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Three-Year Perspective Study on American Kestrels (*Falco sparverius*) Received for Rehabilitation in a Facility in Southern Brazil

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Abstract

The American kestrel is a common bird of prey across Brazil and is abundant in many regions of the country. Kestrels are also found in urban areas, which predispose them to anthropogenic threats. Some threats that wild raptors face around the world include electrocution, barbed-wire lesions, shooting, collision with artificial structures, and vehicle-related accidents. Raptors are often brought to veterinary clinics with traumatic lesions arising from such threats. Infectious diseases are also a primary reason for raptors to be brought to veterinary facilities as well as nestlings and young those are found outside the nest or young. The aim of our study was to report the frequency and causes of injuries in American kestrels (*F. sparverius*) received at a rehabilitation facility in southern Brazil. We evaluated data collected from 2019 to 2021 for a total of 82 individuals, including 47 adults and 35 juveniles, which composed 57.3% and 35% of our dataset, respectively. We found that physical trauma was the main reason for admission (61% or 50/82 of all cases we examined). Traumatic injuries included bone fractures, traumatic brain injury, lacerations, and different kinds of lesions. Juveniles with no signs of trauma or diseases represented the second main cause of admission to the rehabilitation facility (28% or 23/82 individuals). Most individuals were admitted to the rehabilitation clinic in December (37.8%), followed by November (20.7%) and January (4.6%). We found that the outcomes of rehabilitation were generally positive.

Of the 82 individuals received, 44 (53%) were released back to the wild, 20 (24%) were euthanized for humane reasons and 19 (23%) died as a result of their injuries or illness. Future work on the frequency of anthropogenically-induced injuries and illnesses will help shed more light on rehabilitation strategies that lead to successful outcomes for raptor species.

Keywords: Anthropogenic Threats; American Kestrel; *Falco sparverius*; Raptor; Rehabilitation; Trauma

Introduction

The American kestrel is a common bird of prey in Brazil and is abundant in diverse habitats [1,2] including open areas and both semi-desert and desert areas [2,3]. Kestrels also frequent urban areas [4]. This species feeds mainly on invertebrates and occasionally on small vertebrates [5].

In the Southern hemisphere, kestrels breed during the Austral spring and summer (October to December) [6]. Their reproductive behavior occurs from June to October, with more intensity in September. Pairs nest in places such as tree hollows, high posts and artificial structures in buildings. Parents are often observed tending to their clutches in November, and chicks abandon the nest around 32 days after hatching [7]. As kestrels are widespread in Brazil and use human-modified habitats across the country for breeding and foraging, they are commonly exposed to anthropogenic threats that can cause debilitating injuries.

All around the world, wild raptors are brought to veterinary care facilities mainly because of traumatic lesions including electrocution, barbed-wire lesions, shooting, collisions with artificial structures, and accidents with vehicles. Infectious diseases are also a primary reason for raptors to be brought to veterinary facilities as well as nestlings and young that are found outside the nest [8-18].

Body of Paper

In this study, our aim was to assess the frequency and causes of admission of American kestrels (*F. sparverius*) to a rehabilitation facility in Rio Grande do Sul, Brazil. We evaluated data collected from 2019 to 2021 for a total of 82 individuals that were brought to the facility by citizens, environmental police authorities, and associated organizations. Birds were identified as adults or juveniles/young upon arrival, and the kind of lesion or injury they presented was also documented in most cases. The results by age group are shown in Table 1.

	2019	2020	2021	Total
Adults	16	21	10	47
Juvenile/young	7	7	21	35
Total	23	28	31	82

Table 1: Total number of adult and juvenile American kestrels (*F. sparverius*) received by year in the facility in southern Brazil.

The majority of the birds that arrived at the facility were adults (47/82 or 57.3%), followed by juveniles (35/82 or 42,7%). Anthropogenic actions resulting from urbanization negatively impact the ecosystem, where interactions with avifauna are frequent [19]. In some cases, like vehicle collisions, these occurrences pose a threat to both humans and wildlife, causing loss of individuals and risks of injuries. In a facility in Ohio, United States, vehicle collisions caused admission of birds, showing more prevalence in species such as *F. sparverius* and *Megascops asio* [20].

In our study, physical trauma was the main reason for admission to the facility (61% of all birds, or 50/82). Such trauma included bone fractures, traumatic brain injury, lacerations, and different kinds of lesions. In some cases, it wasn't possible to determine the cause of trauma, but in urban environments, window strikes and domestic animals predation should always be considered the major reasons for accidents involving birds (Figure 1). Glass collision casualties are considered one of major causes of death for these animals [21,22]. In the United States, cat predation is considered a consistent cause of admission in rehabilitation facilities, since they have more access to wild life as a result of urbanization. Our results are consistent with several studies confirming that physical trauma is a main cause of injuries in raptors more broadly.

Figure 1: Adult American kestrel presenting limb lameness caused by trauma.

In the same facility, a retrospective study about frequency of radiographic findings in birds of prey admitted in the years 2020 and 2021 showed that 14/32 free range individual submitted to x-rays where presenting some kind of fractures in thoracic or pelvic limbs [23]. Study in Berlin evaluated data from a facility center during eleven years, and demonstrated that 317/724 did present clinical signs of limb fractures or luxations [24].

Even though electrocution is a frequent cause of death among birds of prey, previous study showed a higher prevalence in owls and hawks rather than falcons [25]. Also, the majority of carcasses found dead by electrocution in Mongolia belonged to bigger species, as saker falcons, leading researchers to conclude small birds like common kestrels and little owls were able to escape from electrical discharges in poles they landed [26]. The kestrels evaluated in the facility of our study didn't present signs of this form of injury, such as burns and necrosis of wings and pelvic limbs [25].

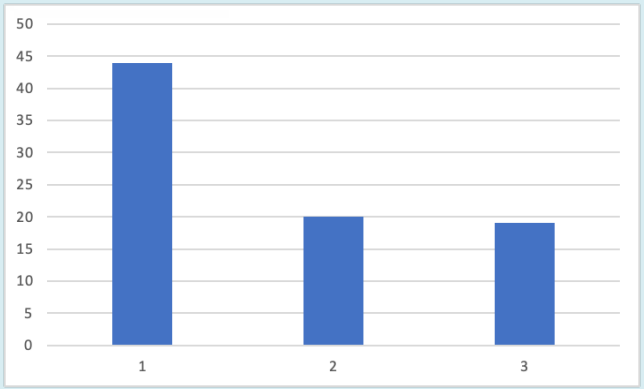
Birds highly adapted to urban areas are more prone to be found as orphan young, as shown in a retrospective study in Spain, where 32% of individuals of several species of birds of prey were included in this category. In that study, 591 from a total of 1295 *Falco tinnunculus* individuals were less than a year of age. *F. tinnunculus* is an european common kestrel [27], very similar to *F. sparverius* in size and habits. Those results are similar to ours, where juveniles with no signs of trauma or diseases represented the second main cause of admission in the facility, with 23/82 (28%) individuals (Figure 2). Most individuals arrived in December (31/37,8%), followed by November (17/20,7%) and January (12/4,6%). These months represent the final weeks of the Austral spring and beginning of the summer, indicating that the increased arrival of juvenile kestrels during these months is probably related to young individuals fledging.

Figure 2: Three juvenile/young orphaned American kestrels received in spring 2019 in a facility in South Brazil.

Birds with clinical signs of infectious diseases represented 11% (9/82) all individuals. *Trichomonas sp*. parasitic infections and *Candida sp*. fungal infections were common in our dataset. Both diseases can present white-yellowish lesions in the oral cavity causing dysphagia, difficulty swallowing, loss of weight or emaciation, and can lead to secondary bacterial/fungal infections and death, especially trichomoniasis [28-30] (Figure 3). In a study by Andery, et al. [11], *F. sparverius* was among the species received at a rehabilitation center in Belo Horizonte, Brazil, where Trichomonas sp. was prevalent in 9.1% of necropsied animals. Higher risk of pathognomonic lesions were observed in non-specific ornithophagous birds of prey as *F. tinnunculus*, and it's related to some genotypic strains, as shown in a previous study in Spain. The characteristic of diet in *F. sparverius* is very similar to *F.tinnunculus*, and results presented in our study shows are close of those observed in Martinez-Herrero, et al. where 9,4% of common kestrels had gross lesions of trichomoniasis.

Figure 3: Gross lesions in juvenile *F. sparverius* oral cavity caused by *Trichomonas* sp.

We also assessed rehabilitation outcomes in our dataset, and results are shown in figure 4. Of the 82 individuals received at the facility, 44 (53%) were able to be released back to the wild, 20 (24%) were euthanized for humane reasons and 19 (23%) died as a result of their injuries or condition. The percentage of birds released was lower than other studies in Spain, 57,7% [31] and in Jordan 55,8% [32] but higher that studies in South Africa, 48%, Canary Islands, 44,4%, Thailand, 40,5% [33], United States, 38% and in Czech Republic, 15,9% [34-36].



1 = Released individuals after admission 2 – Euthanized individuals 3 – Dead individuals.

Figure 4: Graphic distribution of destination after admission in the facility center in south Brazil during years 2019 to 2021.

Our study showed a sad reality for raptors in Brazil, especially kestrels. More studies are necessary to comprehend the anthropogenic influence on the *F. Sparverius* life and to better understand how we are handling these species in captivity relating to the rehabilitation success.

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