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Insights into the two single cases of the silent cause of death in dogs, the carcinogenic nematode

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ABSTRACT

The factor that contributes to the development of oesophageal nodular granuloma in canin is the carcinogenic dog nematode known as *Spirocerca lupi*. This nodular forming nematode can have broader epidemiology because of the widespread availability of its biological host (the beetle) as well as certain environmental factors. Because of the similarities in the morphology of the eggs, the study coprology of depends on the presence of rhabditiform larvae in most nematodes and the features of those larvae. In contrast, the physical appearance of the eggs in the presence of carcinogenic nematodes is conclusive for diagnosis. Flotation and sedimentation techniques may detect this in a faecal examination in order to detect gastrointestinal parasites. These two single cases in the Amedi, Kurdistan Region were the first reports of confirmed cases of the silent killer cause of death in dogs. The parasite's eggs in the samples of the dog's faeces need to be confirmed through molecular and specific gene amplification.

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Introduction

In recent decades, the intimate contact between humans and domestic animals has resulted in major advantages for all species involved, particularly in terms of the social, emotional, and physical welfare of the animals (Robertson et al. 2000). However, it is imperative to keep in mind that this proximity might have major repercussions for human health, particularly where animal cleanliness. Given the high zoonotic probability, the protozoan and helminth parasites that live in the gastrointestinal tract of carnivorous animals pose a threat to the health of the host, as well as the veterinarian and the owners of these animals (Abdul Hafeez et al. 2022; Foroutan et al. 2022). The prevalence of gastrointestinal parasites in dogs all around the world has been the subject of several different surveys (Frangipane et al. 2022; Pilarczyk et al. 2022; Shahat et al. 2022). *Uncinaria stenocephala*, *Isospora canis*, *Ancylostoma*

caninum, *Diploidium caninum*, *Hymenolepis nana*, *Taenia* spp. (Abdulrehman Muhamed & Omer Al-barwary, 2016), *Mesocostoides* spp, *Strongyloides* spp (Hasson 2014), *Diphyllobothrium latum*, *Ancylostoma caninum* (Khalaf & Khalil, 2018). Helminth parasites have been suggested as potential causative agents for a variety of cancers in a number of research publications (Mayer & Fried, 2007; Fried et al. 2011; Brindley et al. 2015). These papers were published in 2015. Helminths including *Schistosoma haematobium*, *Clonorchis sinensis*, and *Opisthorchis viverrine*, which are usually related with urinary bladder cancer in humans, are among the many helminths that have been implicated as carcinogenic agents (Dematei et al. 2017; Jain et al. 2019). *Toxoplasma gondii*, a parasite that raises a person's likelihood of developing brain tumors (Thomas et al. 2012). In 1955, it was observed that there may be a connection between malignant esophageal tumors and lesions caused by the parasite *Spirocerca lupi* in dogs.

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Spirocercosis is a helminthic disease that can be fatal. It is caused by *Spirocerca lupi*, which is a member of the nematode phylum and the spirurida order. It progresses into conditions such as spondylitis, thrombosis, gastric and esophageal nodular granuloma, malignancies, and secondary pulmonary osteoarthropathy, and it may eventually lead to metastatic sarcomas (Porrás-Silesky et al. 2021). The esophageal nodular worm lays embryonated eggs, which need to be ingested by the intermediate host coprophagous beetles and undergo further development within two months to reach the infective stage for the final host, which is the larval stage 3 in dogs. The esophageal nodular worm lays its eggs in the esophagus of infected coprophagous beetles (Fig 1). *S. lupi* can be found all over the world, but its incidence is highest in tropical and subtropical regions. However, there have been documented

cases of the parasite in temperate regions as well. Canine population density is one of the primary epidemiologic drivers of the disease; nevertheless, environmental elements (such as radiation, rainfall, pH, temperature, sunlight, and soil type) that sustain the source of the intermediate hosts are also key contributors to the spread of the disease (Van der Merwe et al. 2008). The pathogenicity of spirocercosis is caused by the migration of the parasite's larvae to the oesophagus, where they are then infected by secondary bacteria. In some instances, a malignant transformation takes place in the oesophageal granuloma, resulting in the formation of a sarcoma, with or without metastasis (Ranen et al. 2004). The goal of this study was to find out if sheepdogs from northern Iraq might have a nematode that causes neoplasia.

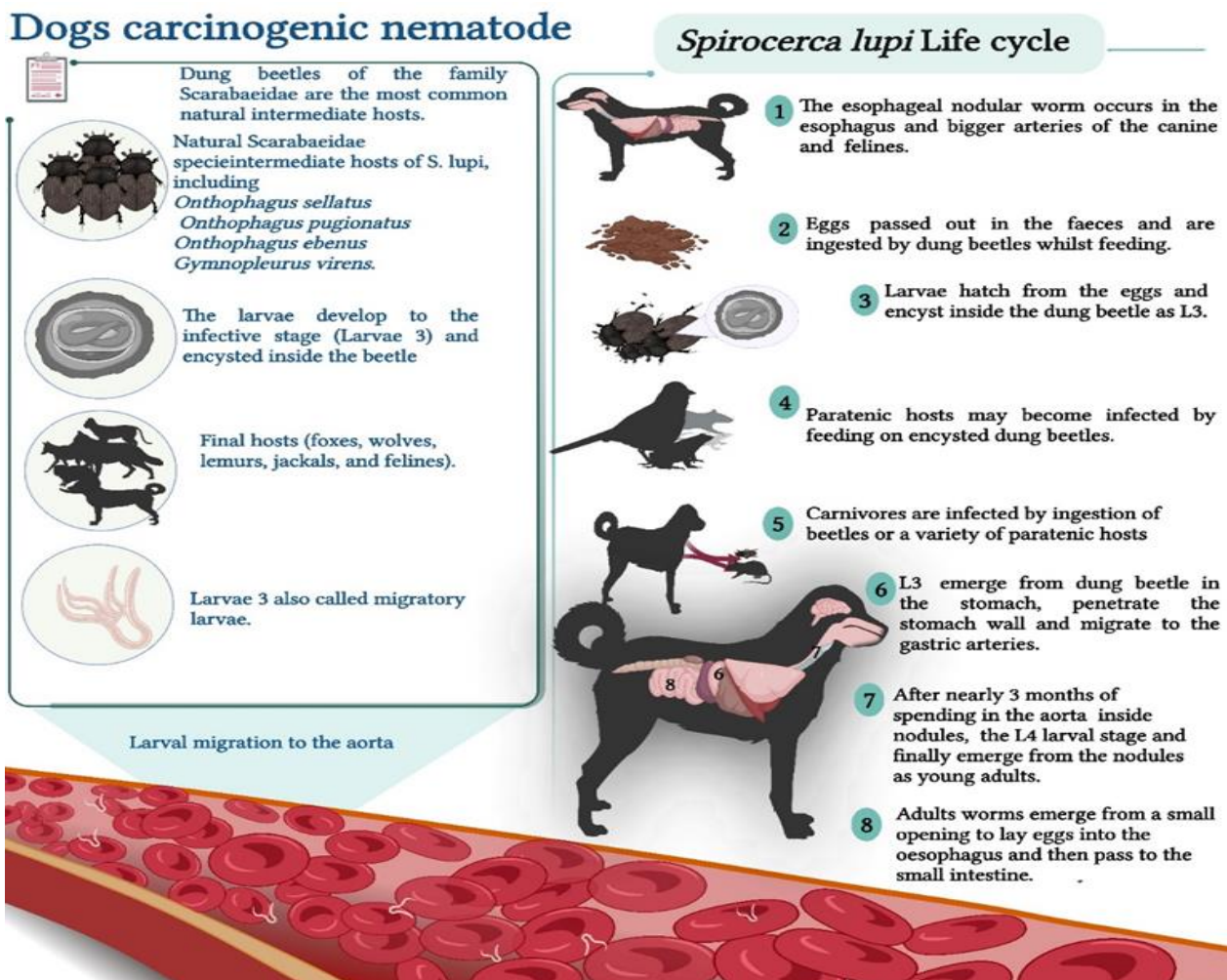


Fig 1. The nodular worm life cycle in the dog's body starts with the ingesting of the infected intermediate with the embryonated egg of the nematodes or the swallowing of the infected paratenic host with the infected intermediate host, followed by the release of the infective larvae into the stomach, where they penetrate the mucosa and begin a migration that may take three weeks to reach the thoracic aorta. The majority of the larvae leave the aorta after three months of infection and migrate into the esophagus, where they may stimulate granulomatous nodules to form. Created with BioRender.com

Case presentation

During screening for the detection of spirocossis causative agents in shepherd dogs, two individual cases were reported among 51 dogs in the Amedy district, Duhok province, Kurdistan Region, Iraq. Two female shepherd dogs with the problem of respiration and regurgitation nearly twice monthly, depression and anorexia were observed (Fig 2). A physical examination was performed on the dogs. The faecal samples were examined by the flotation concentration technique and formalin ether sedimentation, as mentioned by Dryden and Allen (Allen & Ridley 1970; Dryden et al. 2005). The modified Sheather sugar solution (355 ml of tap water, 454 grams of granulated sugar, and 6 ml of formaldehyde) is mixed and dissolved with a gentle heat. No preparation was needed for the formalin-ether sedimentation technique, and the procedure details are in figure 3. Both procedures were done twice, and three slides were made for each method in order to make the technique more sensitive.



Fig 2. Female shepherd dog with signs of illness (abnormal respiration, emaciation, and weight loss).

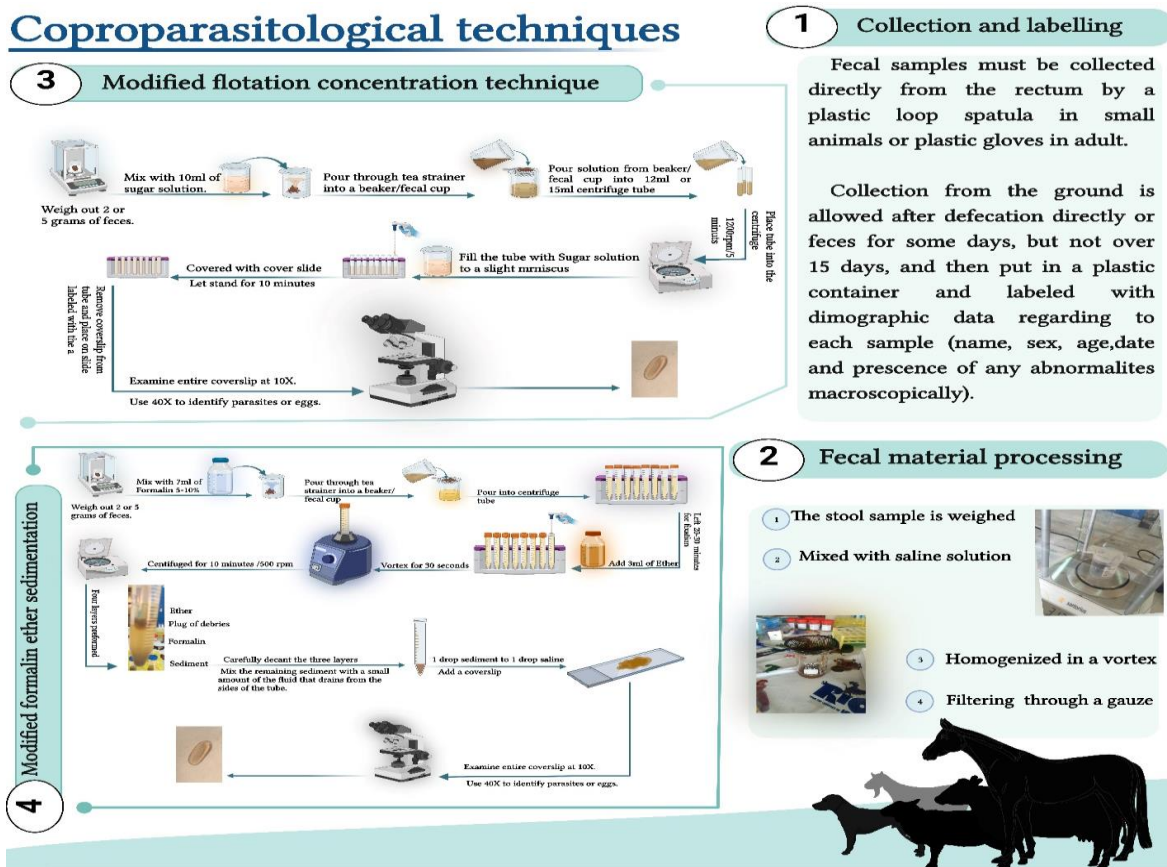


Fig 3. Flotation is the most commonly used technique for recovering parasite eggs and oocysts, and it is based on differences in the specific gravity (SG) of the egg(s), faecal debris, and flotation solution. Most parasite eggs have SG values ranging from 1.05 to 1.23. The SG of the flotation solution must be greater than that of the parasite eggs for the eggs to float. The formalin ether sedimentation is distinguished by the fixation of the egg morphology and the use of ether to remove debris. Created with BioRender.com

Discussion and conclusion

The outcomes of the coprological study are influenced by a number of different elements. The brief lifespan of the parasite, which has an effect on the passage of the eggs and is only present when the female is in patent passage to the oesophageal lumen, makes it difficult to identify eggs in feces. This is because the eggs are only present when the female is in patent passage. In order to get greater diagnostic accuracy, it is necessary to do a negative faecal flotation more than once (Fig. 4). This is in addition to the laboratory expertise that is required for the method. Doramectin is the most effective medicine for treating spirocercosis. It was effective in attaining clinical remission when administered in a dosage of (200 g/kg SC) with 14-day intervals between three treatments.

The effects of canine spirocercosis are still not well known, particularly in nations such as Iraq that do not experience the disease naturally. As a consequence of this, awareness is required in order to hasten the process of diagnosis when clinical symptoms are present. When paired with clinical indications such as regurgitation, vomiting, dysphagia, weight loss, weakness, and shortness of breath, an anamnesis of feeding behavior, dog lifestyle and function, and living environment may assist in the diagnosis of canine spirocercosis.



Fig.4. *Spirocerca lupi* embryonated egg, x1000 by oil immersion.

In conclusion, this article ought to serve as a cautionary note to veterinarians, drawing their attention to the potential risks that are linked with this underappreciated and, as of yet, little-known parasite. In addition, a differential diagnosis for canine spirocercosis should be explored in animals exhibiting hypersalivation, aortic thromboembolism, or asymmetric spinal cord abnormalities. Last but not least, it is essential that research

be done to determine whether or not wild animals are a source of the *S. lupi* sickness. In addition, research needs to be conducted to determine the prevalence of canine spirocercosis in domestic carnivores residing in rural areas of Iraq. These locations are known to have canines living alongside wild animals.

Ethical Statement

This study was fully compliant with the ethical requirements for animal welfare and the study got the license No 289.

Declaration of competing interest

All authors of this manuscript declare there are no financial and personal relationships with other people or organizations that could inappropriately influence the intellectual work presented in this paper.

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