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Short

Impact of kite string injuries and temporal variation in types of injuries and illnesses of White-rumped Vultures of central Gujarat, India

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Abstract: Ahmadabad and its surrounding region (Gujarat, India) is an important breeding area for the Critically Endangered White-rumped Vulture *Gyps bengalensis,* currently with around 60 breeding pairs. The kite flying festival, celebrated on 14 and 15 January, poses a major threat to the vulture. Through rigorous awareness and rescue programs we encountered 108 White-rumped Vultures between January 2009 and August 2012. The vultures were injured due to kite flying (43.9%) and other causes, such as dehydration, visceral gout and illness (56.1%). Considering all encounters, survival rates were higher among vultures with kite string injuries (53.3%) when compared to other causes (36.7%). This was due to a higher proportion of dead-on-arrival encounters in other causes (45.0%) especially when compared to encounters with visceral gout and kite string injuries (2.2%). The survival rates of encounters of live rescued vultures are higher in other causes (66.7%) compared to kite string injuries (54.5%). This is mainly because the majority of live encounters (excluding kite string injuries) are dehydrated fledglings or juveniles which recover well upon administration of intravenous fluids. Encounters of live vultures with kite string injuries involve birds with severe blood loss, incurable infections and stress which result in decreased survival. Most casualties from kite string injuries are due to hypovolumic shock, septic shock and stress.

Keywords: *Gyps bengalensis*, kite festival, visceral gout, White-rumped Vulture.

India has nine species of old world vultures from five genera, of which, seven species (four genera) are resident and two species (two genera) are winter migrants. Populations of the three resident *Gyps* species—namely White-rumped Vulture *Gyps bengalensis*, Indian Vulture *G. indicus* and Slender-billed Vulture *G. tenuirostris* have declined by over 99% since the mid-1990s (Prakash et al. 2003; Green et al. 2004; Prakash et al. 2007) and continue to decline at an alarming rate (Prakash et al. 2007; Green et al. 2007). These vultures are at high risk of global extinction and are listed as Critically Endangered (IUCN 2004) and are categorized under Schedule I of the Indian Wildlife Protection Act of 1972 as amended in 2002. The prime cause for the decline of these three species is the use of the veterinary non-steroidal anti-inflammatory drug Diclofenac Sodium (Oaks et al. 2004; Shultz et al. 2004; Swarup et al. 2007). Despite the ban of this drug in the veterinary sector since 2006, the spillover of human diclofenac multidose formulations into the veterinary sector continues to be the major threat

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(Shah et al. 2011). Vultures play an important role in the ecosystem by scavenging on dead animals. The sharp decline of vultures in India has impacted livestock carcass disposal, sky burial of zoroastrians and increases in human-related diseases (Pain et al. 2003).

Gujarat still holds a sizable population of about 1000 individuals of *Gyps* vultures - primarily White-rumped Vultures (Pandey et al. 2010). The central Gujarat region surrounding Ahmadabad is a very important breeding area for White-rumped Vultures and this population has been monitored in Ahmadabad since 1999 and extended to various other White-rumped Vulture colonies surrounding Ahmadabad in recent years. An established network of local nature enthusiast keeps a regular watch on these colonies (Ahmadabad, Mahesana and Anand districts) which currently hold a population of around 200 White-rumped Vultures of which over 60 are nesting pairs (Authors pers. obs. 2011–2012).

The kite flying festival known as 'Uttarayan' is one of the most widely celebrated social festivals in Gujarat. It is celebrated on the 14 and 15 January and involves people from all religions and age groups. The enthusiasm for flying kites leads to the kite flying season being extended from late November to mid-February. The use of "manja", the abrasive strengthened threads made out of powdered glass, rice and glue paste with a color mix, turns the sport into a major threat to all flying animals and to human health. Traditionally, the threads were made of cotton, easily cut and degradable, but most recently, the use of nylon string—imported from China and which is more resistant and powerful—has gained preference. In Ahmadabad alone, 3000 birds, including vultures, are injured flying into kite strings every year (Authors pers. obs. 2011–2012).

Intensive rescue operations during the kite flying festival are carried out by the Jiv Daya Charitable Trust (JDCT) with the help of over 50 non-government organizations and 2000 volunteers. The JDCT is an animal welfare organization located in Ahmadabad with state-of-the-art medical facilities.

The established rescue network helps rescue vultures round the year, and not only during the kite festival. Rescue operations have been conducted since 2005 and have improved since 2007. A total of 108 White-rumped Vultures were encountered in Ahmadabad and the surrounding areas between January 2009 and August 2012 (Table 1). Here we analyze the patterns of injuries and illnesses and their relation to survival rates of rescued vultures.

Materials and Methods

We maintained a database of vultures encountered since 2009. All possible vulture case sheets and necropsy reports were collected from the archives of the JDCT. We were also personally involved in numerous vulture rescues, surgeries and necropsies as well as in monitoring the nesting colonies of White-rumped Vultures in Ahmadabad at Kadi (Mahesana District) and Daslana (Ahmadabad District). These personal observations were used to relate rescue patterns with vulture breeding and dispersal patterns. An encountered vulture was considered a survivor if we were able to either release it back to the wild or send it to a conservation breeding center.

Results and Discussion

Injuries caused by kite strings (KSI), dehydration and visceral gout have been the major causes of injuries and deaths among White-rumped Vultures in Ahmadabad and surrounding areas (Muralidharan & Dhanjayan 2010; Roy 2011). A total of 108 encounters with White-rumped Vultures have been monitored between 01 January 2009 and 08 August 2012 (Table 1).

The major reasons of vulture encounters were 43.9% due to KSI and 56.1% to other causes, i.e., dehydration, visceral gout and illness (Fig 1.; Images 1–6, 9–10). KSI occurred primarily in January, which corresponds with the time of the kite festival on 14–15 January. Most kite flying occurs from December to February and the general pattern for kite string injuries is shown in Fig. 2 (Images 7–8). The presence of wind is directly related to the amount of kite flying that occurs, hence the annual variation in monthly kite string injuries (Fig. 3). December 2011 shows more KSI compared to February 2012 which is not the case in 2009–2010 and 2010–2011 seasons where February had higher KSI compared to December. Kite string injuries occur very rarely in November due to infrequent kite flying. The KSI that vultures receive towards the end of February are caused

Table 1. White-rumped Vulture rescues (January 2009–August 2012)

Place	Number
Ahmadabad	89
Viramgam	4
Kadi	12
Khambhat	1
Mahuva	1
Surat	1
Total	108

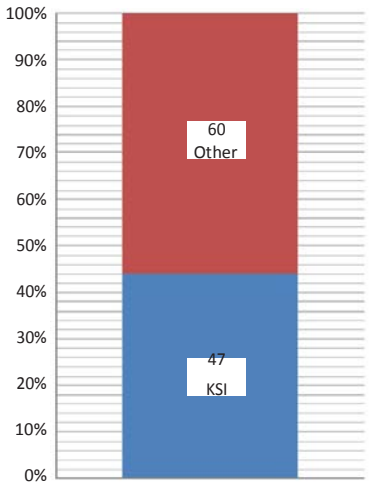

Figure 1. Reasons for encounter

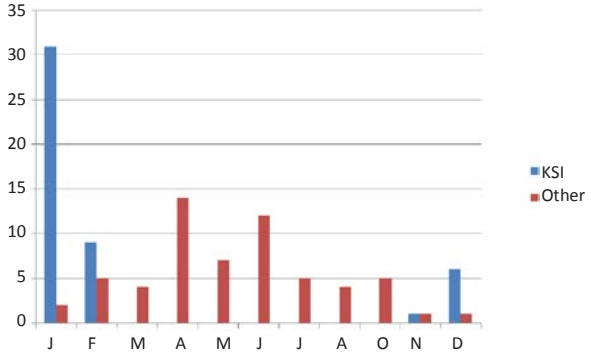

Figure 2. Monthly variation in vulture encounters

also due to strings entangled in trees and around nests.

Over 55% of the encounters were due to dehydration, visceral gout and other illnesses. Dehydration occurred mainly from March to May with the maximum in April (Fig. 4). The overall pattern for live, non-KSI encounters is Apr > May > Aug > Jun = Mar > Jul = Nov = Dec = Jan = Feb. Most encounters in summer were linked to temperature and affected mainly juveniles and sub adults. These vultures were treated usually with intravenous fluids and recovered well. As noted, encounters of live vultures decreased from May and numbers of dead vultures encountered increased simultaneously. The death rate among encountered vultures also increased from summer to monsoon season, which coincided with the breeding season of White-rumped Vultures. Usually nestlings leave the nest by the end of April and colonies start dispersing after the middle of May. During the monsoons, when vultures disperse after the breeding season, food and water are easily available due to high cattle mortality and temporary fresh water ponds, which reduce vulture dependence on traditional, well monitored "Panjrapol" feeding sites. Panjrapols are traditional cattle camps mainly operated by the Jain community as a deed of charity for animals, where large numbers of sick/unproductive cattle are kept. We also observed that vultures were feeding more at such dispersed sites rather than at monitored carcass dumps of panjrapols in the last 2–3 years (Authors pers.

Image 1. Dehydration

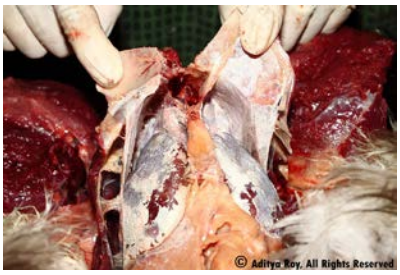

Image 2. Gout Uric acid on visceral organs

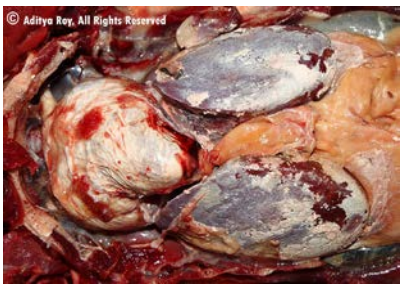

Image 3. Gout Uric acid on visceral organs

Image 4. Fungal infections

Image 5. Fungal infections

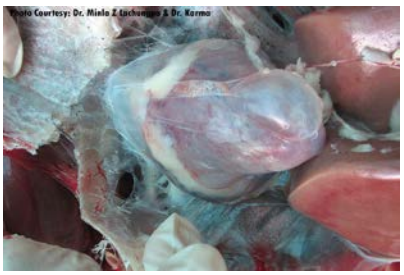

Image 6. Capture myopathi

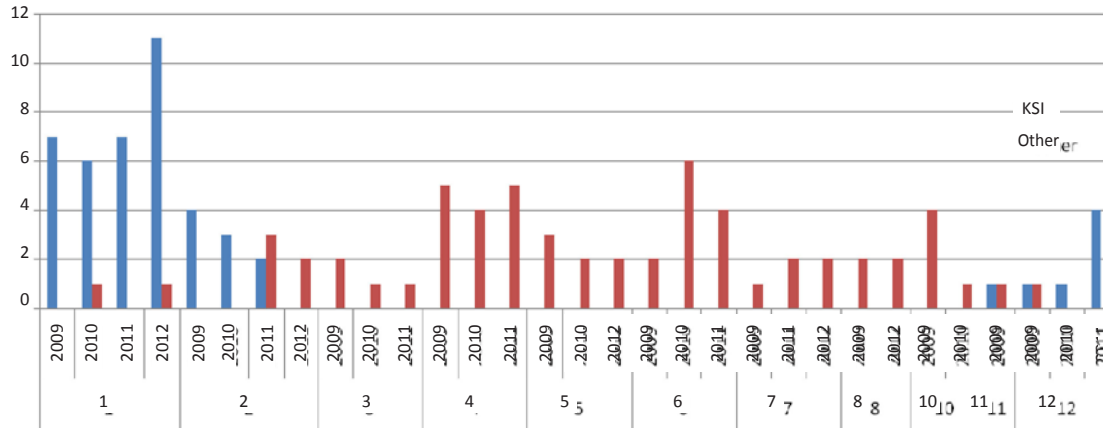

Figure 3. Year-wise monthly encounters

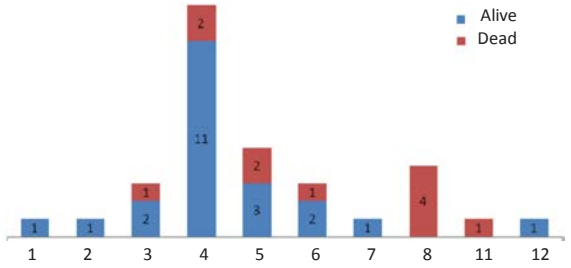

Figure 4. Dehydration, illness and visceral gout—live rescued by month

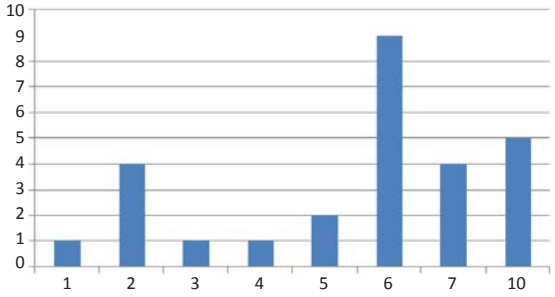

Figure 5. Dehydration, visceral gout and illness—dead encountered by month

obs.). This behavior makes vultures more susceptible to Diclofenac and Ketoprofen containing food, thus leading to more encounters with dead vultures during this period as well as more deaths due to untreatable visceral gout. The pattern is clearly visible in Fig. 5. In 2012, five White-rumped Vultures with severe visceral gout were rescued between February and August from Ahmadabad and the Kadi colonies. Two decomposed White-rumped Vulture carcasses were found at Daslana and Dumana in May. A total of 27 dead White-rumped Vultures were collected between January 2009 and August 2012 which did not show any signs of other injuries. Due to legal permission problems we were not able to perform necropsies of every individual but the pattern of having encounters with multiple vultures within a 1- or 2-day period with symptoms of severe dehydration and yellowish fluid oozing from the buccal cavity suggested a diagnosis of gout. These observations clearly support the spillover of human diclofenac formulations into the veterinary sector (Shah et al. 2011). The change in feeding site selection and the use of human diclofenac and ketoprofen are thus becoming serious issues of concern.

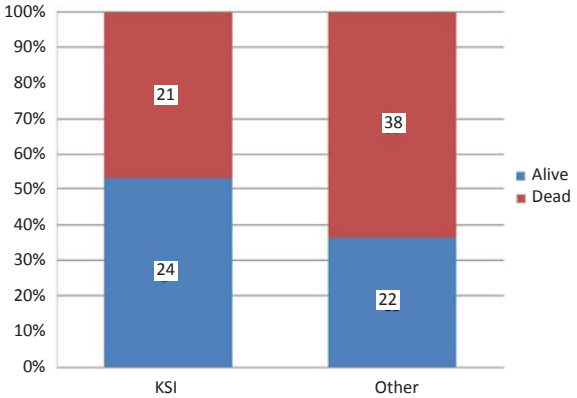

Figure 6. Survivorship of vultures comparing kite string injuries and other causes for encounters

Survival rates in relation to type of injury/illness

Considering all encounters, the survival rate is highest from KSI (53.33%) as compared to other causes (36.67%) (Fig. 6). This is due to a higher percentage of dead-on-arrival (DoA) encounters than to other causes (45%) especially when compared with visceral gout (2.22% DoA). If we look at the survival rates of live vultures, the situation shows a higher survival in

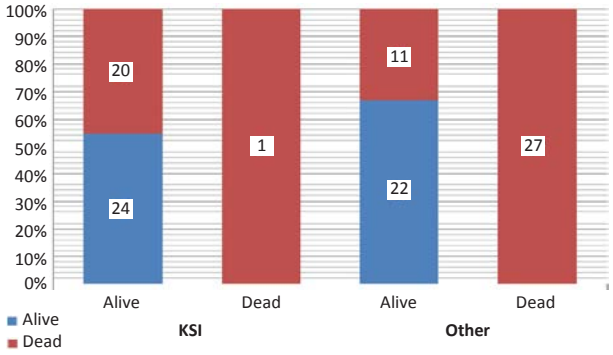

Figure 7. Impact of kite string injuries and other causes for encounters on survival

Image 8. Juvenile *Gyps bengalensis* died by hypovolemic shock caused by kite string injury in right wing patagium

other causes (66.67%) compared to KSI (54.55%; Fig. 7). This is mainly because the majority of live vultures (excluding KSI) are dehydrated fledglings or juveniles which recover well upon administration of intravenous fluids. Encounters of live vultures with KSI involve birds with severe blood loss, incurable infections and stress which lead to decreased survival. Most casualties from KSI were due to hypovolumic shock, septic shock and stress. With the use of a gaseous anesthesia machine, the latest antibiotics and more spacious aviaries and veterinary inputs from across the world we were able to improve the survival rates as compared to previous years. Here the prevention of death was the goal; not all surviving vultures are able to fly. KSI mainly affected the wing, neck and breast regions. In many cases the wings were amputated and these vultures became permanently grounded. During the kite festival of 2012 (from December 2011 to February 2012) six KSI White-rumped Vultures survived of which three had one wing each amputated. Since 2005, 39 grounded vultures have been sent to Junagadh and 27 to Pinjore vulture breeding centers. The vultures have successfully bred and makes this the biggest achievement of the rescue operation. We have also deployed leg bands and released nine White-rumped Vultures between January 2009 and April 2012.

Image 9. Leg fracture is not caused by kite string

Image 10. Leg infection from *E. coli*

Image 7. Kite string injury in patagium area causing damage to muscle, tendons and bone

We were able to collect most of the injured or dead White-rumped Vultures from Ahmadabad and Kadi colonies but we still need to expand our coverage to the Viramgam and Khambhat colonies. We have noted that dead vultures go unnoticed at these colonies and that the cause of death of any of these decomposed bodies that may be examined is impossible to determine. KSI and visceral gout remains the major causes of White-rumped Vulture mortality.

Suggestions

In order to minimize vulture mortalities by KSI the following steps must be implemented by stakeholders and the public:

- A legal ban on imported nylon strings
- Restriction on flying kites before and after the festival
- Law permitting kite flying only in open grounds and collectively.
- Ban on using fire crackers at night during the kite festival.
- Clean-up drives after the festival to remove entangled strings from trees/poles, etc.

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