

Hidden Zoonotic Risk in Cardiac Sarcocystosis of Cattle: Integrative Histopathological and Molecular Evidence from Upper Northern Thailand

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Abstract

Background: *Sarcocystis* spp. are globally important protozoan parasites of livestock with recognized veterinary and public health significance, particularly due to the zoonotic potential of certain species such as *Sarcocystis hominis*. Infection in food animals is often subclinical but may have implications for meat safety and public health. However, information on their pathological characteristics, species distribution, and zoonotic implications in upper northern Thailand remains limited.

Objectives: This study aimed to investigate *Sarcocystis* spp. infection in cardiac tissues from livestock, with emphasis on histopathological characterization and molecular species identification.

Methods: A total of 298 fresh heart samples from cattle (227 samples) and buffalo (71 samples) collected from eight provinces in upper northern Thailand between October 2023 and March 2026, were examined using a parasitological stamp smear method. Histopathological analysis was performed to characterize cyst morphology. For molecular confirmation, 17 representative samples were analyzed by PCR targeting 18S rRNA and mitochondrial cox1 genes, followed by phylogenetic analysis.

Results: Sarcocysts were detected in 82/298 samples (27.5%), with occurrences 31.7% in cattle (72/227) and 14.1% in buffalo (10/71). Histopathological examination revealed numerous intramyocytic sarcocysts embedded within cardiomyocytes without associated inflammatory response. Two distinct morphological groups were identified from 17 randomly selected samples based on cyst wall measurements: thick-walled cysts ($6.45 \pm 1.11 \mu\text{m}$; $n = 16$ cysts) and thin-walled cysts ($1.99 \pm 0.40 \mu\text{m}$; $n = 30$ cysts). Wall thickness was significantly greater in the thick-wall group ($p < 0.001$). Within these selected samples, molecular analysis identified mixed infections consistent with *Sarcocystis hominis* and *Sarcocystis cruzi* in four cattle samples, which related exclusively with the presence of thick-walled cysts (*Sarcocystis hominis*) in histopathology; in contrast, the remaining samples were associated only with thin-walled cysts. Phylogenetic analysis based on both markers clustered predominantly with *S. cruzi*, with 18S sequences showing close relatedness to isolates from Thailand and neighboring countries. The consistent association between thick-walled cyst morphology and molecular detection of *S. hominis* suggests that zoonotic species may be present but underrepresented in phylogenetic analysis.

Conclusion: These findings highlight the presence of thick-walled sarcocysts suggestive of zoonotic *Sarcocystis hominis* in the study area. From a One Health perspective, this raises potential public health concerns associated with the consumption of raw or undercooked meat, emphasizing the need for increased awareness, surveillance, meat inspection, and appropriate food hygiene practices in endemic regions of northern Thailand.

Keywords: Cardiac sarcocystosis, Histopathology, Zoonotic risk, Molecular evidence, Upper northern Thailand

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