

## CHOLECALCIFEROL AS AN ALTERNATIVE TO SODIUM MONOFLUOROACETATE (1080) FOR POISONING POSSUMS

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### SUMMARY

Large-scale possum control in New Zealand is dependent on the use of sodium monofluoroacetate (1080). Although 1080 is highly effective, its use is restricted and there is public pressure to find alternatives. An acute toxicity programme has been set up to identify safer, humane, and more target-specific toxins. Possums were dosed with a new rodenticide, cholecalciferol (Vitamin D<sub>3</sub>). Interim results indicated that cholecalciferol has an LD<sub>50</sub> of approx. 20-50 mg/kg in the possum.

**Keywords:** Brushtail possums, cholecalciferol, toxicology, poisoning

### INTRODUCTION

In recent years the New Zealand government has renewed control efforts against brushtail possums (*Trichosurus vulpecula*) because of their effect on indigenous forests and their role in the spread of bovine tuberculosis to farm stock such as cattle and deer. Large-scale possum control is dependent on the use of 1080 (sodium monofluoroacetate). This toxin is manufactured by one chemical company in the USA, and a continued supply cannot be guaranteed. Alternative overseas sources or manufacture within New Zealand are possible, but import restrictions by overseas countries are feared, based on concerns of 1080 residues in meat from countries still using 1080 for vertebrate pest control. Hence an alternative toxin is needed.

Although this need has been recognised for many years, only limited progress has been made in resolving it. Acute toxicity data exist for the traditional toxins, such as cyanide, arsenic, 1080, and strychnine (Bell 1972); however all these non-specific toxins have disadvantages.

The screening of a number of anticoagulant poisons, including pindone, diphacinone, flocoumafen, and brodifacoum, has shown that caged possums are not sensitive to this class of toxin (Agricultural Pests Destruction Council 1988, unpublished research report). No first-generation anticoagulants appeared effective against possums. The three second-generation anticoagulants tested (bromadiolone, brodifacoum, and flocoumafen) all had to be fed to possums for at least 10 days to be effective. By contrast, rats and mice only need a single dose of these potent new poisons. In addition, residues cause concern about compounds like brodifacoum, which has been shown to persist in the liver of sheep for 260 days after exposure to low oral doses (Laas *et al* 1985).

This paper reports interim results on the acute toxicity testing of a new rodenticide, cholecalciferol (Vitamin D<sub>3</sub>) in the possum. The possums' known susceptibility to dietary calcium (A. Pearson pers. comm.) was the basis for interest in this toxin which mobilises stored calcium and raises plasma calcium concentrations, causing death by heart failure. Unpublished results provided by the manufacturer (Wellcome Environmental Health) indicated considerable species variation in response to cholecalciferol. For example, the oral LD<sub>50</sub> for male rats is 352 mg/kg *versus* 619 mg/kg in females, and the oral LD<sub>50</sub> for male dogs is 56 mg/kg *versus* 88 mg/kg in females. This paper describes an initial dose-ranging study using doses of up to 400 mg/kg that spanned the known LD<sub>50</sub> values for other mammals. Feral cats were also tested to provide comparative data. A second acute toxicity study pin-pointed more precisely the minimum dose of cholecalciferol required to kill possums.

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### METHODS

Possoms and feral cats were caught in cage traps and transferred to the Forest Research Institute animal facility and kept for a minimum acclimatisation period of 3 weeks. Food consumption and body weights were monitored before the study to ensure all animals were healthy. Acute toxicity studies used standard toxicology procedures (Brown 1980).

Possoms were allocated randomly to treatment groups. The possums were weighed immediately before dosing. Cholecalciferol concentrate was supplied by Wellcome Environmental Health, Concord, NSW, Australia. Dose-levels were adjusted by diluting the concentrate in corn-oil to give dose-volumes of 4 ml/kg. Each possum was dosed orally under light ether anaesthesia using an intragastric cannula. After administration of a single oral dose, animals were regularly observed for up to 42 days. The comparative toxicity data provided by Wellcome Environmental Health were supplemented by an evaluation of the acute toxicity of cholecalciferol in feral cats using identical procedures to those described for possums. These studies had Animal Ethics Committee approval.

### RESULTS

In the dose-ranging study, two of the three possums that received 50 mg/kg died (one male and one female). The survivor was a female. All six possums receiving 100 mg/kg died, as did the three in each group receiving 200 and 400 mg/kg cholecalciferol. Cats appeared less susceptible than possums to cholecalciferol; toxicity was less consistent and animals survived at dose-levels up to and including 200 mg/kg (Table 1). In the acute toxicity study all possums receiving 30, 60, or 120 mg/kg died. However, only half of those receiving 15 mg/kg died (Table 2).

**TABLE 1: Mortality of possums and feral cats receiving a range of doses of cholecalciferol.**

Group No.	Dose of cholecalciferol (mg/kg)	Possum mortality per group	Feral cat mortality per group
1	Control	0/3	0/3
2	50	2/3	2/3
3	100	6/6	1/3
4	200	3/3	2/3
5	400	3/3	3/3

**TABLE 2: Acute toxicity of cholecalciferol in male and female possums.**

Group No.	Dose of cholecalciferol (mg/kg)	Mortality per group	
		M	F
1	0	0/3	0/3
2	15	2/3	1/3
3	30	3/3	3/3
4	60	3/3	3/3
5	120	3/3	3/3

### DISCUSSION

These preliminary results showed that cholecalciferol has an LD<sub>50</sub> of approximately 20-50 mg/kg in the possum, indicating that this animal is susceptible to this toxin. Possums are known to be adversely affected by dietary calcium in ordinary stock foods, which cause tissue mineralisation in the kidney and gastrointestinal disturbances. When maintaining captive possums on stock pellets, it is important to select a low-calcium diet. Hence, cholecalciferol seems suitable for further development, particularly since possums appear more sensitive to this compound than other mammals, such as cats, dogs, and rats. Furthermore, non-target bird species are unlikely to be susceptible to

vitamin D poisoning (e.g., cholecalciferol has an oral LD<sub>50</sub> of >2150 mg/kg in the mallard duck).

Further studies will determine the LD<sub>50</sub> of cholecalciferol in the possum more precisely, then assess its palatability and effectiveness in toxic baits. At this stage the profound sex difference in response to cholecalciferol seen in other species has not been observed in the possum. However, the response of both male and female possums to cholecalciferol should become clearer as the project continues.

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