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Original article

Prevalence of *Sarcocystis* spp. in Sheep Cardiac Tissue at Al Bayda Municipal Abattoirs: A Histological Cross-Sectional Study

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Abstract
Sarcocystis is an intracellular cyst-forming protozoan parasite belonging to the phylum Apicomplexa. It infects a wide range of vertebrates, including sheep, and has significant veterinary and public health importance. This study aimed to determine the prevalence of Sarcocystis spp. Infection in cardiac tissues of slaughtered sheep at the municipal abattoirs of Al Bayda, Libya, using histopathological examination, focusing on cases with no visible macroscopic cysts. Fresh cardiac tissue samples were collected from 50 slaughtered sheep (both sexes and various ages) between May 2025 and April 2026 from hearts lacking visible macroscopic sarcocysts. Tissues were fixed in 10% neutral buffered formalin, processed by routine histological methods, sectioned at 5 µm thickness, and stained with Harris's hematoxylin and eosin (H&E) for microscopic examination. Histopathological examination revealed Sarcocystis infection in all 50 samples (100% prevalence). Microscopic thin-walled sarcocysts with similar morphology were observed in cardiac tissues, while no macroscopic cysts were detected by naked-eye inspection. No inflammatory reaction was observed around the sarcocysts (absence of pericystic inflammatory infiltrates), and no prominent degenerative or inflammatory changes were noted in the infected cardiac tissue. The study concludes that Sarcocystis infection is highly prevalent (100%) in the cardiac tissue of sheep slaughtered in Al Bayda abattoirs, with the absence of macroscopic cysts and lack of pericystic inflammation. Histopathological examination is of great diagnostic value for detecting Sarcocystis infection, especially when macroscopic lesions are absent, and gross examination alone is insufficient to estimate the true prevalence of the parasite.
Keywords. Sarcocystis, Cardiac tissues, Sheep, Histopathological examination, Al Bayda, Libya.

Introduction

The Sarcocystis (phylum:Apicomplexa) is an intracellular cyst-forming protozoan parasite that infects a wide range of vertebrates, and is the most common protozoan found in animal muscle tissue that is meant for human consumption[1, 2]. Approximately 220 species of Sarcocystis spp. have been identified in birds, mammals, and reptiles[3, 4]. Sheep and cattle can contract Sarcocystis infections from many species. These parasites cause macrocysts or microsarcocysts to form in the skeletal, cardiac, and central nervous systems[5]. The life cycle of Sarcocystis requires two necessary hosts: the definitive host (a carnivorous animal, such as a dog), in which sporogony and gametogony occur in the intestinal lumen, producing intestinal sarcocystosis, and the intermediate host (an herbivorous or omnivorous animal) in which merogony and cyst (sarcocyst) formation develop in the muscles, leading to muscular sarcocystosis[6]. Developingin a two-host, intermediate, and definitive host, humans can serve as an intermediate host and definitive host for different Sarcocystis species. Consequently, humans are definitive hosts when they consume tissue cysts with undercooked meat,sarcocysts[5]. Animals that are significantly afflicted by sarcocystosis commonly exhibit clinical signs such as pyrexia, debilitation, cachexia, and loss of body mass, as well as compromised wool quality, alopecia, and diminished lactation output. Furthermore, the meat industry incurs considerable financial detriment due to the rejection of carcasses from heavily infected animals that display discernible Sarcocystis cysts [7, 8].

Ovine species exhibit a susceptibility to infection by six distinct species of Sarcocystis. Among these parasites, S. tenella (S. ovicanis), S. arieticanis, S. microps, and S. mihoensis are characterized by canids serving as their definitive hosts. Conversely, the remaining two species, S. gigantea (S. ovifelis) and S. medusiformis, identify felines as their ultimate hosts[9, 10]. It is significant to note that S. tenella and S. arieticanis are categorized as pathogenic and are known to develop microscopic cysts, while S. gigantea and S. medusiformis are classified as non-pathogenic and are responsible for the formation of macroscopic cysts within ovine hosts [11].This study aimed to determine the prevalence of Sarcocystis in slaughtered sheep at the Al BaydaMunicipal Abattoirs in Libya, specifically in cardiac tissues where macroscopic cysts are absent. This process can be performed using histopathological examination.

Methods

From May 2025 to April 2026, samples were systematically collected and underwent gross (macroscopic) inspection during the slaughter process at the Al Bayda Municipal Abattoirs in Libya. The sampling included sheep of both sexes and various age groups. Each carcass underwent examination for visible macroscopic cysts that indicated the presence of cyst-forming Sarcocystis spp. Following this, fresh cardiac tissue specimens were collected specifically from 50 slaughtered sheep that exhibited no macroscopic cysts during

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the gross examination. Immediately after collection, the cardiac tissues were fixed in 10% neutral buffered formalin to preserve their cellular and tissue architecture. The fixed samples were then processed using a standard histological workflow that included graded dehydration through increasing concentrations of ethyl alcohol, followed by clearing of tissues and embedding in paraffin wax. Paraffin-embedded blocks were sectioned on a microtome to obtain serial histological sections of 5 µm thickness, which were mounted onto charged glass slides to enhance tissue adherence, and stained for histopathological assessment with Harris's hematoxylin and eosin (H&E) [12].

Results

Histopathological examination was conducted on cardiac tissue samples collected from 50 slaughtered sheep at Al Bayda Municipal Abattoirs, Libya. Microscopic assessment demonstrated that Sarcocystis infection was highly prevalent, with an overall infection rate of 100%. Sarcocysts were detected in all examined animals, confirming that the parasite was widespread among the slaughtered population during the study period. Sarcocysts observed in the cardiac tissues showed similar morphologies across samples. The consistency of the sarcyst type suggests that the tissue-stage infection shared common developmental and morphological characteristics within the examined group. Importantly, the parasites were clearly identifiable at the microscopic level, providing direct histopathological evidence of infection.

A key histopathological observation in the present study was the absence of an inflammatory reaction around the sarcysts within the cardiac muscle. No pericystic inflammatory infiltrates were detected in association with the cysts, and inflammatory changes were not observed as a consistent feature of the lesions. In addition, most affected samples were reported to be free from prominent degenerative and inflammatory alterations, indicating that although the parasite was present, it was not accompanied by extensive tissue disruption in the cardiac tissue at the microscopic level.

Interestingly, while sarcysts were readily detectable histologically, macroscopic sarcysts were not observed in any of the examined samples. None of the animals showed visible sarcysts in cardiac tissues when assessed by naked-eye inspection. This finding emphasizes that gross examination alone may underestimate or fail to detect *Sarcocystis* lesions.Overall, the study outcomes demonstrate a pattern characterized by widespread microscopic infection withoutpericystic inflammatory pathology in cardiac tissue. The results highlight the diagnostic value of histopathological examination for confirming *Sarcocystis* infection in sheep, especially in cases where macroscopic lesions are absent.

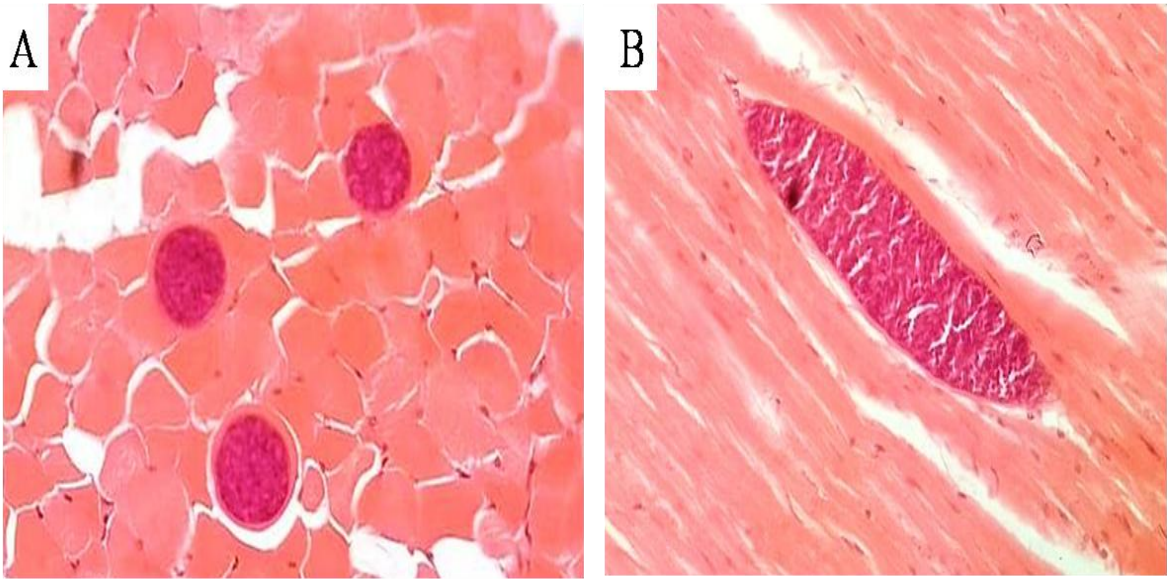

Figure 1. Histopathological findings in Sarcocystis spp. , sheep, hematoxylin and eosin. A) A cross-section of myocardium showing: Within multiple myofibers, several oval to round sarcocysts are clearly visible, adapted to the cross-sectional plane. Eac Each sarcocyst is bordered by a thin, smooth, eosinophilic cyst wall that lacks any radial spines or protrusions. Inside the cyst, numerous crescent-shaped bradyzoites (zoites) are packed densely, often arranged peripherally around a granular, basophilic central core. (100X). B) longitudinalsectionof myocardium showing: thin-walled septatesarcocyst containing a myriad of banana-shaped bradyzoites in the myocardium.The bradyzoites stain deeply basophilic with H&E.(400X)

Discussion

The present study demonstrates a high prevalence and significant parasite burden of Sarcocystis in the cardiac tissue of slaughtered sheep, as indicated by the presence of numerous sarcocysts. Such findings are important for both animal health and public health.It is significant to note that pathogenic species form microscopic cysts, whereas non-pathogenic species form macroscopic cysts within ovine hosts [11]. Consequently, the detection of abundant sarcysts in the current cardiac tissues not only confirms the occurrence of Sarcocystis infection in sheep but also suggests the potential presence of pathogenic

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microscopic stages that may remain undetected by routine gross inspection, thereby strengthening the epidemiological and diagnostic significance of the histopathological findings. In intermediate hosts (including sheep), Sarcocystis infections are associated with economic and health impacts such as poor growth, reduced productivity, carcass condemnation at meat inspection, and, in some situations, reproductive losses [13]. These effects may be subtle in many animals, but the presence of heavy cyst burdens in edible tissues highlights the need for control measures at slaughter. From a zoonotic perspective, Sarcocystis is relevant to human health because people can become infected mainly through the consumption of undercooked meat containing viable sarcysts.

Human intestinal sarcocystosis has been linked to the consumption of raw or undercooked meat containing viable Sarcocystis tissue cysts (bradyzoites). After ingestion, the bradyzoites excyst in the small intestine, invade the intestinal mucosa, and develop into sexual stages, with subsequent egg/sporocyst shedding in stool. Therefore, the detection of abundant sarcysts in cardiac tissue supports the importance of meat inspection, hygienic processing, and proper cooking to reduce transmission risk[14]. Concerning organ distribution, although cardiac muscle was clearly infected in the current study, previous investigations have reported that the occurrence/intensity among organs can vary, and macroscopic cysts (when assessed across organs) have been reported as lowest in the heart compared with other examined tissues[15].

Similarly, studies evaluating the distribution pattern of Sarcocystis across different tissues in sheep show that the parasite preferentially localizes in particular sites rather than uniformly across all organs, supporting the idea that heart infection rates may be lower than other muscles or tissues in some settings[16]. Importantly, these studies were based on macroscopic (gross) examination of cardiac muscle, which may explain differences in detection rates and observed cyst burden compared with microscopic histology. This finding emphasizes that gross examination alone may underestimate or fail to detect Sarcocystis lesions, particularly when cysts are thin-walled and may not produce conspicuous macroscopic changes.

Conclusion

In conclusion, the research presents compelling evidence indicating that Sarcocystis infection among slaughtered ovine specimens within the examined abattoir region exhibits an exceptionally high prevalence rate of 100%, characterized by sarcysts displaying a consistently thin-walled morphology, and an absence of any discernible pericystic inflammatory response within cardiac tissues. The detection of the parasites was effectively accomplished through histological methods; conversely, macroscopic lesions were not identified, thereby underscoring the critical significance of histopathological evaluation for the precise diagnosis and comprehensive assessment of Sarcocystis infection in sheep.

Conflicts of Interest

The authors declare no conflict of interest.

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