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Impact of diclofenac on vultures

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ABSTRACT

Objective: The world is home to 23 different species of vultures. The vulture is one of nature's most adept scavengers. Since the mid-1990s, there has been a drop in the number of vultures in South East Asia. This decline has been attributed mainly to a decline of over 90% in the Indian Gyps species, which includes the Indian white-backed vulture, Gyps bengalensis, Indian vulture, Gyps indicus, and the Slender-billed vulture, Gyps tenuirostris. Based on experimental research, diclofenac, a nonsteroidal anti-inflammatory medicine, is the cause of renal failure that results in vulture death. Since 1974, diclofenac has been used to treat a variety of issues in cattle, including swelling, mastitis, lameness, and pain during calving. Several other ailments, such as actinic keratosis, rheumatoid arthritis, osteoarthritis, dysmenorrhea, and ocular inflammation, were also treated with the drug. It has helped cattle, but among other things, it has had a disastrous impact on the vulture population. It has helped cattle, but among other things, it has had a disastrous impact on the vulture population. The pharmacological makeup, uses, and method of action of diclofenac are discussed in this article, along with its harmful impact on vulture populations. It also discusses preventive measures to stop the vulture species' decline and return their populations to normal, as well as safer alternatives like meloxicam.

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INTRODUCTION

Long-lived vultures have bald heads, hooked beaks, and large bodies. Exceptional heads, necks, and vision. They must go foraging for themselves. And rarely, if at all, consume carrion in place of preying on living things. Both old-world (accipitrid) and new-world vultures belong to the vulture family. (2) cathartid vultures. Global vultures such as the Turkey vultures (Cathartes aura) inhabit the Americas, whereas old world vultures are found in Europe, Asia, and Africa. As soon as they truly to preserve some habitats, vultures are essential. To quickly locate, recognise, and consume carcasses in robust settings because their stomach contents are extremely acidic, they aid in reducing and preventing the spread of infections (2). A raccoon helps control vertebrate scavenger population and composition; their decrease could result in facultative Jackals and hyenas, causing extended carcasses. The cyclooxygenases are a class of enzymes that aid in prostaglandin synthesis. The drug adversely affects the kidneys, according to Swan et al. (2) Drug-induced damage to renal tubular epithelial cells is significant, and reactive decreasing the amount of uric acid and oxygen species exchanged p-amino-hippuric acidNg and, thereby damaging the channels that carry it. NADPH synthesis was found to be decreasing on the rat kidneys' potential for their mitochondrial membrane following keeping Diclofenac near at hand. Environmental endurance, which raises the risk of illness One correlation with vultures has been a decrease in the spread of diseases such as anthrax, distemper, bovine tuberculosis, and reducing the amount of time diseased bodies spend with other scavengers that have intimate relationships with humans, animals, and more fauna. (2) The three vulture species, Mirbahar and colleagues (2016) Oriental plants are indigenous to the region of South Asia. Gyps bengalensis, the long-billed and white-rumped vultures Greece's indicus vulture and the slender-billed vulture is innestris. The populations of all three species have rapidly decreased. Is classified as being in grave danger in several concerning reviews of the literature (Oaks et al., 2004; Anderson et al., 2004), Cuthbert et al. (2,3). According to a different study, all three species experienced a decline at 98% of the subcontinental Indian rate since the early identified as a severely endangered species by the Association for Environmental and Natural Resource Conservation Das & Associates is the source (2010). Asian with a white rear end the vulture G. Bengalensis was one of the most significant reptors found on the Indian subcontinent. Still, a sudden decline of over 95% India's Keoladeo National Park has been home to G. Bengalensis since 1990 (2). The longbilled vulture, or G. Indicus, is a critically endangered species in South Asia. Compared to Pakistan, India has seen a catastrophic decline in this species (Prakash). According to Stotrabhashyam et al. (2015), the long-billed vulture is now considered a threatened species due to its sharp decline in population. There are extremely few established patient breeding sites in the Indian peninsula. It is taken orally, intramuscularly, and rectally. When administered orally, the medication binds to plasma albumin effectively and begins to act rapidly. What distinguishes

these NSIADs is their capacity to inhibit COX-1 and COX-2, the two cyclooxygenase enzymes. Although blood flow to the kidneys is regulated by COX-1 enzymes, COX-2 enzymes are well known to regulate the inflammatory and pain responses (Fig. 3).

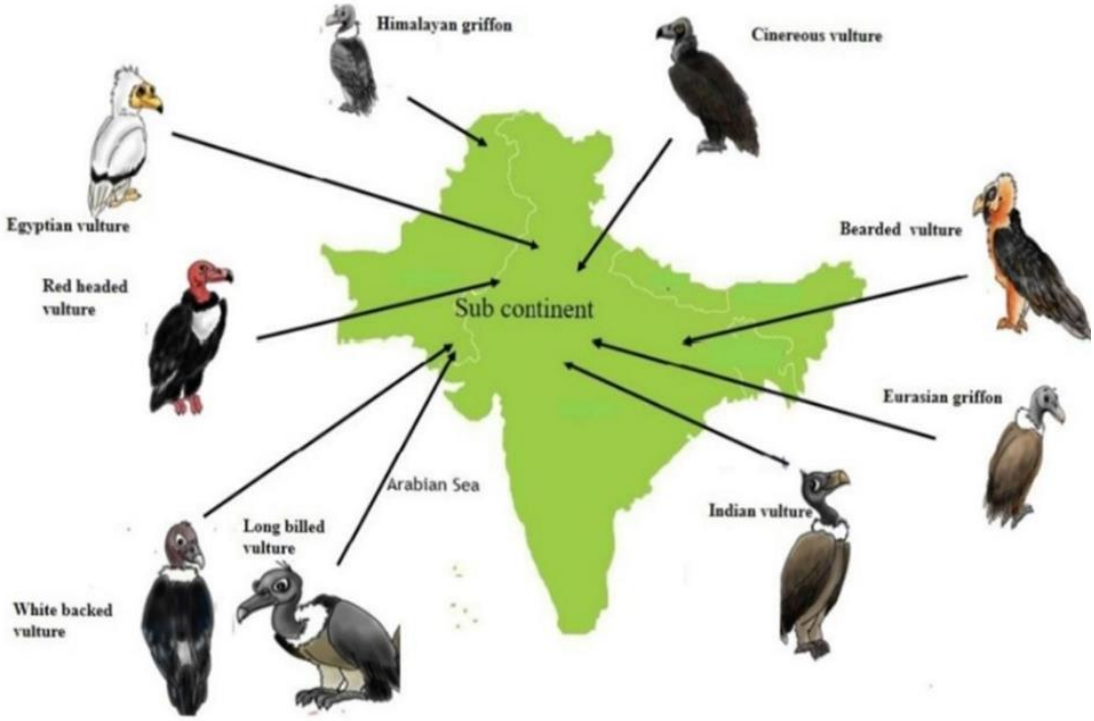

Fig.1.1 Vultures variety

LINK BETWEEN DICLOFENAC USE IN LIVESTOCK AND VULTURE TOXICITY

The drug is ingested by vultures when they eat the carcasses of animals that received diclofenac treatment just before death. Victims of diclofenac-contaminated tissues, and vultures die within days of experiencing renal failure; postmortem examinations reveal widespread visceral gout (2). Comparable observations have been made with wild G. Indicus and Bengalensis carcasses found all over the Indian subcontinent (2). Currently, diclofenac has been recognised as a possible hazard to three species of vultures in the Indian subcontinent. However, five other Gyps vultures found in Asia, Europe, and Africa may also be at risk from diclofenac and other

NSAIDs. Gyps africanus and Gyps fulvus were thus subjected to toxicological testing.

ANTIBIOTIC USED

Diclofenac sodium (CAS No. 15307-79-6) or sodium 2-[(2,6-dichlorophenyl) amino]phenylacetate are examples of phenylacetic acid derivatives, or more specifically, the class of non-steroidal anti-inflammatory drugs (NSAIDs). A daily intramuscular dose of 2.5 mg/kg body weight of diclofenac sodium is advised for the treatment of inflammatory diseases in cattle and pigs. Treatment should last between one and three days. Diclofenac sodium has been used for a long time in human medicine to treat the symptoms of osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, and primary nocturnal enuresis. Applications for acute musculoskeletal injuries and dysmenorrhea may also benefit from its short-term use. Depending on the ailment being treated and the mode of administration (oral, rectal, intramuscular, intravenous, or topical), the daily dosage can range from 50 to 150 mg per person. (2). Diclofenac sodium inhibits cyclo-oxygenase activity, which reduces the synthesis of prostaglandin from arachidonic acid. These pharmacodynamic effects are comparable to those of other non-steroidal anti-inflammatory drugs. It has anti-inflammatory, antipyretic, and analgesic properties. It also inhibits platelet aggregation and has deleterious effects on the mucosae of the stomach and intestine. When given orally to rats, the pharmacological NOEL for antiphlogistic effects was 0.1 mg/kg bw (paw oedema) following a single dosage. The adjuvant arthritis model's dose of 0.1 mg/kg bw/day was an LOEL following repeated administration, and its effective dose (ED50) was 0.26 mg/kg bw/day. When diclofenac sodium was administered orally as a single dose to rats, the pharmacological NOEL for its antipyretic effect was 0.1 mg/kg bw. I.e. When diclofenac sodium was administered orally as a single dose to rats, the pharmacological NOEL for its antipyretic effect was 0.1 mg/kg bw. The bleeding time was unaffected by giving rats the maximum dose—0.1 mg/kg bw—orally. The protective dose (PD50) of diclofenac when given intraperitoneally prevented rabbits from dying when arachidonic acid was administered intravenously. A single 0.1 mg/kg bw dose in foetal rats was shown to cause low oral effective dose of 0.4 mg/kg bw every six hours (or 1.2 mg/kg bw/day) is recommended for the treatment of human pain. The two main metabolites, 4'-hydroxydiclofenac and 3'-hydroxydiclofenac, exhibit acute toxicity that is comparable to that of the parent compound. i..e. However, they only show 1/15 to 1/200 of the activity of diclofenac in various pharmacological animal models, and they only inhibit prostaglandin synthesis at elevated concentrations (IC 50 in vitro being 5 to 8 times higher). In contrast, there is hardly any difference made by the remaining 4 metabolites. From these studies, a pharmacological LOEL of 0.1 mg/kg bw. 3 can be determined. It is demonstrated that oral dosages of a solution containing radiolabelled diclofenac are rapidly and completely absorbed by the rat.

MECHANISM OF TOXICITY

The populations of three vulture species—Geocerus cinerostris, Geocerus benthensis, and Geocerus indicus—are in decline. An important matter the populations of the vultures Geocerus tenuirostris, Geocerus Bengalensis, and Geocerus Indicus have drastically decreased. An important matter. the vulture descended quickly. As a result of these birds' exposure, a population was discovered. According to diclofenac vultures were found to be highly toxic to this medication. Death rates and population numbers appeared one after the other. (2,3) Diclofenac was found in one study to be supplied in a lab setting to vultures, which produced problems resembling visceral gout and renal failure. There were noticeable shifts in the vulture population. Through the nineties. furthermore, a striking 95% decrease was also within ten years, for all three species (2). This could be what happens after disease outbreaks and careless handling of deceased people. After the Research supported the literature's inclusion of diclofenac. These vultures and others have biomagnifications. Nourished on the carcasses of animals that were given these Before dying, medications (3). It was discovered that cow carcasses contained diclofenac, an Origin of the contaminant. By Saini and colleagues (2006), 1251 were gathered. Liver samples taken from the corpses of livestock and examined by Elisa is an enzyme-linked immunosorbent test that is liquid as well as Chromatography Ionisation through Electrospray The presence of diclofenac was ascertained by spectrometry (LC-ESI/MS). The postmortem examination of these vultures revealed remnants of Glucose-induced renal failure (2). Diclofenac was used all over the world, but its side effects were Discovered using vulture populations in experiments in various parts of the globe. For every kilogram of body weight, 0.8 milligrammes were discovered to be especially deadly to people from Europe (G. Fulvus), and an African species of vulture (G. Africanus) (1). In figuring out the toxicological Diclofenac's effects on vultures, particularly Cape Griffons. The Coprotheres, a significant South African 0.8 mg/kg body weight for Taxa was found in the study. The dosage of diclofenac was clinically fatal by all accounts. Features, symptoms, and gross pathology of histopathology outcome. It has been demonstrated that diclofenac is highly toxic to all. verified as dangerous to every Gyps species for example, G. Fulvus, G. Coprotheres, G. Africanus, and G. Bangladeshensis (2). Samples of blood plasma and tissue collected between 2005 and 2007 were derived from several species of vultures, including oriental. The Egyptian vulture, G. Bengalensis, and the rumped vulture, Neophron percnopterus, two griffon vultures. Fulvus revealed that 89% of the plasma specimens had remaining Diclofenac.The top tiers were determined both the kidneys and the liver. Still, the level of concentration of having said that, since 2006 proposals have been made to encourage conservation and completely prohibit the use of diclofenac in livestock. Breeding centres are also working to halt the extinction. As of right now, there are less alternatives to toxicity medications like meloxicam, which must be put to use right away, the drug's toxic limits (0.8 mg/kg body) were not.

Throughout the whole Literature and various vulture analysis metrics size, breeding success, and population trends have all been observed. The mortality rate and gender distribution of the deceased newly hatched babies discovered that diclofenac directly impacted the difference in mortality and the sex ratio (2). The population of G. Bengalensis in Toawala.Research on the decline has rarely been done. The evolution of Pakistani vultures that arise within 1-2 years was reported by Chaudhary et al. (2012). In Pakistan, diclofenac is widely used, and India is the primary reason for the vulture species' extinction. Gilbert & colleagues (2007). Having said that, since 2006 Proposals have been made to encourage conservation and completely prohibit the use of diclofenac in livestock. (1)

CONTROLLING MEASURES TO STOP DECLINE OF VULTURE SPECIES:

Diclofenac is widely used, and India is the primary reason for the vulture species' extinction. (2) Proposals have been made to encourage conservation and completely prohibit the use of diclofenac in livestock. Breeding centres are also working to halt the extinction. From the vulture species previously stated (2,3). As of right now, there are fewer alternatives to toxicity medications like meloxicam, which must be put to use right away. The way that actions: In Pakistan, diclofenac is commonly used, and India is the primary reason for the vulture species' extinction. (2) Proposals have been made to encourage conservation and completely prohibit the use of diclofenac in livestock. Breeding centres are also working to halt the extinction. From the vulture species previously stated (2,3). Additionally, though, it needs regular data gathering and observation for anything to change, kindly update the status of these species. If something isn't functioning properly, make a plan. Taking into account Safford et al. (2019), mentioned that environmentalists are basically hired because of the Growth and stability in Europe's vulture populations But there are still dangers brought on by people.

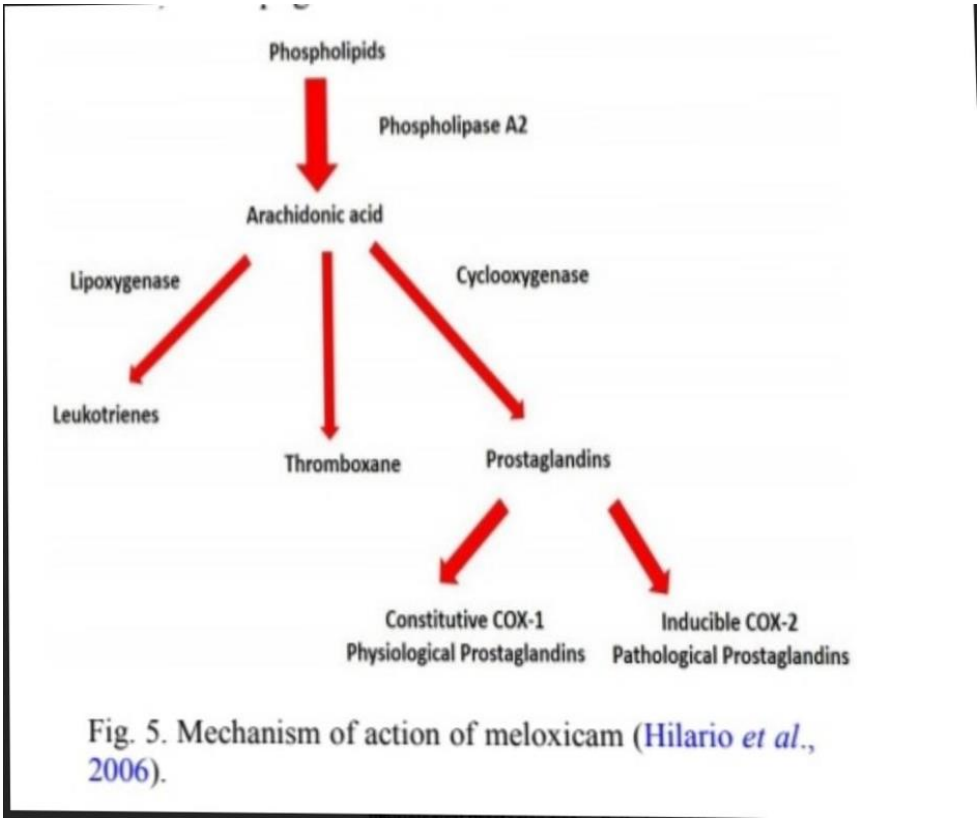

Fig. 5. Mechanism of action of meloxicam (Hilario *et al.*, 2006).

CONCLUSION

Scavenger birds like vultures are very ecologically special species. They are very aware of the natural world. Vision, a peculiar stomach with an extremely low pH, and These qualities are appropriate for their positions since they can remove and discard cow carcasses Terrible infections in human beings. It was determined that diclofenac posed a serious risk to vulture populations and seriously harmed them. It's necessary to use less dangerous alternatives to treat diseases in livestock medications like meloxicam. It is clear from this article that veterinary medications may have an impact on vulture development, which in turn may have an impact on the population and preservation of this extremely endangered species. It also draws attention to the serious gaps in our understanding of this subject and the urgent need for more study to completely comprehend the dangers and effects of veterinary drugs on vulture reproduction. To do this, programmes that track the chemical composition of infertile eggs must be put in place. The same concentrations and possibly different combinations of veterinary pharmaceuticals can be used in in-ovo studies in fertile chicken eggs after the quantification of drug residues in vulture eggs to determine whether the drugs can cause embryotoxicity or teratogenicity.

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