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Exogenous toxicosis in dogs and cats: a 20-year retrospective study

Iolanda Simões Braga[1], Noeme Sousa Rocha[1], Alessandre Hataka[1], Renée Laufer Amorim[1]*

[1]Department of Veterinary Clinic, School of Veterinary Medicine and Animal Science, São Paulo State University (UNESP), Botucatu, SP, Brazil

[*]**Corresponding author:** renee.laufer-amorim@unesp.br
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Abstract

Exogenous poisoning is a form of mistreatment inflicted upon animals, with pesticides being the primary agents associated with fatal poisoning in dogs and cats in Brazil. Given its significance for animal, human, and environmental health, the objective of this study was to conduct a retrospective necropsy study of patients diagnosed with exogenous poisoning. One hundred necropsy cases of poisoning in dogs and cats were selected over a period of 20 years (2000-2019). Reports from these cases were retrieved, and the following information was compiled: species, breed, sex, age, cause of death, diagnosis, toxicological examination, and police report. Dogs were most affected (68%; 68/100), followed by cats (32%; 32/100). Mixed-breed animals were more prevalent, representing 87.5% (28/32) of the cats and 33.82% (23/68) of the dogs. The most frequently diagnosed chemical agent was carbamate (59.37%; 19/32). During necropsy, the most common finding was congestion of one or more organs (80%; 80/100), and the most frequent cause of death was respiratory failure (47%; 47/100). A police report was filed in 29% (29/100) of the cases, with neighbors often identified as the primary suspects. Based on the results of the present study, it can be concluded that exogenous poisoning in dogs and cats is prevalent (14,34%; 100/697). Furthermore, as necropsy findings are nonspecific, it is essential to conduct a toxicological examination to confirm the diagnosis.

Keywords: carbamates, crime, forensic medicine, toxicology.

Introduction

The relationship between humans and animals is ancient and encompasses various uses of animals, including labor, food, protection, research, and companionship (26). In 2023, Brazil had 62.2 million dogs and 30.8 million cats (11). While this relationship can be mutually beneficial, negative interactions may also arise, such as the mistreatment of animals (1). According to Resolution No. 1,236, issued on October 26, 2018, by the Brazilian Federal Council of Veterinary Medicine (23), mistreatment is defined as any act, whether commission or omission, direct or indirect, resulting from negligence or intentionality, imprudence, or incompetence that causes unnecessary suffering or pain to animals. Among the various forms of mistreatment, exogenous poisoning, whether intentional or unintentional, has emerged as a significant issue worldwide and is frequently documented in the literature (6, 10, 15, 25). In Brazil, pesticides are the leading cause of fatal poisoning in animals, particularly carbamates, which account for 80% of reported cases, although some compounds, such as Aldicarb, have been banned (2). Other common agents include organophosphates, coumarins, and pyrethroids (24, 26).

In certain regions of Brazil, there remains limited adherence to necropsy examinations in animals, which can be attributed to the emotional distress experienced by pet owners following the loss of their animals. A similar issue arises concerning the performance of toxicological examinations, where the primary reason for refusal is the high cost associated with these tests (5). Consequently, studies that compile relevant information regarding exogenous poisoning in dogs and cats, commonly used agents, typical necropsy findings, and data contained in police reports, among other

factors, are of paramount importance for the preservation of animal, human, and environmental health.

Therefore, the objective of this study was to conduct a retrospective study of necropsy cases suspected of exogenous poisoning carried out by the Veterinary Pathology and Legal Veterinary Medicine Laboratory (Lapavet) of the School of Veterinary Medicine and Animal Science (FMVZ) at São Paulo State University (Unesp), located in the city of Botucatu, São Paulo, Brazil, between 2000 and 2019.

Material and Methods

A research study was conducted using the registry records of Lapavet at FMVZ Unesp, which was approved by the laboratory manager. Initially, necropsy cases related to legal veterinary medicine were selected manually, revealing that the majority of these cases were associated with poisoning conditions. Specifically, cases of poisoning in dogs and cats from 2000-2019 were chosen for further analysis.

A search was subsequently conducted for case reports in both physical and virtual archives. From these reports, information was collected regarding the species, breed, sex, and age of the necropsied animals, as well as the diagnosis, cause of death, main necroscopic findings, toxicological examinations (conducted by Ciatox [Toxicological Information and Assistance Center] at the Bioscience Institute of Unesp, using, more frequently, quantitative methods [silica gel thin layer liquid chromatography] and, less frequently, qualitative methods [high-performance liquid chromatography with ultraviolet detector]), police reports, and other pertinent information about the cases, including suspected food sources and conflicts with neighbors.

A table listing the cases, including species, breed, sex, age, toxic agent, and toxicological examination (with sample and identification method) can be found in the supplementary material (table S1).

Results

Between 2000 and 2019, Lapavet performed 1,664 necropsies, of which 697 (41.88%) were on dogs and cats. Among the 697 dogs and cats necropsied, 100 (14.34%) had suspected or confirmed diagnoses of poisoning. Among the 68 dogs necropsied, 39 (57.35%) were male, and 29 (42.65%) were female. Among the 32 cats, 15 (46.87%) were male, 16 (50%) were female, and 1 (3.12%) had no sex information available. In terms of age, 23.53% of dogs had one year or less, 19.12% were between 1 and 2 years old, 16.18% were between 3 and 4 years old, 16.18% had 5 years or more and 13.23% were between 2 and 3 years old. Among the cats, 37.5% were less than 1 year old, 12.5% were between 1 and 2 years old, 12.5% were over 2 years old and 31.25% did not contain information about age. Animals described only as young or adult were not considered for this parameter.

For both dogs and cats, the most affected breeds were mixed breeds, accounting for 33.82% and 87.50%, respectively. Among the other most affected dog breeds, large breeds, such as the German Shepherd (10.29%), Pitbull (5.88%), and Rottweiler (4.41%), were notable. Additionally, small dog breeds such as Poodle (5.88%), Brazilian Terrier (4.41%) and Dachshund (4.41%) were also significantly affected. Among the cats, the only affected breeds were Angora and Siamese, each representing 6.25% of the cases.

Between 2000 and 2019, the years with the highest number of poisoning cases, relative to the total number of necropsies performed on dogs and cats each year, were 2005 (32%) and 2012 (30%), followed by 2000 (25%) and 2002 and 2009 (24% each) (Figure 1).

Among the 100 reports analyzed, in 49 cases it was possible to identify the suspected agent. Specifically, 22 cases were suspected of carbamate poisoning, 7 were dicumarinic, 5 were Aldicarb, 3 were “chumbinho” (the popular name for carbamate), 3 were organophosphate, 3 were fluoroacetate, 2 were permethrin, 2 were *Ricinus communis*, 2 were both

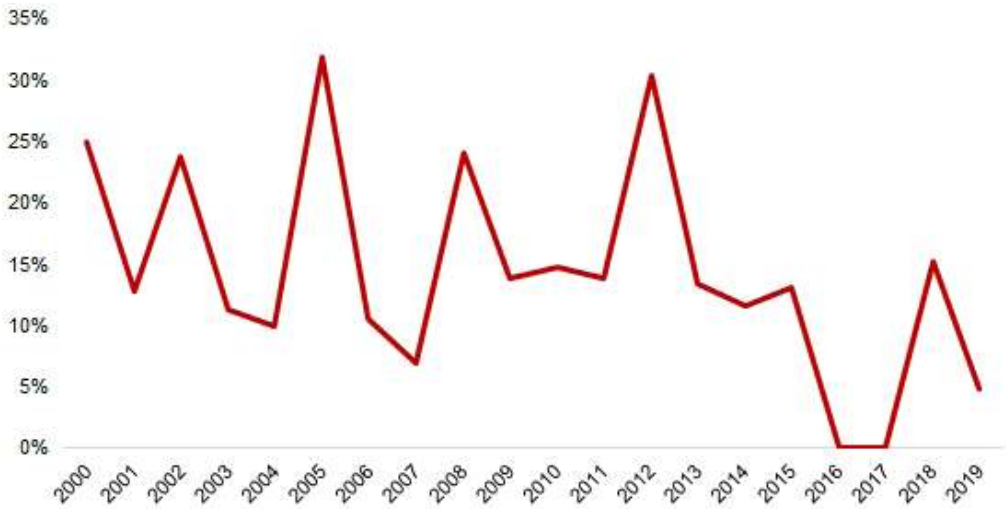

Figure 1. Annual percentage of poisoning cases in dogs and cats.

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carbamate and organophosphate, and 1 was both carbamate and dicumarinic. Among these 100 reports, it was possible to retrieve the toxicological reports for 32 cases.

Among the 32 toxicological reports recovered, 13 (40.62%) confirmed poisoning by carbamate, 5 (15.62%) by Aldicarb, 1 (3.12%) by Thiodicarb, 3 (9.37%) by dicumarinic, 3 (9.37%) by organophosphate, 1 (3.12%) by permethrin, 1 (3.12%) by cypermethrin, 2 (6.25%) by both carbamate and organophosphate, 1 (3.12%) by fluoroacetate, and 2 (6.25%) were negative for chemical agents.

The most common cause of death was respiratory insufficiency (47%), followed by hypovolemic shock (11%). The most frequent necropsy findings included congestion of one or more organs (80%), such as the lungs, liver, and kidneys; black granular content in the gastrointestinal tract (45%) (Figure 2); lung edema (26%); and dilation of the right cardiac ventricle (25%).

Of the 100 cases, only 29 were accompanied by a police report. In 15 cases, the animal owner reported having suspicions or mentioned receiving complaints from neighbors, with 4 cases involving direct threats from neighbors. In 3 cases, the owner indicated that other animals in the neighborhood had already died under similar circumstances.

Discussion

In this study, dogs were found to be more affected by exogenous poisoning than cats. This finding contrasts with the results reported by Marlet and Maiorka (15) and Xavier et al. (28) in studies conducted in São Paulo, as well as those by Rebollada-Merino et al. (19) in Madrid. However, our results are consistent with those found in studies conducted in Niterói, Rio de Janeiro (17); southeastern Italy (6); northwestern Liguria, Italy (3); Tunisia (12); South Bačka district of Serbia (8); Austria (27); western Canada (7); Portugal (10) and Germany (16), where specific studies on exogenous poisoning indicated that canines were the most affected species. This may be related to the greater popularity of dogs as pets (15) or to the fact that cats tend to be more selective regarding their diet (17).

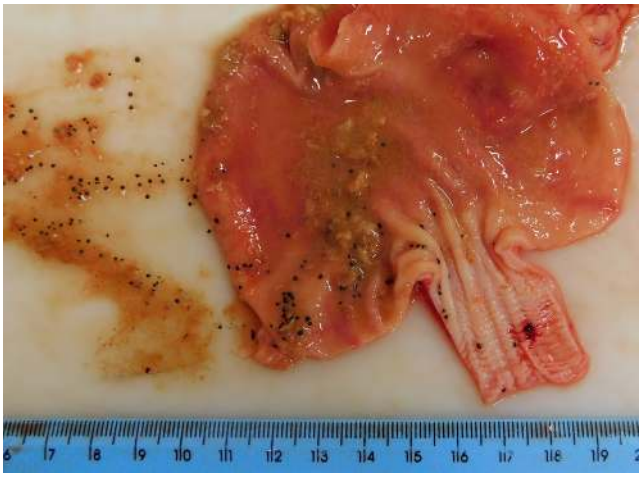

Figure 2. Presence of black granular content in a cat stomach, suspected carbamate.

The most affected animals in this study, both dogs and cats, were mixed breeds, a result that aligns with findings from another Brazilian study (28), which also indicated a predominance of mixed breeds in both species. Similarities were observed in the common breeds identified in both studies, with German Shepherds and Poodles among the most affected dog breeds and Siamese cats among the feline breeds.

With respect to age, the most significant number of cases involved animals aged two years or younger, accounting for 42.65% of the dog cases and 50% of the cat cases. This result is consistent with other studies that identified young animals (under five years old) as the most affected in both species (15, 16, 19, 28), which may be attributed to the heightened curiosity exhibited by animals in this age range.

A slight predominance of affected males was observed in the canine species (57.35%), whereas females predominated in the feline species (50%), results that are consistent with those obtained by Marlet and Maiorka (15) and Rebollada-Merino et al. (19). When these results were compared with those obtained by Xavier et al. (28), similarities were noted in the findings related to felines, but differences were observed in the canine species.

Among the 100 evaluated cases, 49 identified the chemical agent, with carbamate being the predominant agent (32 cases), which was occasionally associated with organophosphate (2 cases) or dicumarinic acid (1 case). However, toxicological examinations were recoverable for only 32 of the 100 cases. Among these, carbamate was again the most prevalent, accounting for 19 cases (59.37%), of which 5 were specifically identified as Aldicarb and one specifically Thiodicarb. The second most common agent was organophosphate, which was diagnosed in isolation in three patients (9.37%) and concurrently with carbamate in another two patients (6.25%). Carbamate has been identified as the most common agent in studies conducted in Brazil (15, 17, 28), Tunisia (12), Serbia (8), and Austria (27). In southwestern Italy (6) and Portugal (10), molluscicides are predominant. Conversely, in northwestern Italy (3) and Germany (16), anticoagulants are more prevalent. Strychnine is the most common chemical agent associated with dog poisoning in Western Canada (7).

Notably, differences in the primary causative agents of poisoning across various countries may be related to the availability of these products in each region. Importantly, some agents are restricted or prohibited in these countries, and there are laws against the practice of poisoning pets. In Brazil, in addition to some carbamates, such as Aldicarb (2), Carbofuran (20) and Carbendazim (22), sodium monofluoroacetate (18) and strychnine (21) are also prohibited. The mere existence of legislation is not sufficient to prevent these crimes; it must be accompanied by effective supervision and appropriate penalties for offenders.

Furthermore, the predominance of certain agents, given that these are exclusively necropsy cases, can be explained by their greater toxicity. The most common way of measuring the toxicity of an agent, although not ideal, is the LD_{50} (lethal dose required to cause death in 50% of the population exposed to the agent). An agent is considered extremely toxic when its LD_{50} is less than 5 mg/kg. Aldicarb, considered the most toxic carbamate and accounting for 5% of our total cases, has an LD_{50} of 0.6 to 1.0 mg/kg in rats. Fluoroacetate, also common in our research (3%), has an LD_{50} of 0.06 mg/kg in dogs and 0.2 mg/kg in cats (24).

Another factor contributing to impunity is the lack of formal complaints. As evidenced in this study, only 29% of the cases resulted in a police report. This may be related to a lack of awareness regarding legal rights, fear of retaliation, and/or a perception of impunity. However, it is possible that this percentage may increase in Brazil in the future with the implementation of prison sentences for individuals who commit such crimes, such as those sanctioned in 2020 (13, 14), which has already been observed in some cities, such as Juiz de Fora (Minas Gerais), where an increase of nearly 60% in reports of animal mistreatment between 2020 and 2021 (4). Although some cases of poisoning may be accidental, given that some of the toxic agents mentioned above, even though prohibited, are used as rodenticides. However, among the 29 police reports, 51.72% indicated suspicion that the neighbor was the perpetrator of the crime, with four owners having received threats previously. This finding is consistent with observations made by Marlet and Maiorka (15). Furthermore, in 10.34% of the cases, the whistleblower reported other similar deaths in the neighborhood, indicating that such crimes often do not occur in isolation.

The findings from necropsies were predominantly nonspecific, with cardiovascular injuries being the most common, leading to congestion and hemorrhage, depending on the agent used. In 45% of the cases, black granular content was identified in the gastrointestinal tract; of these, 12 tested positives for carbamate, and one tested positive for organophosphate, underscoring the importance of toxicological examinations for confirming the agent involved. Given this significance, the low percentage of samples submitted for toxicological analysis represents the most significant limitation of this study.

In conclusion, the findings of this study corroborate the literature, with young dogs of undefined breed being the main victims of this type of abuse. It was also observed that the necropsy findings are nonspecific, highlighting the importance of toxicological testing to confirm poisoning and identify the agent. However, it was observed that adherence to this test is still low, having been performed in only 32% of cases.

Supplementary Material

The online version contains supplementary material available at https://doi.org/10.24070/bjvp.1983-0246.019001.

Conflict of Interest

The authors declare no competing interests.

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