Heinz body anaemia in two dogs after Catalan spring onion ("calcot") ingestion: a case reports

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ABSTRACT: Catalan spring onions, or "calcots", are a very popular kind of vegetables obtained by special agronomic practices that avoid photosynthesis and subsequent metabolism by the *Allium cepa* plants. They have been considered for more than a century harmless for pets, as pleasant odour and sweet taste differ so largely from any other onion that can be ingested by children and adults in huge quantities, up to ~3% body weight, without problems being observed. However, the organosulphur chemicals responsible for oxidative damage to canine red blood cells found in this plant species seem to remain present, as two dogs were confirmed to be poisoned after eating left-over "calcots". Both patients presented haemolytic anaemia with Heinz body formation, and eccentrocytosis. Veterinarians and owners should be aware of the dangers associated with this particular onion variety and type, as it is highly palatable to pets and no effective treatment is currently available.

Keywords: *Allium cepa*; poisoning; organosulphur compounds; oxidative damage

The onion (*Allium cepa*) is one of the oldest crops. Native to Central Asia (Brown, 2002), onion and garlic (*A. sativum*) are probably the most well-known representatives of the genus and also of the Liliaceae family. Apart from their culinary uses – fresh, cooked or dehydrated – medicinal properties have been attributed to both since ancient times (Brown, 2002; Arnault and Auger, 2006), prompting in recent years an accurate chemical analysis of the most characteristic active ingredients (Jones et al., 2004; Arnault and Auger, 2006; Lanzotti, 2006; Santas et al., 2008). Nevertheless, ingestion of onion and other *Allium* sp. are known to be toxic to many animal species, including dogs, cats, cattle, horses, sheep and goats (Talcott, 2004; Sebastian, 2007). Although the dog appears to be one of the most susceptible species (Sebastian, 2007), there are very few reports in the scientific literature concerning accidental canine poisoning associated with onion ingestion (Stallbaumer, 1981; Kay, 1983; Fenwick and Hanley, 1985; Houston and Myers, 1993), most of them being anecdotic.

Catalan spring onion, locally and internationally known as "calcot", is a variety of *A. cepa* known as Blanca Gran Tardana cultivated mainly in Catalonia (North East of Spain), under very strict conditions. It is planted, replanted and successively covered in soil in order to prevent photosynthesis, so that the edible part remains white. The process is similar to the production of white asparagus (*Asparagus officinalis*), another liliaceae, a fact that explains the differences between the organoleptic and chemical composition of the white and green types of this vegetable (Rodriguez et al., 2005). The "calcot" is collected young, before the plant fully develops, and is 15–25 cm long and 1.7–2.5 cm diameter in the edible stem (onion bulb not yet present), which makes its shape similar to a green onion, but with a distinctive colour and flavour. The texture is pleasant and tender, and the taste surprisingly sweet, very different from the strong odour and taste of any other known onion. Those produced in Valls (Tarragona, Catalonia) have been honoured with the European Union Protected Geographical

Indication "Calcot de Valls" (European Commission, 2002), considering it a "fruit" (and not a vegetable), and are subject to active research (Laso et al., 2005; Santas et al., 2008).

The most traditional way of eating "calcots" is in popular gastronomical fiestas known as "calcotades", where they are massively consumed after being roasted on open fires. Introduced in the late XIX Century, there are currently some 300 000 big "calcotades" every year in Catalonia, and they have become an important tourist attraction during the winter and spring seasons. There are contests where winners eat around 2.8–3.0 kg of "calcots" in one sitting, demonstrating that they are devoid of toxicity for human beings even at very high doses. Children are also active fellow diners, a fact that could erroneously induce us to believe that these vegetables can be equally safe for pets.

CASE HISTORIES

Case 1

A 14-month-old 4.2 kg female smooth-haired Dachshund was presented to a Veterinary Clinic in Mataro (Barcelona, Catalonia) with a history of dark coloured urine and anorexia. The owners reported that the day before the dog ate an unknown, but presumably quite large, quantity of "calcots".

Initial physical examination confirmed very dark and turbid urine, though other urine analysis parameters were normal. Haematocrit (Hct) value was 40.7% (reference range 37–55) and haemoglobin (Hgb) 12.7 g/dl (reference range 12–18). The following day, Hct decreased to 38%, although urine was slightly less dark.

Four days later, anorexia worsened, 2–3 vomits occurred, and pale mucous membranes and abdominal gases were observed. Ecography revealed moderate splenomegaly. Hct was 24.7%, Hgb 7.0 g/l, and platelet count 735 × 10^9/l (reference range 175 × 10^9–500 × 10^9). Urea and creatinine were well below the normal range. Cimetidine (Tagamet, GlaxoSmithKline) and, to control vomits, metoclopramide (Primperan, Sanofi-Synthelabo), were administered.

The next day, Hct increased slightly to 26.3%, with red blood cell (RBC) count 3.06 × 10^6/µl (reference range 5.61–7.46) and mean corpuscular volume (MCV) 85.9 fl (reference range 65–80). Supravital staining of a blood sample (Figure 1) confirmed regenerative normochromic macrocytic anaemia, with presence of abundant Heinz bodies, some eccentrocytes, and no parasites. Urine was normal, without haemoglobinuria. During the following days, Hct recovered up to 35%. Appearance of the animal improved, and finally the dog made an uneventful total recovery, with no further clinical signs to date.

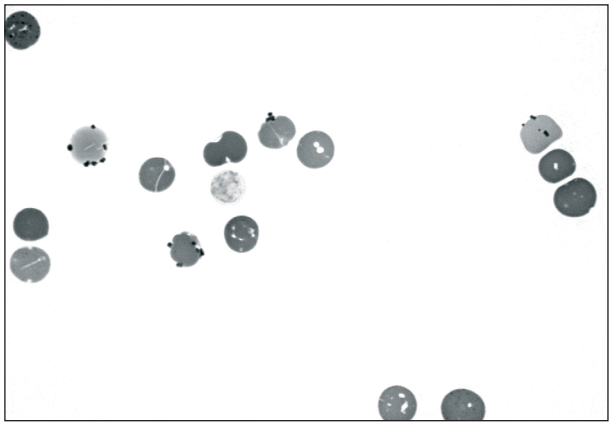

Figure 1. Blood smear (new methylene blue stain, × 1 000) showing widespread Heinz bodies in erythrocytes

Case 2

A 9-year-old 38 kg female Siberian husky was admitted to a Veterinary Hospital in Mataro because the dog had refused food for the last three days and was apathetic and depressed. According to the owners, the animal had ingested the left-overs of a "calcotada" six days before; the amount of onions consumed could not be quantified and, moreover, part of them was eliminated later by non-induced vomits.

Upon arrival at the clinic early in the morning, the dog was examined and samples of blood withdrawn for analysis. Hct was 15.4%, Hgb 5.9 g/dl, RBC 1.86 × 10^6/µl and MCV 82.8 fl. Potassium was 2.9 mmol/l (reference range 4.4–6.1), with all other parameters analyzed normal. Infection with *Ehrlichia canis*, *Dirofilaria inmitis* and *Borrelia bugdoferi* was serologically discarded. With the recent experience of the previously described case, the hospital makes a rapid tentative diagnostic of hyperchromic macrocytic anaemia induced by "calcot" ingestion. A Ringer lactate supplemented initially with potassium chloride infusion and oxygen therapy was provided. A broad spectrum antibiotic, ampicillin (Nuvapen, Reig Jofré) at 15 mg/kg tid, was also administered for three days.

The day after admission, a transfusion of packed red blood cells (PRBC) was initiated at 01:00 a.m. At 4:45 a.m., Hct was 23%, and at 09:00 a.m., 21.2%, with Hgb 7.9 g/dl, RBC 2.72 × 10^6/µl, MCV 77.9 fl and potassium 3.9 mmol/l. Urinanalysis was normal. Supravital staining of a blood sample confirmed the presence of abundant Heinz bodies, some eccentrocytes, and no parasites. Discarding other potential causes for the haemolytic anaemia, a confirmed diagnosis of "calcot" poisoning was established.

In the following two days, Hct recovered to 25.2% and 27.2%, with the other haematological parameters also showing a trend to return to normality. The dog was discharged after 72 hours of hospitalization. Vitamin E (Auxina E; Chiesi-Espana) 400 UI bid was prescribed, and subsequent clinical examination revealed no further problems.

DISCUSSION

Ingestion of onions has been associated with haemolytic anaemia accompanied by the formation of Heinz bodies (Talcott, 2004; Sebastian, 2007). Eccentrocytes can also be observed, but are seen in higher proportion after garlic ingestion (Lee et al., 2000). Both haematological damages are indicative of oxidative injury, although in experimental studies the increase of methaemoglobin was of no clinical significance (Harvey and Rackear, 1985). Splenomegaly is a response to haemosiderosis (Gault et al., 1995), and discoloured urine, varying from port wine to almost black colour, is frequent (Sebastian, 2007). Heinz body anaemia is an uncommon finding in dogs, and few other toxicants can induce it (Kay, 1983; Houston and Myers, 1993; Zaks et al., 2005; Sebastian, 2007), so onion ingestion must always be suspected in such situations (Gault et al., 1995). In our case, experience acquired with the first poisoned dog was crucial to establish a rapid diagnostic for the second one, avoiding use of non-useful medication, such as corticoids.

Onions contain many organosulphur compounds (Lanzotti, 2006), some of which are responsible for their characteristic odour (Jones et al., 2004). Di-*n*-propyl-disulphide ($H_7C_3S_2C_3H_7$) and allyl propyl disulphide ($H_5C_3S_2C_3H_7$) have been implicated in onion-induced haemolytic anaemia (Kay, 1983; Fenwick and Hanley, 1985; Houston and Myers, 1993; Gault et al., 1995; Talcott, 2004; Sebastian, 2007) but, recently, more active oxidizing sulphur-containing compounds have been discovered and proposed as causative agents, either in onion (Munday et al., 2003) or in garlic (Yamato et al., 2003) poisoning episodes. The susceptibility to onion intoxication depends on several factors (Talcott, 2004), the hereditary condition resulting in erythrocytes with high concentrations of reduced glutathione and potassium probably being the most studied (Yamato and Maede, 1992; Yamato et al., 1999).

The special farming technique applied to "calcots" modifies their chemical composition. It has been shown that, compared to other onions, it reduces their content in flavonoids, a group of polyphenolic compounds with antioxidant activity (Santas et al., 2008), probably in a similar way to what occurs to white asparagus (Rodriguez et al., 2005). According to their differential flavour, pungency and odour – characteristics known to be associated with organosulphur compounds (Jones et al., 2004; Lanzotti, 2006) – "calcots" also probably contain lower, but still significant, levels of these toxins.

Several therapeutic approaches have been suggested to treat onion-poisoned animals, including gastrointestinal decontamination, administration of antioxidant vitamins (C and E) or N-acetylcysteine, and intravenous fluid therapy or blood transfusions (Kay, 1983; Gault et al., 1995; Hill et al., 2001; Talcott, 2004), but none has been proven really effective. Nevertheless, even taking into account that lethal effects are infrequent in dogs (Stallbaumer, 1981; Kay, 1983; Gault et al., 1995), avoiding exposure to any kind of *A. cepa* in this and other domestic animal species seems to be the best preventive health strategy.

"Calcotades" being traditional friendship or familiar celebrations, presently also extended to some restaurants in the USA, the UK and France, where people eat and drink together, there are usually dogs present. Participants may consider that these special onions are devoid of toxicity because of the huge amount they can ingest (~3% body weight), and the extended belief in their medicinal properties. However, as shown in this paper, "calcots" still pose a severe risk for dogs (and probably other species), with only supportive and symptomatic treatment.

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