

The use of diclofenac on livestock and its affect on the population size of Asia's *Gyps* vultures.



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The *Gyps* vultures are a genus of the Old world vultures belonging to the family Accipitridae. There are several species belonging to the genus *Gyps*:

Asian: Indian White-rumped Vulture (*Gyps bengalensis*), Indian Vulture (*Gyps indicus*), Slender-billed Vulture (*Gyps tenuirostris*), Himalayan Griffon Vulture (*Gyps himalayensis*).

African: Rüppell's Vulture (*Gyps rueppellii*), White-backed Vulture (*Gyps africanus*), Cape Griffon (*Gyps coprotheres*).

Eurasian: Griffon Vulture (*Gyps fulvus*).

The size of the *Gyps* vulture varies. The smallest is the Indian White-rumped Vulture (*Gyps bengalensis*) which weighs up to 8 kg, measures 89-93 cm in length and has a wingspan of 260 cm. The largest is the Himalayan Griffon Vulture (*Gyps himalayensis*) which can weigh up to 12 kg, measure up to 110 cm and have a wingspan of 260-289 cm.

Vultures are large scavenging birds and feed mostly from carcasses of dead animals which they find by soaring high and looking for other scavengers. Vultures of the Old world solemnly use their eye-sight to find food.

Typical features are broad wings, short tail and dark plumage and most characteristic is the bald head which lacks feathers. The baldness is due to their eating habits and prevents the head from getting dirty with blood and other body fluid from the cadaver.

Introduction

Since the end of the 20th century/beginning of the 21st century there has been a drastic decline in the population size of the Asian vultures. More than 95% of the birds have died and the most probable cause is the use of diclofenac (a veterinary non-steroidal anti-inflammatory (NSAID) drug) for the treatment of domestic livestock. In Asia diclofenac is a commonly used veterinary drug. It is used for treatment and management of inflammation, fever as well as pain in case of disease or injury in domestic livestock. Vultures are exposed to the drug when scavenging carcasses of livestock that were treated with diclofenac. The International Union for the Conservation of Nature has listed the *Gyps bengalensis*, *Gyps indicus* and *Gyps tenuirostris* as critically endangered.

Method

In 2000-2004 a study¹, carried out by Susanne Shultz et al. was made on dead and dying vultures, *Gyps bengalensis* and *Gyps indicus*. Twenty eight birds were collected, fifteen *Gyps bengalensis* and thirteen *Gyps indicus*. Eight of the collected birds were still alive when collected but four of them died within one day of the collection and the remaining four, died within three days. The study was also carried out by using captive *Gyps bengalensis*, which then were deliberately fed with contaminated tissues. This made it possible to study the effects the whole way, meaning from ingestion to death.

The birds being studied in general showed a high mortality rate, visceral gout and deposits of uric acid on and within internal organs. In the kidneys of those birds with visceral gout residues of diclofenac was found, and those individuals without visceral gout no diclofenac could be detected.

The use of diclofenac is widely spread and could in the future present a threat to other *Gyps* vulture populations than the ones in Asia. A study, by Gerry E. Swan et al.², was carried out to test the toxicity of diclofenac to *Gyps fulvus* and *Gyps africanus*. Neither of these species is endangered or extinct today.

¹ Diclofenac poisoning is widespread in declining vulture populations across the Indian subcontinent, by Susanne Shultz et. al.

² Toxicity of diclofenac to *Gyps* vultures, by Gerry E. Swan et. al.

Vultures were given diclofenac orally or fed with carcasses that were treated with diclofenac just prior to death.

During the experiment the estimation of the median lethal dose of diclofenac was carried out. During the estimation of the median lethal dose the probability of death was modeled in relation to the logarithm of the diclofenac dose (mg kg^{-1} vulture body weight).

In order to be able to continue the treatment of sick livestock and keeping vultures alive an alternative to diclofenac must be found. Preliminary tests under the lead of toxicologist Gerry Swan³ showed that meloxicam, which also is an NSAID, could be an alternative to diclofenac. In this study⁴ 35 individuals of Gyps vultures were fed with meloxicam treated cattle tissue or got it administered orally at a dose of 0.2–0.5 mg kg^{-1} . The Asian vultures were not used in this study because of their status as critically endangered.

The loss of tens of millions of vultures has become a threat against human health⁵. The number of feral dogs as well as rats has increased at the carcass dumps in and near settlements. Vultures also probably play a role in controlling livestock diseases such as tuberculosis and anthrax by disposing the infected carcasses.

Result

In the study carried out by Susanne Shultz et al.⁶ visceral gout was found in 72% of the birds examined at postmortem. The percentage rate was about the same in both species examined, *Gyps bengalensis* and *Gyps indicus*.

The birds examined in this study which had gout all had a detectable amount of diclofenac. In the few birds which did not show signs of gout, diclofenac was not detected.

The birds that were fed with contaminated tissues showed dose dependent mortality and examinations done postmortem showed widespread visceral gout.

In the study by Gerry E. Swan et. al.⁷, performed to test the toxicity of diclofenac to other vulture species than the Asian ones showed that diclofenac is generally highly toxic. Examinations of the birds after being exposed to diclofenac showed visceral gout, lesions in the kidney, liver and spleen with uric acid deposits. Diclofenac is highly toxic to *Gyps fulvus* and *Gyps africanus* at 0.8 mg kg^{-1} . The species are likely to be at least as sensitive to the drug as the Asian vultures which have an estimated median lethal dose of 0.098 or 0.225 mg kg^{-1} . The testing suggests that diclofenac probably is toxic to all eight *Gyps* vulture species.

The testing of meloxicam⁸ as an alternative to diclofenac seems to be successful. In the 35 tested birds there were no apparent ill effects. None of the birds showed signs of being negatively affected. The usage of several other NSAIDs was associated with renal failure.

The increase in number of feral dogs and rats is a problem for the humans living in their vicinity⁹. The feral dogs no longer have to compete with the vultures for the carcasses and can increase in number. This leads to an increased risk of human rabies since feral dogs are

³ Switching Drugs for Livestock May Help Save Critically Endangered Asian Vultures, by Liza Gross

⁴ Removing the Threat of Diclofenac to Critically Endangered Asian Vultures, by Gerry Swan et al.

⁵ Counting the cost of vulture decline—An appraisal of the human health and other benefits of vultures in India, by Anil Markandya et. al.

⁶ Diclofenac poisoning is widespread in declining vulture populations across the Indian subcontinent, by Susanne Shultz et. al.

⁷ Toxicity of diclofenac to Gyps vultures, by Gerry E. Swan et. al.

⁸ Removing the Threat of Diclofenac to Critically Endangered Asian Vultures, by Gerry Swan et al.

⁹ Counting the cost of vulture decline—An appraisal of the human health and other benefits of vultures in India, by Anil Markandya et. al.

carriers. The increasing population size of rats will lead to the same kind of problems, the increasing risk for disease transmission to humans.

Discussion

The balance in any ecosystem is fragile, the vultures' role is not an exception. The great loss of vultures over the last decade has led to threats not only to the wildlife balance in Asia but also to a growing threat against humans and their health.

Since the vultures of the Old world use their eyesight to find food, by soaring high and looking for other scavengers the decrease in number will automatically lead to a further decrease since the still living birds have problems to find carcasses by themselves.

Vultures play a role in cleaning the environment from infectious diseases. The decline in vultures leads to an increase in spreading of pathogenic agents, to humans, livestock as well as wildlife. The decline also leads to the fact that there simply are a smaller number of scavengers taking care of the carcasses, the number of rotting carcasses is increased as well as the environmental pollution of soil, water and air.

I think the most urgent issue is to find a suitable replacement to diclofenac. As it seems meloxicam may be suitable for this. It's important to find a replacement so the Asian vultures have a chance of recovering but also to eliminate the chances of the same thing happening to *Gyps* vultures of other continents, this since all *Gyps* vultures seem to be sensitive to diclofenac.

Since the testing of meloxicam is only in the beginning stage it's important to continue the studies and also test the toxicity of other NSAIDs. *G. africanus* is phylogenetically close to *G. bengalensis* and is not considered to be threatened. *G. africanus* would be a suitable surrogate for the safety testing of alternative drugs to diclofenac. It is also important that the testing and development of meloxicam proceeds but that the cost of the drug is held low. This due to the fact that the livestock in need to be treated and the vultures scavenging on them live in poor areas of the world. The farmers will not use meloxicam instead of diclofenac if they cannot afford it.

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