ABSTRACT. Limited information is available regarding gastro-intestinal (GI) parasitic infections in Malaysian swine populations. Hence, the present study aims to determine the prevalence of GI parasites in two swine populations in Malaysia, using formalin-ether concentration technique. In the present study, three helminths and two protozoa were detected in 91 swine rectal fecal samples. The zoonotic transmissible protozoan, Balantidium coli (22.0%) had the highest infection rate, followed by strongyle (4.4%), Entamoeba spp. (2.2%), Fasciolopsis spp. (1.1%) and Trichuris suis (1.1%). The co-infection between T. suis and B. coli was also found in this study.

Keywords: Balantidium coli, parasitic infection, swine

INTRODUCTION

Up to 2011, the swine population in Malaysia has reached 1.8 million and contributed 231,000 million tons of pork products. The pork consumptions (229,820 million tons) were 9 and 1.4 folds higher than mutton (24,221.3 million tons) and beef (168,273 million tons), respectively (Department of Veterinary Services, Malaysia, www.dvs.gov.my). These data indicates the significant contribution of swine to the livestock production on local economies as well as the need to safeguard this industry as a source of reliable nutrition for Malaysia.

The high demands of swine products in Malaysia require better farm management to minimize the impact of gastro-intestinal (GI) parasitic diseases which might cause reduced productivity in terms of weight loss and ill health. As reviewed by Waller (2006), nematode parasites have been the most hazardous helminths to livestock, causing severe losses in the agriculture industry. Among these helminths, Ascaris suum (5.2% to 72.7%), Oesophagostomum spp. (2.5% to 25%) and Trichuris suis (5.7% to 37.5%) have been the commonest parasites detected in swine with a wide range of infection rate (Roepstorff et al., 1998; Eijck and Borgsteede, 2005; Weng et al., 2005; Lai et al., 2011). In addition, several zoonotic transmissible protozoa have also...
been commonly reported in swine (i.e., *Balantidium coli*, *Cryptosporidium* spp. and *Giardia* spp.) (Roepstorff et al., 1998; Weng et al., 2005; Lai et al., 2011).

Over the years, a number of studies on GI parasitic infections in livestock (i.e., sheep, goats, deer and cattle) have been reported in Malaysia (Singh and Krishnasamy, 1980; Ikeme et al., 1987; Dorny et al., 1995; Jalila et al., 1998; Chandrawathi et al., 2009; Norhamizah et al., 2011). Unfortunately, the most recent reported GI parasitic infections among swine have been 26 years ago (Lee et al., 1986; Lee et al., 1987; Lee et al., 1988). There has been a serious lack of information regarding the GI parasitic infection in swine populations in Malaysia. Hence, the aim of the present study was to determine the prevalence of GI parasites in swine populations in Malaysia. The findings of this study are crucial for the development of a better understanding of the GI parasite fauna in swine and for the prevention of the spread of infectious parasitic diseases among swine as well as humans.

**MATERIALS AND METHODS**

The experimental design in this study (MEC Ref. No. 896.36) was approved by the Ethics Committee of the University Malaya Medical Centre (UMMC), Malaysia. The scatological survey was carried out in two farms in Malaysia: Farm A situated in Tapah from the state of Perak and Farm B situated in Bau from the state of Sarawak. In both farms, Yorkshire breed swine aged between six to eight months were raised under intensive farming.

A total of 91 rectal fecal samples were collected from both farms (Farm A=69, Farm B=22). Formalin-ether concentration technique (Allen and Ridley, 1969) was performed prior to the examination of the GI parasites. The processed samples were smeared on the clean slides followed by Lugol’s iodine stain and examined by using light microscope with low power of 100× total magnification for helminth egg detection and high power of 400× total magnification for protozoan (oo)cysts detection. Besides, Ziehl-Neelsen staining technique (Casemore et al., 1985) was also applied on the samples to detect the presence of *Cryptosporidium* under 1000× total magnification.

The identification of the GI parasites was based on the morphological characteristics described by Kaufmann (1996) and Taylor et al. (2007). The samples were considered as GI parasite positive when at least one parasite egg or (oo)cyst was detected in each parasitic detection technique.

**RESULTS**

In the present study, five GI parasites (three helminths and two protozoa) were detected in 91 swine rectal fecal samples. The zoonotic transmissible protozoa, *B. coli* (22.0%) recorded the highest infection rate, followed by strongyle (4.4%), *Entamoeba* spp. (2.2%), *Fasciolopsis* spp. (1.1%) and *T.*
suis (1.1%) (Table 1). Different species of parasites were observed in two farms with the exception of B. coli being found in both farms. In farm A, B. coli (7 or 10.1% of 69) was the commonest GI parasites detected followed by strongyle (4 or 5.8% of 69) and Fasciolopsis spp (1 or 1.4% of 69) (Table 2). Similarly, B. coli (13 or 59.1% of 22) reported the highest infection rate in Farm B and a low number of swine were infected by Entamoeba spp. (2 or 9.1% of 22) and T. suis (1 or 4.5% of 22) (Table 2). With regards to the multi-parasitism in swine, only one sample (1 or 3.7% of 27) showed co-infection between T. suis and B. coli (Table 3).

DISCUSSION AND CONCLUSION

Lower GI parasite diversity and infection rate were observed in the present study as compared to the study conducted in 26 years ago at Shah Alam Abattoir in Selangor, Malaysia, where B. coli (65%), coccidial oocysts (59%), Entamoeba suis (42%), Schistosoma incognitum-like eggs (7%), strongyle (4%), Strongyloides spp. (2%), Trichuris spp. (5%), Ascaris spp. (2%) and Capillaria spp. (1%) have been reported from 100 gastrointestinal tracts of swine (Lee et al., 1987).

The frequently reported nematode, T. suis was found less common among studied swine samples compared to other countries over the world, such as 32.2% in Kenya (Nganga et al., 2008), 11.1-37.5% in The Netherlands (Eijck and Borgsteede, 2005), 5.7-10.1% in China (Weng et al., 2005; Lai et al., 2000).

**Table 1**: Overall prevalence of gastrointestinal parasites in swine.

<table>
<thead>
<tr>
<th>Parasitic infection</th>
<th>Swine (N=91)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Helminth</td>
<td>5</td>
</tr>
<tr>
<td>Protozoa</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>27</td>
</tr>
</tbody>
</table>

**Table 2**: Infection rate of gastrointestinal parasites by species in swine.

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Parasitic infection</th>
<th>Farm A (N=69)</th>
<th>Farm B (N=22)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Helminth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fasciolopsis sp.</td>
<td>1</td>
<td>1.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Strongyle</td>
<td>4</td>
<td>5.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Trichuris suis</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>4.5</td>
</tr>
<tr>
<td>Protozoa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balantidium coli</td>
<td>7</td>
<td>10.1</td>
<td>13</td>
<td>59.1</td>
</tr>
<tr>
<td>Entamoeba sp.</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>9.1</td>
</tr>
</tbody>
</table>

**Table 3**: Prevalence of monoparasitism and polyparasitism in GI parasites positive swine samples.

<table>
<thead>
<tr>
<th>Type of Parasitism</th>
<th>Swine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Monoparasitism</td>
<td>26</td>
</tr>
<tr>
<td>Poliparasitism</td>
<td></td>
</tr>
<tr>
<td>Helminth + Protozoa</td>
<td></td>
</tr>
<tr>
<td>Trichuris suis + Balantidium coli</td>
<td>1</td>
</tr>
</tbody>
</table>
et al., 2011) and 4.6% in Ghana (Permin et al., 1999). With regards to 5.8% (4 of 69) of strongyle infected swine samples in Farm A, species specific molecular analyses were performed for the detection of *Haemonchus contortus* and *Trichostrongylus* spp. (Tan et al., 2014), but none of the samples were positive for these species. It has been suggested that the common strongyle species, *Oesophagostomum* spp. might be the possible species infected in the studied swine populations given that these parasites have been frequently reported in many studies (2.5-25%) (Eijck and Borgsteede, 2005; Weng et al., 2005; Lai et al., 2011). However, this statement has yet to be confirmed since no fecal culture and molecular approach was performed for the detection of *Oesophagostomum* spp. On the other hand, *B. coli* was the only pathogenic protozoa parasite detected in the present study. As compared to the present study, the overall infection rates were apparently lower than the survey in the pig herds in Western Australia and Nigeria where more than 50% of the samples have been infected with *B. coli* (Mercy et al., 1989; Yatswako et al., 2007). Nonetheless, the infection rate in the current study concurred with the reports from China (Lai et al., 2011) and Ghana (Permin et al., 1999).

In Malaysia, public health concern on swine was heightened because of the outbreaks of Japanese encephalitis and Nipah viruses (Chua, 2010). However, parasitic infections in Malaysian swine have been totally neglected, particularly the zoonotic transmissible parasites (i.e., *B. coli*). Despite balantidiosis being uncommon in humans, several outbreaks and human infection cases have been reported around the world (Walzer et al., 1973; Cooper and Guderian, 1994; Anargyrou et al., 2003; Vasilakopolou et al., 2003). In addition, it has also been reported that *B. coli* infection may occur due to the close contact with swine among farm workers and pork-butchers; ingestion of swine feces contaminated foods and drinks; and inappropriate waste disposal management (Ferry et al., 2004; Owen, 2005). Therefore, the occurrence of *B. coli* in the studied swine populations could pose a risk of balantidiosis to farm workers. It is crucial to enhance the current farm management, especially the hygiene regulation and proper sewage management in order to prevent the spreading of GI parasites and enhance the healthiness of livestock as well as the farm workers.

In conclusion, low diversity and infection rate of GI parasites were observed among swine samples from two populations in Malaysia. However, to unravel the diversity of GI parasite fauna in Malaysian swine populations, additional sampling efforts should be carried out in the near future.
REFERENCES


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