


CASE REPORT

PIGS

Disseminated *Sarcocystis miescheriana* infection in a finisher pig in Grenada

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Abstract

Sarcocystis miescheriana infection is an important cause of carcass condemnation during meat inspection. The infection can cause morbidity and mortality in domestic pigs. In this study, an 8-month-old finisher pig was presented to a local abattoir for slaughter. Multiple white nodular lesions affecting the meat were observed, resulting in the condemnation of the carcass. Consequently, half of the carcass was submitted to the necropsy diagnostic laboratory in the School of Veterinary Medicine for further evaluation. Grossly, all superficial and deep muscle groups had severe multifocal macrocysts (3 mm × 2 mm × 1 mm) on the surface and extending deep into the skeletal musculature. Histopathology revealed moderate multifocal granulomatous and eosinophilic myositis with intralesional degenerated and intact parasites. Sample genomic DNA sequence analysis of the 18S RNA gene showed 100% identity to *S. miescheriana* in the GenBank. This is the first report of *S. miescheriana* in Grenada, West Indies.

KEYWORDS

Grenada, necropsy, phylogeny, pig, *Sarcocystis miescheriana*

1 | INTRODUCTION

Sarcocystosis is a protozoan disease caused by intracellular parasites belonging to the genus *Sarcocystis*. Domestic and wild pigs are important intermediate hosts of *Sarcocystis* spp. worldwide (Avapal et al., 2004). The reported *Sarcocystis* spp. affecting domestic pigs include *Sarcocystis miescheriana*, *Sarcocystis suis hominis* and *Sarcocystis porcifelis*, the definitive hosts of which are dogs, humans and cats, respectively (Avapal et al., 2004; Imre et al., 2017).

Among the three species of *Sarcocystis*, only *S. suis hominis* is of public health importance (Solaymani-Mohammadi & Petri, 2006). Meat and meat products are the main sources of infection to human beings

through the ingestion of well-developed tissue cysts containing bradyzoites (Dubey and Powell, 1994).

Although sarcocystosis caused by *S. miescheriana* has no zoonotic implications, it is an important cause of carcass condemnation at meat inspection, resulting in significant economic losses (Rubiola et al., 2023). Additionally, it has been reported as a cause of reduced growth rate, morbidity and mortality in domestic pigs (Avapal et al., 2004; Caspari et al., 2011). To the best of our knowledge, sarcocystosis due to *S. miescheriana* has not been reported in the Caribbean region and Grenada in particular. We report a case of severe disseminated sarcocystosis in a domestic finisher pig.

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FIGURE 1 Multiple macrocysts are present in skeletal muscle (arrows).

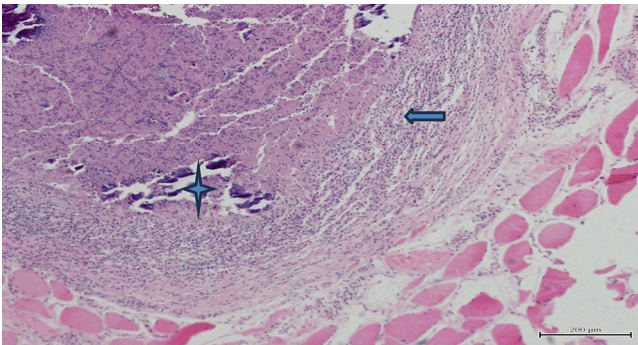


FIGURE 2 Granulomatous and eosinophilic myositis (arrow) with intralesional degenerated *Sarcocystis* parasites (star).

2 | CASE PRESENTATION

An 8-month-old pig was presented to a local abattoir for slaughter. Due to multiple white nodular foci affecting the meat, the butcher contacted the Veterinary Department in the Ministry of Agriculture, who subsequently condemned the entire carcass against human consumption. Consequently, the meat representing half of the carcass was submitted to the necropsy diagnostic laboratory in the School of Veterinary Medicine at St. George's University for further evaluation.

Grossly, all superficial and deep muscle groups contained hundreds to thousands of small white, spindle-shaped, rice grain-like, soft macrocysts (3 mm × 2 mm × 1 mm) on the surface and extending deep into the skeletal muscles (Figure 1). Histopathology revealed moderate multifocal granulomatous and eosinophilic myositis with intralesional degenerated parasites (Figure 2). Intact sarcocysts with bradyzoites were also observed in myofibres (Figure 3). Furthermore, sample genomic DNA was used in a nested PCR to amplify approximately 310 bp fragments from 18S ribosomal RNA (18S rRNA) gene as previously described by Costa da Silva et al. (2009). Nucleotide sequence analysis of the 18S rRNA PCR products showed 100% identity to *S. miescheriana* in the GenBank (Figure 4).

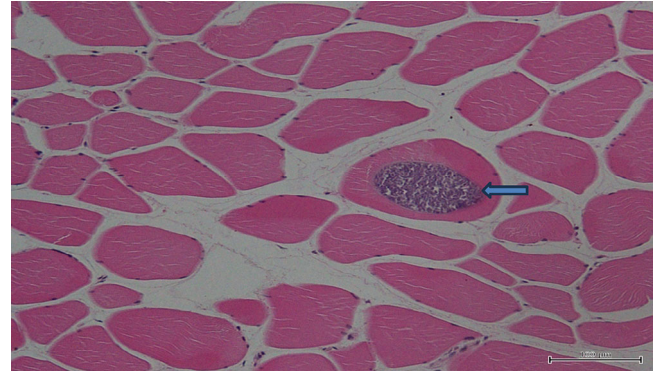


FIGURE 3 Tissue cyst with bradyzoites in a myofibre (arrow).

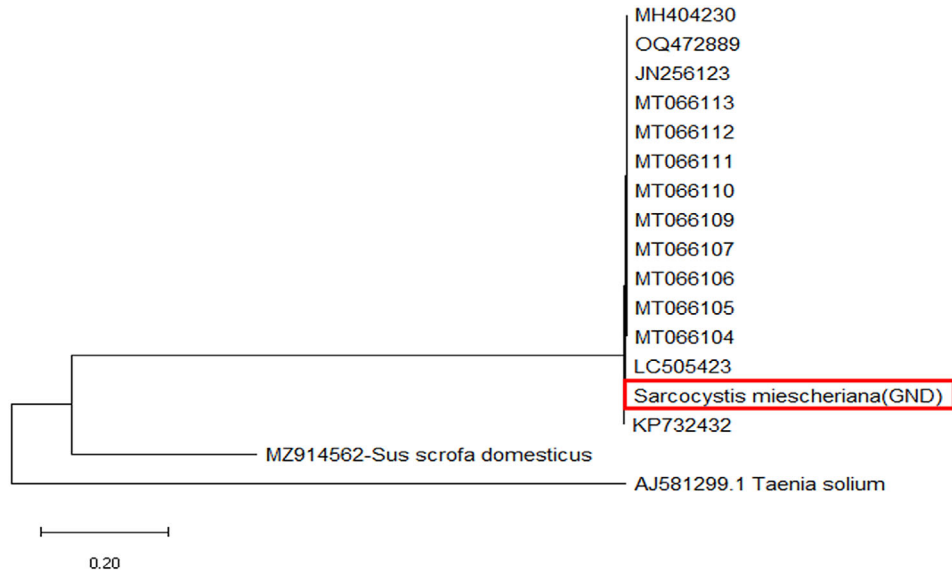
3 | DISCUSSION

Sarcocystosis has been reported in pigs worldwide (Zainalabidin et al., 2017). Prevalence of *Sarcocystis* spp. in slaughtered pigs varies widely among and within countries. For example, it is 68% in India (Saleque & Bhatia, 1991), 36.8% in China (Huang et al., 2019), 58% in Malaysia (Zainalabidin et al., 2017) and 27% in the Philippines (Claveria et al., 2001). The present case provides evidence of the presence of sarcocystosis in pigs in Grenada and forms the basis on which to conduct a cross-sectional study to determine the prevalence of *Sarcocystis* spp. and associated risk factors. Additionally, this calls for increased surveillance for this parasite at the abattoir by trained meat inspectors from the Ministry of Health, working in conjunction with veterinary personnel.

To guarantee food safety, antemortem and post-mortem inspection of animals meant for slaughter cannot be overemphasized (García-Díez et al., 2023). This practice provides an important tool for the surveillance and monitoring of diseases, especially those of public health importance (García-Díez et al., 2023). As mentioned earlier, only *S. suis-hominis* from pigs is zoonotic, whereas *S. miescheriana* reported in the present case is not. However, infected meat is aesthetically unpleasant and, therefore, unfit for human consumption.

The pig industry in Grenada is underdeveloped and consists of small-scale farmers (Tiwari et al., 2009). The farm under discussion has approximately 60 pigs, which can be considered a medium farm in Grenada. Pigs are fed both commercial and local feed and biosecurity is inadequate. So far, only this farm, located in St. David, one of the six parishes of Grenada, has been affected by *S. miescheriana*. A few additional pigs have succumbed to *S. miescheriana* after the present case. Dogs are present on the farm, and because they are the definitive hosts for *S. miescheriana*, they can be important in the outbreak of *S. miescheriana* on this farm.

Although pigs are raised throughout the island of Grenada and both owned and stray dogs are present on the farms, it is surprising that only one pig farm has been affected so far. It is possible that the pigs on this farm are genetically susceptible to *S. miescheriana*. Evidence of



Phylogenetic relationships based on 18S ribosomal RNA (18S-rRNA) sequences of the amplified *Sarcocystis miescheriana* DNA fragment. The tree was constructed and analyzed using a maximum likelihood method and Tamura-Nei model.

FIGURE 4 Phylogenetic relationships based on 18S ribosomal RNA (18S-rRNA) sequences of the amplified *Sarcocystis miescheriana* DNA fragment. The tree was constructed and analysed using a maximum likelihood method and the Tamura-Nei model.

genetic predisposition to *S. miescheriana* has been documented in Chinese Meishan and European Pietrain breeds of pigs (Reiner, Hepp, et al., 2007; Reiner, Kliemt, et al., 2007).

The common cause of parasitic myopathy with eosinophilic myositis in pigs is trichinosis, a disease of economic and public importance (Valentine, 2022). *Sarcocystis* spp. are occasionally reported in pigs as an incidental finding and can experimentally cause eosinophilic myocarditis in pigs (Valentine, 2022). Based on the gross and histologic findings in this report, *S. miescheriana* should be included as a differential diagnosis for eosinophilic and granulomatous myositis in pigs in Grenada.

4 | CONCLUSION

This case confirms the presence of *S. miescheriana* in a finisher pig. This report also underscores the need for a standardized meat inspection protocol on the island to assure meat quality and protect public health. Further studies on *Sarcocystis* spp. in Grenada will be valuable to provide insight into the epidemiology and possible genetic predisposition of Grenadian pigs to this protozoan parasite.

AUTHOR CONTRIBUTIONS

Conceptualization; investigation and writing of original draft: Alfred Chikweto. Technical support and review of original draft: Veronica

Mapp-Alexander. Investigation and review of original draft: Kimond Cummings. Investigation and review of original draft: Muhammad I. Bhaiyat. Conceptualization; investigation; review of original draft: Andy Alhassan.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

FUNDING INFORMATION

None.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

None.

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PEER REVIEW

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