

Chocolate (Methylxanthine) Intoxication

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Introduction

Chocolate contains the methylxanthines caffeine and theobromine. Different types of chocolates exhibit wide ranges of methylxanthine content. In most chocolate compounds, the primary toxic component is theobromine, while caffeine is present in lesser amounts. Unsweetened chocolates are generally more toxic than the sweet varieties. There are also numerous non-chocolate sources of methylxanthines that pets may come in contact with, such as coffee beans, cocoa bean hull mulches, sleep prevention aids and asthma medications.

Toxicology

The median lethal dose (LD₅₀) of caffeine in dogs is 140 mg/kg and theobromine is 250-500 mg/kg.¹ The minimum toxic doses are not established, but potentially lethal doses of caffeine vary from 110-200 mg/kg in the dog and 80-150 mg/kg in the cat. Doses of theobromine from 100-250 mg/kg are considered potentially lethal in the dog. Severe and life-threatening clinical signs may be seen at levels as low as 20-50 mg/kg (this corresponds to less than 2 oz/kg for milk chocolate and 0.2 oz/kg for unsweetened baking chocolate).² The caffeine and theobromine amounts should be added together to determine the total amount of methylxanthine ingested. In cases where the material ingested is not a pure source, such as an assorted chocolate with nuts, an estimation of a worst-case scenario of the predominant or most concentrated form of chocolate used in the candy should be employed. Methylxanthines are rapidly absorbed from the gastrointestinal tract, primarily metabolized by the liver, eliminated mainly through the kidneys, and they undergo enterohepatic circulation, returning to the circulating bloodstream through the portal vein after uptake in the ileum.¹ Re-absorption of caffeine into the circulatory system through the urinary bladder may occur.³ The half-life of theobromine and caffeine in the dog is 17.5 hours and 4.5 hours respectively (half-life in the cat is unknown).³

Clinical Signs

Clinical signs generally occur within 6-12 hours of ingestion, but may be seen within 1-4 hours. Methylxanthine intoxication can cause the following symptoms: restlessness, hyperactivity, panting, vomiting, diarrhea, polyuria, polydipsia, ataxia, tremors, lethargy, tachycardia (sometimes bradycardia), cardiac arrhythmia, premature ventricular contractions, seizures, hypertension (sometimes hypotension), hyperthermia, coma and death (generally due to cardiac arrhythmias and/or respiratory failure). Dogs are more frequently affected than cats. The clinical effects of methylxanthines appear to mainly be the result of adenosine antagonism (causes CNS stimulation, tachycardia, gastrointestinal upset, vasoconstriction and diuresis).^{1,2,4}

Treatment

As with all intoxications, treat the patient, not just the toxicant. Providing excellent supportive and symptomatic care is the best course of therapy.

1. Stabilize the patient
2. Control seizures with diazepam or a barbiturate such as phenobarbital as needed.
3. Monitor cardiac status via auscultation and electrocardiography
4. Treat tachyarrhythmias as necessary. Use metoprolol (Dog: 0.5-1.0 mg/kg PO q 8h ; Cat: 12.5-25 mg/cat PO q8-12h)⁵ as propranolol reportedly delays renal excretion of methylxanthines such as theophylline.⁶
5. Treat frequent premature ventricular contractions in dogs with lidocaine (1-2 mg/kg IV bolus followed by 25-75ug/kg/min IV infusion).⁵
6. Treat bradycardia if present with IV atropine (0.02 - 0.04 mg/kg IV or IM)⁷
7. Avoid corticosteroids as some may interfere with methylxanthine excretion.¹
8. Decontaminate the gastrointestinal tract via emesis or gastric lavage if ingestion has occurred within the last 4 hours. If the patient has ingested wrapped candy, the effects of the methylxanthines may be

delayed by many hours. Chocolate may form a ball in stomach and require surgery to remove the material.

9. Control vomiting with metoclopramide (0.2-0.4 mg/kg SQ or IM q 6h)⁷
10. Administer plain activated charcoal (1 to 4 g/kg PO with 1g/5ml H₂O) or a 10% suspension (100 mg/ml) such as Toxiban® (6-10 ml/kg or 240 mls/24-40 kg).⁵ Repeat doses of activated charcoal q4-12h, to help control enterohepatic circulation of methylxanthines.
11. Administer intravenous fluids at twice the maintenance rate to support circulation and enhance renal excretion.
12. Place an indwelling urinary catheter in severely affected animals to reduce re-absorption of caffeine from the urinary bladder.³
13. Monitor electrolyte imbalances and correct as they occur, especially hypokalemia, which may occur from diuresis and vomiting.
14. Pancreatic enzymes should be monitored due to the high fat content of many chocolate compounds.
15. Treatment may be necessary for greater than 72 hours due to the long half-life of theobromine.

Table 1: Approximate methylxanthine concentrations in common substances^{1,8}

Form	Caffeine (mg/oz)	Theobromine (mg/oz)
White chocolate	0.85	0.25
Milk chocolate	6	58
Dark, sweet chocolate	20	130
Semi-sweet chocolate chips	22	138
Baker's chocolate (unsweet)	47	393
Dry cocoa powder	70	737
Cacao bean mulch	?	56-850
Coffee, brewed (fl oz)	22-30	?
Coffee, instant (fl oz)	8-21.6	?
Chocolate milk (fl oz)	0.25	5
Hershey's Kisses® (5-6 pcs)	7.1	58.7
Hershey's Syrup®	7	69
OTC Stimulants (e.g. Vivarin)	200mg/tablet	?
Coca-Cola® (fl oz)	3.8	?

Additional information is available at the ASPCA Animal Poison Control Center, 1-888-4-ANI-HELP and <http://www.apcc.aspc.org>

Note: Veterinary Medicine is an ever-changing field. Standard safety precautions must be followed, but as new research and clinical experience broaden our knowledge, changes in treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current product information provided by the manufacturer of each drug to be administered to verify the recommended dose, the method and duration of administration, and the contraindications. It is the responsibility of the treating veterinarian, relying on experience and the knowledge of the animal, to determine dosages and the best treatment for the animal. Neither the publisher nor the editor assumes any responsibility for any injury and/or damage to animals or property arising from this publication.

¹ Carson, TL. Methylxanthines. In: Petersen, ME, Talcott, PA, eds. *Small Animal Toxicology*. Philadelphia: W.B. Saunders Company, 2001; 563-570.

² Gwaltney-Brant, S.: Chocolate intoxication. *Veterinary Medicine* 2001;96:108-111.

³ Hooser S.B., Beasley V.R.: Methylxanthine poisoning (chocolate and caffeine toxicosis). In: Kirk, RW, ed. *Current Veterinary Therapy for Small Animal Practice IX*. Philadelphia: WB Saunders Company 1986; 191-192.

⁴ Johnson, L: CVT Update: Canine Chronic Bronchitis. In: Bonagura, JD ed. *Kirk's Current Veterinary Therapy XIII. Small Animal Practice*. Philadelphia: W.B. Saunders Company 2000; 803.

⁵ Boothe, DM: *Small Animal Clinical Pharmacology and Therapeutics*. Philadelphia: W.B. Saunders Company, 2001.

⁶ Upton RA. Pharmacokinetic interactions between theophylline and other medication (Part I). *Clin Pharmacokinet* 1991;20:66-80

⁷ Plumb, DC. *Plumb's Veterinary Drug Handbook, 3rd Ed.* Ames: Iowa State University Press, 1999.

⁸ Hershey Foods Corporation: Caffeine and theobromine contents of Hershey's products on a per-serving basis. http://www.hersheys.com/nutrition_consumer/index.shtml; Jan. 2002.