

# Chocolate Poisoning in the Dog

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*A springer spaniel weighing 20.9 kg developed generalized seizures and died about 15 hours after ingestion of two pounds of chocolate. The dog's symptoms and the serum theobromine concentration of 133 mg/L immediately post-mortem point to an intoxication with this dimethyl xanthine as the cause of death. Supportive data is presented on the pharmacokinetics of theobromine in dog and man. Possible interventions in suspected theobromine intoxication from chocolate are also discussed.*

## Introduction

Cocoa, derived from the seeds of the plant *Theobroma cacao*, and all products made from it, contains theobromine, a dimethylated xanthine similar in structure and function to caffeine and theophylline. This group of compounds exerts various pharmacologic effects which include CNS stimulation, diuresis, cardiac muscle stimulation, peripheral vasodilatation, cerebral vasoconstriction and smooth muscle relaxation.<sup>1</sup> Caffeine and theobromine, at one time used to treat angina pectoris, cardiac insufficiency and some forms of peripheral vascular arteriosclerosis, have been superseded by other medications. They are, however, abundantly available in various foodstuffs and can therefore pose a significant toxicologic danger when ingested in quantity.

Due to its obvious taste appeal, chocolate is found in a huge variety of foods and is present in most households. The most common type of cocoa product is "milk chocolate" found in candies and cakes. A pound of milk chocolate contains approximately 960 mg of theobromine;<sup>2</sup> a four ounce (113.4 gm) Hershey's milk chocolate bar therefore contains 240 mg of theobromine. For comparison, a single therapeutic dose of theobromine for an adult human is 200 mg<sup>3</sup> while for dogs it is about 20 mg/kg of body weight.<sup>4</sup>

This article reports the death of a dog after chocolate ingestion. It also includes the results of a pilot study of the pharmacokinetics of theobromine from chocolate in another dog. These findings are contrasted by data<sup>5</sup> in humans, specifically the latter dog's owner.

## Case Report

An intact female springer spaniel weighing 20.9 kg was presented DOA at 9 am. Late in the afternoon of the previous day, she had consumed an entire two pound bag of Hershey's chocolate chips. The owner had noted some restlessness during the evening, followed by urinary incontinence, but failed to seek professional care. By the fol-

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lowing morning, the dog had become "agitated and extremely nervous." Generalized motor seizures occurred about 8 am, lasted 15 to 20 minutes and terminated in death. Permission for complete necropsy was not granted, but a sample of whole blood was obtained by right ventricular puncture. The serum theobromine concentration was 133 mg/liter.

The recommended therapeutic dose of theobromine for dogs is 20 mg/kg and chocolate contains about 960 mg of theobromine per pound. Thus, this dog had probably ingested 1920 mg or 4.6 times the therapeutic dose.

### Pilot Study

A one-and-one-half year old spayed female mixed-breed dog weighing 19.5 kg was fasted for 12 hours. A four ounce (113.4 gm) bar of Hershey's pure milk chocolate was then fed, and a meal of eight ounces of Wayne "Bite Size" dry food<sup>a</sup> and one-half can Cadillac "M" Diet<sup>b</sup> was given two hours later. Blood samples were drawn via a cephalic vein catheter just prior to chocolate ingestion and at 10 observation points over the subsequent 28 hours. The serum was harvested and examined for dimethyl xanthines by high performance liquid chromatography.<sup>6</sup>

Serum theobromine concentration approached 12 mg/L following a dose of 12.3 mg/kg of body weight. Figure 1 displays the course of the serum concentration of theobromine in this dog (triangles). Incidentally, matching data on the owner, a 29-year-old female weighing 65.9 kg had been obtained as part of a previous investigation<sup>5</sup> and has been included (circles). It should be noted that both dog and master ingested the same amount of chocolate resulting in a 3.4 fold higher dose per kilogram of body weight in the dog.

### Discussion

In the experimental canine model, theobromine serum concentration reached a peak at about four hours and declined at an extremely slow rate over the subsequent 24 hours of testing. It is unclear whether this pattern was due to a zero order, *ie*-rate limited absorption of the theobromine from a chocolate mass in the bowel, a long serum half-life or both. The average serum half-life of theobromine in humans is seven hours.<sup>5,7</sup> Compared to the animal in our pilot study, the dog described initially had ingested roughly 7.5 times as much theobromine on a body weight basis. Her serum theo-

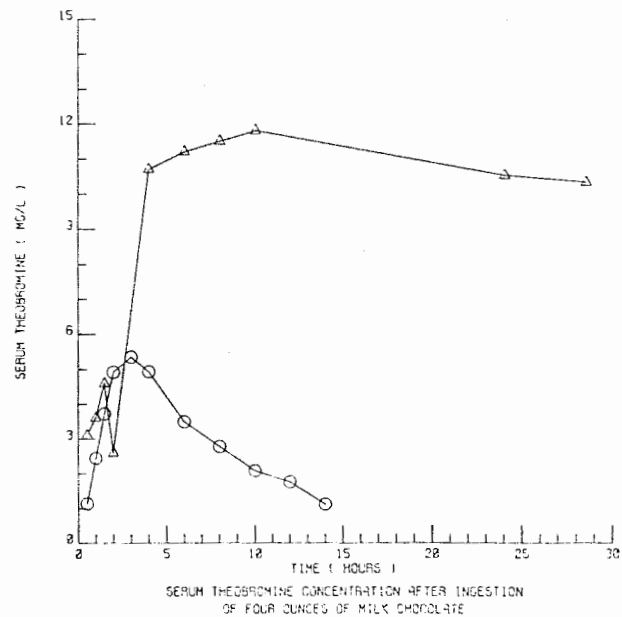


Figure 1— Serum theobromine concentration after ingestion of four ounces of milk chocolate by dog (19.5 kg, triangles) and owner (65.9 kg, circles).

bromine concentration, determined shortly after death, exceeded the peak in our model 10.3 fold.

The question remains, how to manage massive chocolate ingestion in dogs. It would seem quite beneficial to induce vomiting. Even if many hours have elapsed, the apparent slow absorption rate suggests that removing the remaining chocolate would limit the time of the theobromine serum plateau. An activated charcoal-shake given by gastric lavage may be beneficial in binding the remaining material. Hemoperfusion using charcoal<sup>8</sup> or resin<sup>9</sup> has been utilized to treat theophylline intoxication in man. Although apparently successful, this is impractical for veterinary use. There is no specific antidote for theobromine, theophylline or caffeine. Since their effects are so widespread, adverse reactions in many organs systems can be anticipated. Excitation, gastrointestinal and cardiovascular reactions should signal the possibility of seizures, which apparently herald a poor prognosis. Seizures should be controlled by diazepam, phenobarbital or phenytoin but may prove refractory, necessitating short-acting barbiturate anesthesia. Positive pressure ventilation and antiarrhythmic medications should be used if necessary.

From the paucity of reports of chocolate toxicity in the literature<sup>10,11</sup> and its conspicuous absence from the toxicity sections of veterinary textbooks,<sup>12</sup> one may assume that it occurs infrequently. Yet, due to the tremendous size of the American "sweet tooth," chocolate is ubiquitous and thus available for the enjoyment by dogs as well. It behooves prac-

tioners to be aware of the dangers of chocolate and to be familiar with the treatment of their patients who overindulge.

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°Cadillac Pet Foods, Inc., Pennsauken, NJ

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