-biochemical parameters of this species in India, highlighting the relevance of the present study.

The biochemical values obtained in this investigation (Table 2) indicate that all six rescued Black Kites were in good physiological condition, with parameters falling within normal ranges reported for raptors and other avian species. The total protein (TP) values observed in the present study are consistent with those reported by Gupta and Kanaujia (2016) for *Milvus migrans govinda* from the Bundelkhand region. Similar TP values have also been reported in other raptors, such as the Common Buzzard (*Buteo buteo*) and the Red Kite (*Milvus milvus*), suggesting that protein metabolism in Black Kites is comparable to that of other Accipitridae species (Lumeij, 1997; Harr *et al.*, 2005). Total protein levels are influenced by nutritional status, hydration, and hepatic function, and normal TP values in this study indicate adequate nutrition and absence of dehydration in captivity. Serum creatinine levels observed in the present investigation (mean 0.32 mg/dl) remained within normal avian reference ranges and did not show significant elevation, suggesting normal renal function. In birds, creatinine has limited diagnostic sensitivity compared to mammals; however, stable creatinine values are still indicative of the absence of severe renal impairment (Campbell, 2015). Comparable creatinine concentrations have been reported in captive and free-ranging raptors such as the Peregrine Falcon (*Falco peregrinus*) and the Eurasian Eagle Owl (*Bubo bubo*), supporting the interpretation that captivity did not adversely affect kidney function in the studied Black Kites.Liver enzyme activities, including aspartate aminotransferase (AST) and alanine aminotransferase (ALT), did not show any alarming elevation in the present study. AST is widely used as an indicator of hepatic and muscle integrity in birds, while ALT has limited liver specificity in avian species but may still reflect hepatocellular stress when interpreted alongside other parameters (Hochleithner, 1994; Harr, 2006). The observed AST and ALT values were comparable to those reported in other raptors, including the Steppe Eagle (*Aquila nipalensis*) and Black-winged Kite (*Elanus caeruleus*), suggesting that the captive diet consisting primarily of chicken meat did not exert adverse effects on liver function (Samour, 2011). Calcium (Ca) and phosphorus (P) levels in the present study showed a Ca:P ratio close to the recommended 2:1 ratio essential for bone development, neuromuscular function, and metabolic stability in birds. Similar Ca:P ratios have been documented in captive birds of prey such as the Barn Owl (*Tyto alba*) and the Crested Serpent Eagle (*Spilornis cheela*) (Lumeij & de Matos, 2004). Maintenance of an appropriate Ca:P balance is particularly important in captive raptors to prevent metabolic bone disease, and the findings indicate that mineral supplementation and dietary management were adequate for the studied Black Kites.Overall, the serum biochemical profile of *Milvus migrans govinda* observed in this study aligns closely with previously reported values for both conspecifics and other raptor species. These findings suggest that the captive management practices, including diet and husbandry conditions, were sufficient to maintain physiological health. The results also provide valuable baseline biochemical reference data for Black Kites in central India, which can be useful for clinical assessment, rehabilitation monitoring, and future conservation-oriented health studies.

**Table 2: Serum Biochemical parameters of Black kites (n=6)**

| S. No. | Parameter | Mean ± SE |
|---|---|---|
| 1 | Total protein (g/dL) | 3.10 ± 0.07 |
| 2 | ALT (U/L) | 32.54 ± 0.62 |
| 3 | AST (U/L) | 157.40 ± 7.70 |
| 4 | BUN (mg/dL) | 6.90 ± 0.07 |
| 5 | Creatinine (mg/dL) | 0.32 ± 0.01 |
| 6 | Uric acid (mg/dL) | 4.83 ± 0.15 |
| 7 | ALP (U/L) | 88.93 ± 0.94 |
| 8 | Calcium (mg/dL) | 8.17 ± 0.10 |
| 9 | Phosphorus (mg/dL) | 3.38 ± 0.07 |

## Conclusion

The present study establishes baseline biochemical reference values for captive and rescued Black kites *(Milvus migrans govinda)* maintained at SWFH, Jabalpur. The values obtained for serum enzymes, renal markers and mineral parameters were within normal physiological limits, indicating that the captive environment and feed management practices supported normal hepatic, renal and metabolic functions. The study highlights the diagnostic significance of routine biochemical monitoring in raptors and provides valuable reference data that can aid wildlife veterinarians, researchers, and rehabilitation facilities in evaluating the health status of Black kites across India. These data can also serve as a foundation for future research exploring ecological influences, environmental toxicology, and emerging antimicrobial resistance in birds of prey.

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## Conflicts of interest and financial disclosures

The authors state that there are no conflicts of interest to disclose.

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