Grapes, raisins and sultanas, and other foods toxic to dogs

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One of the more striking poisonings to have emerged as a potential concern over the last few years has been that of raisin poisoning in dogs. A foodstuff thought unlikely to cause problems in the past, it may well be that significant exposures had been wrongly diagnosed for many years. Assuming the incidence of ingestions has not changed much over the years then there is certainly increased awareness and reporting of such occurrences if the call enquiry data to the Veterinary Poisons Information Service (VPIS) are analysed. This article intends to outline current knowledge based on both the literature reports and the VPIS experience and to offer some guidance as to an appropriate case management strategy. In addition there will be a brief reminder about other foodstuffs with the potential to cause intoxication in dogs.

Fig. 1 outlines the enquiries concerning canine ingestion of fruits of the vine, *Vitis vinifera* (grapes, raisins and sultanas). The rise observed in 2003 occurred relatively late in that year, following some significant press coverage of a couple of cases that happened at about the same time. Further to that coverage the VPIS reviewed all past cases, and realising a potential problem alerted the veterinary profession (Campbell and Bates, 2003). Although some of the enquiries from 2003 onwards have been prospective to ascertain the likely risks to dogs there has been an increased reporting of actual incidences too. All confirmed or suspected cases reported have since been followed up by questionnaire and by the end of 2005 the VPIS had 45 cases with good follow-up information on its database. Of the 45 animals involved in these cases 22 (49%) showed no clinical signs following ingestion. In a recently published report on these cases (Sutton and Campbell, 2006) it was notable that 80% of those animals that showed no clinical signs throughout had all received either emetics and/or absorbents in the hours after the ingestion. However, there were eight cases with a fatal outcome. Owing to severe deterioration in their condition seven had been euthanased, one after consuming a large amount of fruitcake. The other case concerned a dog that had died owing to renal failure. The ingested ‘doses’ involved in these fatal cases ranged from 10 to 57 g of fruit per kg body weight. Interestingly, none of these cases with fatal outcomes had received any form of gastric decontamination, probably as they had presented to surgery after developing clinical signs.

There are now several reports that confirm that ingestion of these fruits can cause renal failure in dogs. The toxic mechanism remains to be elucidated, and the apparent lack of a reproducible dose response relationship has led some authors to suggest this may reflect either a component of the fruits that is present in varying quantities, or the existence of an extrinsic compound that may not always be present (Eubig et al., 2005). Individual variations in response may also occur. So the general consensus at present is that potentially any dose should be considered a problem. Certainly renal failure has occurred following ingestion of raisins at estimated doses as low as 2.8 mg/kg (Eubig et al., 2005) and one dog was euthanased after ingestion of 4.7 g/kg (Mazzaferro et al., 2004). Where grapes are concerned 4-5 grapes caused renal failure in an 8.2 kg dachshund (Mazzaferro et al., 2004) doses as low as 19.6 g/kg caused similar effects in another report (Eubig et al., 2005).
Clinical effects usually become apparent within 6 hours of ingestion, and always within 24 hours. Early signs are vomiting (in almost all cases), diarrhoea, anorexia, abdominal tenderness and lethargy. Ingesta may be present in the vomitus or faeces. Polydipsia may also be apparent. Evidence of renal impairment, characterised by elevated urea and creatinine, with accompanying oliguria or anuria, is usually apparent by 24 hours. Other laboratory findings in cases reported to VPIS or detailed in the literature include elevated phosphate, amylase, glucose, ALP and white blood cell count. Urinalysis may reveal proteinuria, glucosuria, microscopic haematuria and, rarely, crystalluria (Eubig et al., 2005). It is generally agreed that prognosis in dogs with oliguria or anuria is poor (Gwaltney-Brant et al., 2001).

In some of the cases with fatal outcomes reported to VPIS (London) post mortem results were available, and revealed proximal renal tubule necrosis and renal calcification. Mineralisation or calcification of tissues has also been reported, but these findings are not always of a severity to fully account for the poor case outcomes.

![Fig. 3: Aggressive fluid therapy for at least 48 hours is required.](image)

VPIS’ OUTLINE TREATMENT PROTOCOL

Ingestion of any quantity of grapes, raisins or sultanas by a dog should be considered treatable.

- Gut decontamination should be considered by means of emesis or gastric lavage
- Digestion of the fruits appears to be slow and decontamination several hours post-ingestion may be worthwhile as whole grapes and swollen raisins have been recovered after remaining in the stomach overnight (Eubig et al., 2005)
- Activated charcoal may be of benefit, but care should be taken to ensure bowel sounds are regular before this is administered
- If spontaneous vomiting is protracted consider use of anti-emetics such as metoclopramide: dosage 0.5–1 mg orally, SC or IM q 6–8h or 1–2 mg/kg per day by slow IV injection
- Aggressive IV fluid therapy for at least 48 hours for rehydration and support of renal function
- Monitor renal function and electrolytes for at least 72 hours post-ingestion
- Monitor for signs of fluid overload and, if possible, monitor central venous pressure
- Where necessary use of furosemide or mannitol may be considered to re-establish urine output
  - Dosage for furosemide 5 mg/kg IV initially followed by IV infusion of 5 mg/kg/hour
  - Dosage for mannitol 0.25–0.5 g/kg IV over 5–10 minutes
- Note that the efficacy of these therapies remains unproven and that there is evidence that tubular necrosis and or renal tubule obstruction may prevent urine flow (Mazzaferro et al., 2004)
- Dopamine may be used to enhance renal perfusion - dosage 1–3 mcg/kg per minute as constant IV infusion

It is worth noting that peritoneal dialysis has reportedly been employed in several cases, over a few days, with varying degrees of success.

OTHER DANGEROUS FOODSTUFFS

So what other dangerous foods lurk out there to harm the unsuspecting pet? Well - some are relatively well known and have been covered in many articles before. Chocolate remains a big concern to the VPIS, with cases occurring throughout the year but particularly at Easter and at Christmas when there may be more lying around the home in dog accessible places. 475 enquiries concerning ingestion of chocolate by dogs were handled in 2005 - the second most common enquiry taken. In 2005 there were three cases reported with fatal outcomes - so death by chocolate is not a term to be used lightly. The toxic component is the methylxanthine alkaloid theobromine, which is present in variable concentrations dependent on the quality of the chocolate - the darker or richer in cocoa solids the more dangerous the preparation. This topic has been covered in an article in UK Vet (Campbell 2001, UK Vet, 6 (6), pp40–42, 2001).

Several other foodstuffs spring to mind as regularly common enquiries to VPIS. One such is onions, and other members of the Allium species such as garlic, shallots, leeks and even chives - although the onion (Allium cepa) is the most commonly implicated of this grouping in poisoning referrals. All parts of the plant, whether raw or cooked, should be considered toxic. Although the plants contain several toxic substances it is widely agreed that n-propyl disulphide is the principal toxin, and it appears that this and the other toxins cause oxidative haemolysis, sulphhaemoglobin formation and subsequent Heinz body formation. These changes within the erythrocytes alter their structure and render them
prone to damage. The toxic constituents appear to have direct effects on erythrocyte membranes as well. The net result is development of a broad haemolytic anaemia, which may take 1–5 days to reach full intensity. The clinical manifestations of intoxication are initial gastrointestinal; effects such as vomiting, diarrhoea, abdominal discomfort, anorexia, depression and dehydration. Haematuria and haemoglobinuria are common, and haematology may reveal neutrophilia, lymphopenia, Heinz-body anaemia and methaemoglobinemia.

Treatment is advocated of ingestion of any quantity. For recent ingestions gastric decontamination should be considered, and use of adsorbents, but thereafter management is largely supportive. It is important that the animals remain hydrated; anti-emetics may be given to control persistent vomiting. Non-enzymatic reductants such as ascorbic acid may also be useful (dog dose 30 mg/kg body weight IV q 6-8h). In severely poisoned animals blood transfusions have been successfully employed (Kay, 1983).

Another unusual occurrence in dogs is ingestion of macadamia nuts. These originate from the trees Macadamia integrifolia and Macadamia tetraphylla. The mechanism of toxicity is unknown; but may involve a constituent of the nuts, processing contaminants or mycotoxins (Hansen et al., 2002). Principal signs of intoxication include weakness (more pronounced in hind limbs), tremor, ataxia, vomiting, depression, pyrexia, abdominal tenderness, lameness, stiffness and recumbency. Ingestion of doses as low as 2.2 g/kg have reportedly caused clinical effects. In an experimental study doses of 20 g/kg given to dogs caused clinical signs to develop within 2–3 hours. These dogs deteriorated over the following 12 hours but then recovered over the next 24–48 hours. It was noted they developed mild elevations in serum triglycerides and alkaline phosphatase (Hansen et al., 2000). Management is generally supportive, with decontamination appropriate for recent ingestions. Use of mild laxatives may assist the passage of ingesta through the gastrointestinal tract. Care should be taken to ensure the animals remain hydrated.

In summary it is useful to remember these known examples illustrate the potential hazards of feeding animals foodstuffs that appear innocuous, and that there may other toxic syndromes as yet unrecognised that result from giving animals foods to which they might not normally be exposed. The best advice must surely be to give animals foodstuffs and or treats specifically developed for their diets.

REFERENCES
Grapes, raisins and sultanas

Allium spp

Macadamia nuts