

Detection of NSAIDs in livestock animals and scavenging birds of prey with emphasis on vultures and condors

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Background

Three species of Old World Vultures (*Gyps bengalensis*, *G. indicus* and *G. tenuirostris*) currently face extinction on the Indian subcontinent. Exposure to the non-steroidal anti-inflammatory drug (NSAID) diclofenac, via the consumption of livestock carcasses containing residues of the drug, has been conclusively implicated in this mass mortality (Oaks *et al.* 2004, Shultz *et al.* 2004). NSAIDs are administered to livestock animal to relieve or minimise pain, fever and inflammation.

While the use of diclofenac is now being phased out on the Indian subcontinent, the drug has recently been registered for veterinary use in Chile, where a large proportion of the 'Near Threatened' Andean Condor *Vultur gryphus* population is found. The use of veterinary drugs is likely to be more tightly regulated in Chile than in India, given the former's status as a major exporter of meat to first world countries. However, condors, like vultures, gather in groups to feed, and the availability of even a few contaminated carcasses could have important repercussions to the local population (N.

Hocking, pers. comm. 2006).

The NSAIDs registered for veterinary use in other countries may pose similar, but as yet undocumented, risks (Anderson *et al.* 2005). Feeding stations, stocked primarily with livestock carcasses, are established as part of reintroduction or conservation efforts, and may attract a number of resident and migrating vulture species. Measures to prevent the provision of NSAID-contaminated carcasses at these stations vary widely. At certain locations (e.g. Israel) carcasses of animals known to have been administered NSAIDs just prior to death are now deliberately excluded (O. Bahat, pers. comm. 2005), however in most countries the animal's veterinary history is unknown.

Additionally, there are few standards in place for evaluating the potential NSAID content of carcass meat provided to long-term and releasable birds at rehabilitation/captive facilities. Given the mandate of these facilities to offer the best possible care, and the role that captive-bred birds will play in the reintroduction of *Gyps* and other threatened or endangered species, it

is important to ensure that the long-term health of individuals is not compromised.

Proposed study

Very little is known about the pharmacokinetics and pharmacodynamics of NSAIDs in avian species; however, it has been established that different species exhibit markedly different responses and that exposure must specifically be examined on a species by species basis (Baert & De Backer 2003).

We propose to develop analytical methods to investigate NSAIDs and their metabolites in the hair of livestock animals and in the feathers and talons of scavenging birds of prey. At present, our focus will be on vulture species, since they seem to be most susceptible to NSAID exposure. However, it would be interesting to determine whether or not the Andean Condor is similarly affected given that New World Vultures are ecologically convergent with Old World Vultures, but of completely different evolutionary origins (Sibley & Monroe 1990).

Our research will provide baseline information with which to evaluate the level of tolerance that scavenging species may exhibit to these drugs. This methodology could also serve as an alternative diagnostic tool when avian carcasses are too decomposed for tissue analysis. Finally, the detection method may be used to evaluate the safety of carcass meat put out as part of reintroduction or conservation efforts, or offered as food in rehabilitation facilities.

Our objectives are to:

- 1) Generate a database of NSAIDs registered for use throughout the range of Old World Vultures and the Andean Condor;
- 2) Develop a comprehensive screening procedure by adapting known detection methods for human hair and nails;
- 3) Apply the detection methodology and reference the database to trace and cross-match exposure in livestock and avian specimens;
- 4) Document the availability of NSAID-contaminated carcasses in relation to observed mortality incidents;
- 5) Document incidences of non-fatal exposure to identify those NSAIDs that are tolerated;
- 6) Develop an international field and laboratory sampling protocol that can be adapted by country, by NSAID and by species of concern.

Analytical Methods

Exposure to NSAIDs is currently assessed via tissue analysis. However, evaluating the role that a given drug may have played in a mass mortality event can be hampered by the difficulty in finding carcasses before they become too decomposed for analysis.

Studies have shown that human hair and nails provide an ideal matrix for the determination of previous drug ingestion (Henderson 1993, Engelhart & Jenkins 2002, Lin *et al.* 2004). This is because drugs circulating in the bloodstream become locked into these structures as they grow.

We hypothesise that the same principles of incorporation and detection of NSAIDs apply to the hair of livestock animals, to feathers and to talons. Analytical methods will be adapted from (Engelhart & Jenkins 2002, Lin *et al.* 2004, Fry 2004, Rothe *et al.* 1997). Method development is first being carried out using hair and nails from human subjects with a known history of NSAID (diclofenac) use. The method will then be applied to animal specimens received to determine the presence or absence of NSAID(s).

Your collaboration is vital to the success of our research...

To verify that the laboratory methodology we develop is effective, we require feather and hair samples from animals *known to have been exposed* to NSAIDs.

If you are a researcher engaged in a

dosage study of birds or mammals, or are involved in the care/display/rehabilitation of birds of prey, we would greatly appreciate receiving samples for analysis.

We would also request hide (with hair) from livestock animals provided as part of conservation or reintroduction efforts and would be interested in obtaining samples of kidney and liver from the carcasses for comparative analysis as well.

Should you wish to collaborate in any aspect of this research, including in the creation of the NSAID database, or if you would simply like more information, please contact N. Richards. If you would be interested in receiving a copy of the NSAID database, of any resultant protocols or of final reports, we should be pleased to notify you once these are completed.

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