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Source: Journal of Wildlife Diseases, 11(4) : 534-536

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-11.4.534

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FLUOROACETAMIDE (1081) POISONING IN WILD BIRDS

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Abstract: An outbreak of poisoning in four greylag geese (*Anser anser*) and 35-45 teal (*Anas crecca*) is described. Laboratory findings led to the conclusion that a wheat bait containing the rodenticide fluoracetamide (1081) caused the poisoning. Circumstantial evidence incriminated fluoracetamide as the cause of death in white-fronted geese (*Anser albifrons*), mallards (*Anas platyrhynchos*), and chukars (*Alectoris chukar*).

INTRODUCTION

Fluoroacetamide (FAA) is a water soluble, tasteless, odorless, very stable and highly toxic compound used as a rodenticide. Use of this poison in Israel is restricted by law to licensed pest-control officers,[2] but is readily available and is very widely used. FAA is marketed as a green-stained wheat bait containing 0.2% FAA. In the last 10 years numerous fatal cases of accidental FAA poisoning in farm and pet animals have been diagnosed in this laboratory.[3,4] In addition, many instances of FAA poisoning in wild mammals have been noted in this country. The most severe was in 1964 when FAA was used in a large scale poisoning campaign against golden jackals (*Canis aureus*), causing disastrous secondary poisoning in wildlife. Populations of jackals, foxes, (*Vulpes vulpes*), wild cats (*Felis sylvestris*), mongooses (*Herpestes ichneumon*) and other wild animals were almost exterminated.[7]

A search of the literature failed to reveal prior publications on FAA poisoning in wild birds.

HISTORY

Over a period of 2 weeks local ornithologists found dead or sick birds around two reservoirs in northern Israel. Four greylag geese (*Anser anser*) and 35-45 teal (*Anas crecca*) were affected. All were found dead except three of the geese, and one of these subsequently died. Clinical signs in the latter goose were: severe convulsions, incoordinated twisting of the neck, total anorexia, prostration and depression. These signs were observed until death, about 8 h later. The two surviving geese were both weak, but one was strong enough to fly short distances. Green-stained grains of wheat were discovered on the ground in the area where the geese and ducks were found.

Concurrently, ten white-fronted geese (*Anser albifrons*), mostly birds in their first year, and a number of mallards (*Anas platyrhynchos*) were found dead or dying on and around a reservoir about 50 km south of Tel-Aviv. Fields in the vicinity of the reservoir were littered with grains of green-stained wheat. In addition, small numbers of chukars (*Alectoris chukar*) are found dead each year following campaigns for control of field-mice; baits containing FAA are used in these campaigns.

RESULTS AND DISCUSSION

Several teal were examined postmortem and all appeared to be in good condition. The gizzards of all these teal

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contained grains of wheat. This wheat was stained green in most birds.

Diagnosis of FAA poisoning in this laboratory is based on a biochemical-biological method.[4,5] In the body, FAA is converted to fluoroacetate (FAC) and thence to fluorocitric acid (FC) which is about 100 times more toxic than FAC. The FC inhibits the enzyme aconitase which metabolizes citric acid in the Krebs cycle.[8] Thus the toxic effect of FC is to cause a reduction in cellular energy utilization and is associated with an accumulation of citrate in the tissues of the body.[5] However, elevated citrate levels disappear from tissues as soon as one hour after death.[8] The FC is stable for as long as 2-3 days after death; thus extracts are made of suspect tissues and injected into guinea-pigs to induce a secondary poisoning by FC. The level of citrate in the kidneys of these guinea-pigs is measured immediately after death.

The general procedure used in this laboratory is to homogenize kidney and heart tissue from animals suspected of dying from FAA or FAC poisoning, or suspect baits, urine, or ingesta, with water in the ratio of 1:3. The suspension is then boiled and left at 4 C overnight. After filtering through muslin, the pH is adjusted to 7.2. The volume is reduced by boiling so that for every 10 g of original tissue, one ml of extract remains. Five ml of concentrate is then injected intraperitoneally into a guinea-pig weighing 300-400 g. The animal is sacrificed 5 h later, or earlier if symptoms of FC poisoning (convulsions) develop. The citrate level in the kidneys of the guinea-pig is measured by the colorimetric method of Taylor.[9] Levels of citrate in the kidneys of normal guinea-pigs are less than 50 μg/g, whereas after exposure of animals to FAA or FAC, levels of citrate in the kidneys of the injected guinea-pigs of from 70-1200 μg/g have been recorded.[4,5] Several rarely encountered compounds can also cause elevations in citrate levels but on a practical basis this possibility can be discounted.[4]

This method does not differentiate between FAA or FAC. Extracts of hearts, kidneys, and gizzard contents from several teal were examined for the toxic metabolite of FAA, namely FC. Injection of the extract into guinea-pigs increased citric acid (citrate) levels in the kidneys of 75 μg/g, indicating possible exposure; injection of the extract from gizzard contents induced a citric acid concentration of 355 μg/g, confirming poisoning by FAA or FAC.

Tissues from the white-fronted geese and chukars were not examined for FC, but green-stained grains of wheat were found in the gizzards of birds examined, furnishing good circumstantial evidence that they had been poisoned by FAA.

No reports have been found on FAA poisoning in birds, but several works on FAC have been published. In chickens, the LD_{50} of orally administered FAC was 10-100 times greater than the LD_{50} for goats, sheep and horses and about 5 times greater than the LD_{50} for rats.[6] Juvenile mallards had an LD_{50} similar to chickens, whereas juvenile chukars were about three times more susceptible.[10] Clinical signs of FAC poisoning in chickens and mammals are ventricular fibrillation and persistent convulsions. Death in chickens is said to be from the action of FAC on the heart.[1] Convulsions were the most prominent feature in the birds seen alive in the field.

Geese are uncommon winter visitors to Israel, and are usually found in very small groups. Probably only a few geese were poisoned because the majority were not in the area where poisoned wheat had been distributed. Several species of ducks are commonly found around the reservoirs, but only teal and mallards habitually forage in the grassy and waterlogged areas in the environment; thus only these species ate the wheat. Obviously FAA in a wheat bait can be a considerable hazard to grazing ducks, geese and other non-target animals.

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Acknowledgement

We would like to thank Mrs. Esther Preissler for her excellent technical assistance.

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Received for publication 4 February 1975

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