Short Communication
The Journal of Animal & Plant Sciences, 23(6): 2013, Page: 1758-1760
ISSN: 1018-7081

FOOD LIMITATION AS A POTENTIALLY EMERGING CONTRIBUTOR TO THE ASIAN VULTURE CRISIS

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ABSTRACT

It was believed that the reason for decline in Asian vulture population is the drug, Diclofenac sodium (DFS), used in livestock. Even after declaring the DFS use banned by the government, apparent decrease in the population of vultures was reported. Alternate hypothesis was suggested that food limitation may be a cause of Asian vulture crisis in Pakistan. Very recent shifts in livestock utilization observed in Pakistan may present a significant barrier to vulture recovery. Increased livestock utilization is translated to fewer carcasses. Since 2005, no livestock carcasses were found in 1650 km transect in the habitat of vultures. Carcasses recorded 13 in 1999 gradually declined to almost zero in 2005 and onwards, which suggests DFS may not be the only cause of Asian Vulture Crisis.

Key words: Diclofenac Sodium (DFS), Asian Vulture, Food Limitation.

INTRODUCTION

In conservation biology, the declining population paradigm; focuses on identifying the cause or causes of a population decline, and remove the cause to reverse the decline (Caughley, 1994). When population decline of a species has a single cause, recovery efforts might seem as straightforward as removing the threat. However, should the population become too small, additional threats emerge (Brook *et al.* 2008). The environmental, demographic, and genetic stochasticity inherent in small populations can interact with other environmental changes to create a self-reinforcing feedback loop that hinders population recovery. In such cases, conservation efforts that focus on eliminating the original cause of population decline may fail to lead to population recovery.

Seven vulture species were once common throughout Pakistan, frequently seen in flocks consuming animal carcasses (Roberts, 1992). Three of these species, Bearded Vulture (*Gypaetus barbatus*), Eurasian Griffon (*Gyps fulvus*), and Himalayan Griffon (*G. himalayensis*), are classified as Least Concern by the World Conservation Union (IUCN 2013). The population of remaining four species, Egyptian Vulture (*Neophron percnopterus*), Oriental White-backed Vulture (*Gyps bengalensis*), Indian Black Vulture (*Sarcogyps calvus*), and Cinerous Vulture (*Aegypius monachus*) have undergone significant decline since late 1990s (Pain *et al.* 2003). As of 2010, the Cinerous Vulture is ranked as Near Threatened, the Egyptian Vulture is listed as Endangered, and the Oriental White-backed Vulture and Indian Black Vulture are ranked as Critically Endangered (IUCN, 2013). Diclofenac sodium or DFS (a non-steroidal anti-inflammatory drug used as an analgesic, antipyretic and anti-inflammatory medicine) was regarded as the cause of Asian vulture crisis (Oaks *et al.*, 2004).

The DFS toxicity hypothesis as the cause of vulture declines was developed during studies on the Oriental White-backed Vulture (OWBV) in Pakistan. In livestock, DFS accumulates in kidneys, liver, muscles, and is transferred to vultures when they feed on carcasses. This results in kidney failure and uric acid accumulation in liver and the death of OWBV through visceral gout and hyperuricemia. Oaks *et al.* (2004) reported the acute renal tubular recession and deposition of uric acid crystals in necropsied vultures and detected no indication of toxic chemical poisoning, accumulation of heavy metals, or parasite infection. Feeding trials established lethal DFS toxicity to OWBV. DFS was banned in India and Pakistan in 2006 for use in veterinary medicine. Efforts are now underway for the recovery of these vulture species. We are skeptical that vulture populations will reach their pre-decline levels as DFS is now banned.

MATERIALS AND METHODS

The study focused on gathering data from the literature, and field observations conducted by employing belt transect (Arnold *et al.* 2005). In belt transects we

traveled a distance of 1450km between Karachi and Islamabad and distance was calculated by mileage meter installed in vehicle. Both sides of road under vision were monitored and carcasses were recorded. The five different trips were made to and from, during years 1999, 2002, 2005, 2007, 2009 and 2010

RESULTS AND DISCUSSION

Field data confirmed a decline in carcass availability. In 1999, we observed 13 livestock carcasses and 6 jackal road kills. In 2002, there were 17 livestock carcasses and 3 jackal carcasses. Successive surveys in 2005, 2007 and 2009 yielded a total of zero livestock, 2 jackals, 2 civets and a few feral dogs (which we did not count) (Figure 1).

Rapid shifts in the agrarian socioeconomic patterns in Pakistan have appreciably reduced the availability of carcasses for vulture consumption, so much so that we believe food limitation may prevent vulture populations from returning to pre-decline numbers. Starvation causes a reduction in renal clearance with consequent hyperuricemia. It therefore may lead to renal failure and consequent development of visceral gout (Styles and Phalen, 1998). Visceral gout is now used to diagnose DFS poisoning in the field (Gilbert *et al.* 2006), potentially making it more likely researchers overlook starvation induced gout not the DFS caused gout. Convincing supportive data in favor of this alternate hypothesis is difficult to collect (Pain *et al.*, 2003). We know that populations of wild ungulates and carnivores have decreased in Pakistan in recent decades. Wild animals are likely a minor source of food for vultures, especially in more settled areas of the province of the Punjab (Shiekh and Molur, 2005). Traditionally, male cattle and buffalo were previously used as draft animals. When these animals died, their carcasses were left in open areas around villages. This provided food for vultures. The shift to mechanized agriculture is eliminating the need for these animals, so now male cattle and buffalo are now culled at very early age for beef markets. Female cattle and buffalo once provided food for vultures, but these too are declining. Once they reach pass their prime milk production years, they are sold for beef markets. Even when these animals die due to accidents or disease, they still frequently make their way to beef markets.

Poultry agribusiness emerged as industry in early 1970's. The number of poultry farms and size of the poultry flock has greatly expanded, increasing 20% between 2005 and 2010 (Pakistan Statistical Year Book, 2009). Presently there are around 85 million birds maintained in different poultry farms throughout the country. Animal proteins constitute an important part of the poultry feed. A mad cow-related ban on the import of poultry feed ingredients, combined with an increasing market price of fishmeal has led poultry feed manufacturers to search for the cheaper alternatives. Equine (donkeys, horses, mules) carcasses were identified as a source of cheap animal protein for the poultry feed. These carcasses are now either purchased or collected from open places. Truckloads of such carcasses can now be seen on the roads of the country. Estimates suggest that the poultry industry used 1.15 and 1.4 million tons of equine feed during 2004 and 2010, respectively (Poultry Research Institute, Rawalpindi Pakistan, pers. comm.). Animal protein constitutes a minimum of 15% of the poultry feed. Therefore the feed industry required some 207 million kg of the base animal protein during 2009, 38%, 35%, 19% and 8% of which was consumed in the provinces of KPK , Punjab, Sindh and Baluchistan, respectively. The estimates suggest that some 10,500 (horse = 2,000, mules = 5,000, ass = 3,500) equines die annually in Pakistan (out of a population of around 5.5 million). These animals provide only 16 million kilos of animal protein to the feed industry, still requiring 191 million kilos to be managed through other sources, including fishmeal. The trend of collection of such carcasses started in the mid 1980's and has since increased coincident with the onset of the Asian Vulture Crisis.

The impacts of all these agrarian socioeconomic factors are less pronounced in the more remote parts of the country, particularly in the provinces of Sindh and Baluchistan and northwardly located KPK. Anecdotal reports suggest that vulture declines are less conspicuous in these regions. Interestingly, declines in scavenging mammals have paralleled vulture declines (Shiekh and Molur, 2005). These mammals, most notably the jackal, rely extensively on livestock carcasses.

In the villages it is a common practice to throw such carcasses out of their villages and towards roads. In plain areas it is very common and only in mountainous and plateau areas such carcasses could be neglected which was not included in study area as not the habitat of OWBV

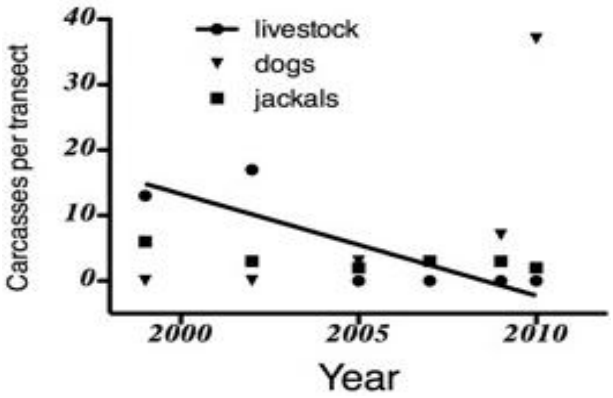

Figure 1: Decline in number of carcasses during study duration (i.e. 1999-2010).

Research in India conduced prior to 2005 indicated no shortage of carcasses for vultures (Prakash *et al.,* 2003). To the extent that similar changes in agrarian socioeconomic dynamics are underway, it is prudent to continue monitoring carcass availability in India and nearby countries inhabited by vultures. If the elimination of veterinary DFS does not solve the Asian Vulture Crisis, conservation action plans must continue to include provisions for permanent feeding stations (vulture restaurants), and additional research into the causes of population limitation in vultures.

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