CHOCOLATE INTOXICATIONS

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Chocolate intoxication is potentially serious and life threatening. Most intoxications occur around holidays, usually Halloween, Thanksgiving, Christmas, Valentine’s Day, and Easter. Owners are often unaware that chocolate poses a hazard in animals, or that chocolate products vary in their potency. Methylxanthines are the bioactive agents in chocolate and related products. Theobromine is the dominant methylxanthine alkaloid in the seed of the cocoa bean, Theobroma cacao, from which chocolate is produced. The methylxanthine caffeine is also found in the cocoa bean, as well as in coffee beans and many over-the-counter stimulant drugs used to combat fatigue (as high as 200 mg in some tablets). Table 1 lists various methylxanthine-containing products and their approximate concentrations of caffeine and theobromine. When calculating exposures, the concentrations of caffeine and theobromine are added together to obtain total amounts of methylxanthines in various chocolate products.

Chocolate is readily available, unprotected, palatable, and pleasant smelling, thus animals are attracted to it. A toxicosis may occur in any animal species, but dogs are most commonly affected. Cats are less likely to eat large quantities of chocolate due to their usually more discriminate eating habits. Intoxications in a red fox and a European badger were recently reported and were due to ingestion of waste chocolate bars that were being fed to cattle and hogs at a nearby farm. Cocoa bean hulls in garden mulches have been responsible for toxicoses in dogs and horses when hulls were used as bedding. Companion animals are usually exposed by gaining access to their owners’ treats or medications.

Methylxanthines are rapidly absorbed from the gut. The fatty composition of most chocolate products may slow absorption. Enterohepatic recirculation accounts for the long half-life of theobromine in the dog (17.5 hours). Methylxanthines inhibit cellular phosphodiesterase, increasing intracellular cyclic adenosine nonphosphate. They enhance the release of epinephrine and norepinephrine (catecholamines). The methylxanthines are competitive antagonists of cellular adenosine receptors, and they cause an increased entry of calcium and inhibit calcium sequestration by the sarcoplasmic reticulum, increasing muscular contractility. The overall clinical picture is one of neurologic and cardiac stimulation.

DIAGNOSTIC CRITERIA

Historical Information
Gender Predisposition: None.

Age Predisposition: All ages are affected; however, young animals seem to be more at risk because of their natural curiosity and propensity to consume large amounts of chocolate quickly.

Breed Predisposition: Small-breed dogs may be more at risk because of their size relative to the amount of chocolate often available.
**Owner Observations:**
- Chewed or missing chocolate products.
- Polydipsia, vomiting, restlessness by 6–12 hours post-ingestion. Vomitus may appear brown or contain clumps of chocolate. Followed by diarrhea, hyperactivity, tachypnea, tremors, and polyuria. Seizures possible following massive ingestions.

**Other Historical Considerations/Predispositions:** Animals with pre-existing cardiac, neurological, or renal dysfunction may be more at risk.

**Physical Examination Findings**
- Restlessness, hyperexcitability, agitation, tremors.
- Tachycardia, tachyarrhythmias, hyperreflexia, stiffness, seizures.
- Tachypnea or cyanosis.
- Hyperthermia.
- Hypertension (more prevalent at toxic but nonfatal doses).
- Hypotension (less common; often associated with very high and potentially fatal doses), bradycardia, and coma.
- Pancreatitis possible from the high fat content of some chocolates.

**Laboratory Findings**
- **Hypokalemia** possible late in the course of the toxicosis (N = 3.6–5.6 mEq/l).
- **Hypoglycemia** possible secondary to increased muscle activity (N = 70–110 mg/dl).
- **Low urine-specific gravity** due to the diuretic effect of methylxanthines (N >1.012).
- **Caffeine and theobromine** can be detected in serum, stomach contents, liver, and urine by an analytical laboratory. No rapid and reliable in-house tests are currently available. Methylxanthines may be detectable for 3–4 days following consumption in plasma or serum.

**Other Diagnostic Findings**
- ECG may detect tachycardia and ventricular tachyarrhythmia.

**Summary of Diagnostic Criteria**
- Evidence that a toxic dose has been consumed (see Tables 2 and 3 to determine dosage).
- Consistent clinical signs and physical examination findings.
- Analytical confirmation of suspect material, serum, stomach contents, liver, or urine.

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**TABLE 1**

Approximate Amounts of Theobromine and Caffeine in Various Methylxanthine-Containing Products

<table>
<thead>
<tr>
<th>Substance</th>
<th>Theobromine (mg/oz)</th>
<th>Caffeine (mg/oz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White chocolate</td>
<td>0.25</td>
<td>0.85</td>
</tr>
<tr>
<td>Milk chocolate</td>
<td>56</td>
<td>6</td>
</tr>
<tr>
<td>Dark, sweet chocolate</td>
<td>130</td>
<td>20</td>
</tr>
<tr>
<td>Semisweet chocolate</td>
<td>138</td>
<td>22</td>
</tr>
<tr>
<td>Baking chocolate</td>
<td>393</td>
<td>47</td>
</tr>
<tr>
<td>Dry cocoa powder</td>
<td>737</td>
<td>67</td>
</tr>
<tr>
<td>Cocoa beans</td>
<td>600</td>
<td>NA</td>
</tr>
<tr>
<td>Coffee beans</td>
<td>0</td>
<td>600</td>
</tr>
<tr>
<td>Cocoa bean hulls</td>
<td>255</td>
<td>NA</td>
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</table>

Methylxanthine concentrations may vary depending on seasonal growing conditions and bean variety.

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**Editorial Mission:**
To provide busy practitioners with concise, peer-reviewed recommendations on current treatment standards drawn from published veterinary medical literature.

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**Compendium’s Standards of Care:** Emergency and Critical Care Medicine is published 11 times yearly (January/February is a combined issue) by Veterinary Learning Systems, 780 Township Line Road, Yardley, PA 19067. The annual subscription rate is $69. For subscription information, call 800-426-9119, FAX 800-556-3288, email soc.vh@medimedia.com, or visit www.VetLearn.com. Copyright © 2002, Veterinary Learning Systems.

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**Substance (mg/oz)**

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Amphetamines or amphetamine-like compounds in attention-deficit disorder medications (e.g., Ritalin® [Novartis], Cylert® [Abbott Laboratories]), weight-loss aids (Pondimin® [Wyeth]), or illicitly possessed amphetamines (e.g., Ecstasy, XTC, Euphoria, Meth, Eve, Cat).

Selective serotonin reuptake inhibitors (SSRIs), such as Prozac® (Eli Lilly) and Paxil® (GlaxoSmithKline).

Cocaine (may result in neurological or cardiac effects).

Albuterol tablets and inhalers used in humans for the control of asthma. Expect more pronounced cardiac stimulation than neurological (usually dogs exhibit weakness and/or depression despite a tachycardia).

Tremorgenic mycotoxins, produced in some moldy foods, garbage, compost piles, and moldy English walnuts.

Metaldehyde-containing snail baits, available as pellets, granules, and liquids, are applied to sidewalks, lawns, and gardens.

Permethrin-containing “spot-on” products in cats; history of exposure, or close contact with a recently treated dog. Cats may have a greasy spot on their backs. Contact a diagnostic analytical laboratory for chemical confirmation.

Lindane, an organochlorine insecticide still available in some over-the-counter dips. Coats may appear and feel greasy and have a chemical odor. Contact a diagnostic analytical laboratory for chemical confirmation.

Of systemic rose and flower insecticides containing disulfoton or disyston. This is a potent organophosphorus insecticide that will result in a rapidly progressive clinical course of drooling, vomiting, diarrhea, tremors, tachypnea, seizures, and possibly death. Labels may suggest applying to ground at base of plant.
along with a bone or blood meal fertilizer. Dogs may be attracted to the fertilizer and inadvertently ingest the insecticide. Contact a diagnostic analytical laboratory for whole blood cholinesterase enzyme activity and chemical confirmation.

• **Fly bait dusts** often contain methomyl, a potent carbamate that will result in a rapidly progressive clinical course of drooling, vomiting, diarrhea, tremors, tachypnea, seizures, and possibly death. Contact a diagnostic analytical laboratory for whole blood cholinesterase enzyme activity and chemical confirmation.

**Lead toxicosis** may present with vague and nondescript signs including occasional seizures and possibly vomiting and weight loss in dogs and cats. Common sources of lead include old paint, fishing sinkers, bullets, drapery weights, foil on wine bottles, and some tiles and linoleums. A whole blood lead level will confirm lead toxicosis.

**Idiopathic epilepsy**; animal may have seizures at weekly or monthly intervals and appear normal for the majority of time between seizure episodes. Blood work and radiographs are usually normal. EEG may be abnormal.

**Brain tumors** may have an insidious onset. Neurologic exam, radiographs, and CAT scans may reveal evidence of a tumor.

### Table 3: Amounts of Various Chocolate Products Required to Reach a Dose of 50 mg/kg in a 50-lb Dog

<table>
<thead>
<tr>
<th>Chocolate variety</th>
<th>Amount required for a 50-lb dog to reach 50 mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk chocolate</td>
<td>17.9 oz (1.1 lb)</td>
</tr>
<tr>
<td>Dark, sweet chocolate</td>
<td>7.7 oz (0.5 lb)</td>
</tr>
<tr>
<td>Semisweet chocolate</td>
<td>7.2 oz (0.45 lb)</td>
</tr>
<tr>
<td>Baking or unsweetened chocolate</td>
<td>2.6 oz (0.16 lb)</td>
</tr>
<tr>
<td>Dry cocoa powder</td>
<td>1.4 oz (0.09 lb)</td>
</tr>
<tr>
<td>Cocoa beans</td>
<td>1.92 oz (0.12 lb) or less</td>
</tr>
<tr>
<td>Coffee beans</td>
<td>1.92 oz (0.12 lb) or less</td>
</tr>
<tr>
<td>Cocoa bean hulls</td>
<td>4.5 oz (0.28 lb) or less</td>
</tr>
</tbody>
</table>

Note: It would take 65 lb of white chocolate to reach a dose of 50 mg/kg. A dog would suffer from gastroenteritis and pancreatitis long before reaching a toxic amount of methylxanthines from this variety of chocolate.

**TREATMENT RECOMMENDATIONS**

Treatment is aimed at minimizing absorption of methylxanthines, identifying and correcting cardiac or neurologic abnormalities, and providing supportive care. The treatment recommendations that follow are categorized according to whether the patient is asymptomatic or symptomatic.

**Initial Treatment For Recent Ingestions in Asymptomatic Animals $**

Induce emesis with 3% hydrogen peroxide PO (1 ml/lb body weight up to a maximum of 45 ml) or apomorphine (crush a pill and instill into the conjunctival sac, rinsing the sac with physiological saline once vomiting has occurred).

- Induction of emesis may be useful for up to 4 hours following ingestion of some chocolate products, as they may congeal in the stomach and remain there for prolonged periods.
- Caution should be used when an extended period of time has elapsed between ingestion of baking chocolate, cocoa powder, coffee grounds, or caffeine tablets and induction of vomiting. These agents are quickly absorbed and may have a rapid onset of action.

- Large ingestions (see Tables 2 and 3) also require the administration of activated charcoal (1–2 g/kg PO) and a cathartic such as sorbitol (3 ml/kg of a 70% solution) or magnesium sulfate (¼ tsp/10 lb body weight, Epsom salts). Either cathartic may be added to the charcoal slurry and given concurrently. Some prepared charcoal products already contain sorbitol, and no additional cathartic is needed.

- Monitor for onset of clinical signs for the next 6–8 hours.

**For Recent Ingestions in Symptomatic Animals $$**

Do not induce vomiting in an animal that is markedly stimulated, comatose, or has lost the postural or gag reflex.

Evaluate the cardiovascular and respiratory systems using:

- Metoprolol or propranolol for tachycardia. Several dosages have been suggested (same dosage for either drug): 0.04–0.06 mg/kg IV q8h; 0.1–0.3 mg/kg IV q8h, not to exceed 1 mg/min; or 0.2–0.4 mg/kg PO q12h. For most emergency situations, the IV route is recommended. Metoprolol is preferred over propranolol because propranolol may reduce methylxanthine clearance. Once the patient is stable following emergency IV administration, oral therapy may be used (metoprolol 0.2–1.0 mg/kg PO q12h or propranolol 0.2–1.0 mg/kg PO q8h).

- Atropine (0.02 mg/kg IV as needed) for bradycardia.

**Provide Seizure Control, to Effect:**

Diazepam (0.5–2.0 mg/kg IV). Repeat as needed. Severe seizures may not respond to diazepam alone, and one of the following drugs may be necessary:
• Phenobarbital (6 mg/kg IV).
• Pentobarbital (3–15 mg/kg IV).
• For severe cases, a combination of diazepam and methocarbamol (Robaxin®-V [A.H. Robins], 50–220 mg/kg IV) may be more effective.
• Propofol drip may also be effective (0.1–0.6 mg/kg/min IV).
• Inhalation anesthetics such as isoflurane may be effective for refractory cases.

Decontaminate the Animal:
• Place an endotracheal tube, inflate the cuff, and perform a gastric lavage. Some chocolate products may melt and form a soft, pasty mass that may be difficult to remove.
• Instill activated charcoal (1–2 g/kg PO) and a cathartic such as sorbitol (3 ml/kg of a 70% solution) or magnesium sulfate (½ tsp/10 lb body weight, Epsom salts). Either cathartic may be added to the charcoal slurry and given concurrently. Some prepared charcoal products already contain sorbitol, and no additional cathartic is needed.
• Repeated doses of activated charcoal (q 6–8 hrs) are recommended at 1 g/kg to interrupt enterohepatic recirculation of theobromine and enhance elimination.
• Repeated doses of cathartic should be avoided if the animal has had diarrhea.

Alternative/Optional Treatments/Therapy
Instruct owner to induce vomiting at home with 3% hydrogen peroxide (provided that exposure was recent, animal is not exhibiting clinical

Supportive Treatment
• Intravenous fluids. §
• Encourage frequent urination or catheterize the urinary bladder. Methylxanthines may be resorbed through the bladder wall, prolonging the syndrome. §
• Avoid unnecessary handling. Stress and excitement could precipitate a seizure.

Patient Monitoring
• Monitor cardiac status.
• Monitor and correct electrolyte disturbances.
• Monitor and correct hyperthermia. Use caution when reducing body temperature. Usually, control of excess muscle activity and cool IV fluids is sufficient to return body temperature to normal.
• Pancreatitis may develop in 2–3 days.
• Severe, uncontrolled seizure activity may result in myoglobinuric renal failure, hypoxia, hyperthermia, and trauma. These sequelae are not common.

Home Management
• Bland diet for 2–3 days to allow recovery from gastroenteritis.
• Keep methylxanthine-containing products out of the pet’s reach.
• Once the animal has recovered in the clinic, no permanent sequelae are expected.

Treatment Contraindications
• Do not give emetics to patients exhibiting signs of stimulation. The result may be induction of a seizure and secondary aspiration. Similarly, comatose animals lack the swallowing reflex and may aspirate.
• Animals that have had diarrhea do not require a cathartic.
• Corticosteroids and erythromycin should be avoided. They may impair the excretion of methylxanthines.

PROGNOSIS
Favorable Criteria
Early and aggressive decontamination before clinical signs appear lends to a favorable prognosis.

Unfavorable Criteria
• Animals that have intractable seizures or that present with profound tachycardia or ventricular arrhythmias, acid-base disturbances, rhabdomyolysis, and myoglobinuric renal failure.
• Animals presenting in a coma.

RECOMMENDED READING