A SURVEY OF BOVINE, BUBALINE AND SWINE SARCOCYSTOSIS IN THE PHILIPPINES

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Abstract. In a survey conducted from January to December, 1994, muscle tissues in 12 out of 22 slaughtered carabaos ages 8-17 years old and obtained from the Food Terminal Inc, Abbatoir in Laguna showed numerous white and creamy elliptic-shaped soft bodied macrocysts in the throat muscles. Microscopic examination of the throat and cardiac muscle tissues revealed the presence of fusiform-shaped microcysts. Our observations are consistent with previous reports incriminating *Sarcocystis fusiformis* as the most important etiologic agent of bubaline sarcocystosis in the country. In a survey of bovine sarcocystosis in muscle tissues of imported Australian cattle (Brahman Breed) and native cattle obtained from various slaughter houses in Manila and suburbs, prevalence rates of 17% (98/577) and 3% (1/31) were noted, respectively. Sarcocysts were predominant in skeletal muscles and to a lesser extent in cardiac, esophageal and diaphragm muscle tissues. Light microscopic examination of sarcocysts morphology suggests *Sarcocystis cruzi* (=*Sarcocystis bovis*), and *Sarcocystis hominis* (=*Sarcocystis bovihominis*) or *Sarcocystis hirsuta* (=*Sarcocystis bovifelis*) as the likely etiologic agents of bovine sarcocystosis in the country. Of the 225 swines examined, only muscle tissues from a 6-month old swine revealed very young sarcocysts (=metrocytes). A review of available documented studies on sarcocystosis suggests that to date, our findings may represent the first data on the prevalence of bovine and swine sarcocystosis in the Philippines.

INTRODUCTION

Zoonoses are commonly reported worldwide affecting wild and domestic animals as well as humans. There is a paucity in information on the biology, prevalence and distribution of zoonotic infections in the Philippines evidenced by the scanty reports on the subject. Earlier studies have demonstrated the presence of sarcocysts (Arambulo *et al*, 1972; Manuel *et al*, 1983) and/or zoites (Tongson, 1960; Tongson and Pelagio, 1978) in muscle tissues of water buffalos (Philippine Carabao: *Bubalus bubalis*). Manuel *et al* (1983) noted the widespread distribution of bubaline sarcocystosis with *Sarcocystis fusiformis* as the most important etiologic agent. Furthermore, documented studies on bovine and swine sarcocystosis in the Philippines are also wanting. In addition to recent additional data on bubaline sarcocystosis in the country, the present study documents initial findings on the prevalence of sarcocystosis in cattle and swine in the country.

MATERIALS AND METHODS

Host animals consisted of the Philippine water buffalos, Brahman Breed (Australia), and native cattle, and Duroc and Pietrain Breeds of swine. Muscle tissues were obtained from 22 slaughtered carabaos, 608 cattle and 225 swine from various abbatoirs in Manila and nearby provinces during January to December, 1994. Slaughtered animal hosts were from various provinces in the country. Samples of cardiac, skeletal, esophageal/throat and diaphragm muscle tissues were collected from freshly slaughtered animals as early as 0600 hour, were kept in properly labeled sterilized containers and were brought to the laboratory in an ice-box for examination.

Muscle tissues were examined for sarcocysts by gross inspection and examination of unstained squash preparations. Thin slices of muscle tissues were mounted on glass slides, teased lightly with fine needles to which drops of physiologic saline added. Sarcocyst morphology was documented using photomicroscopy.

RESULTS

Twelve (55%) of the 22 slaughtered carabaos (origin: Laguna) at the Food Terminal Inc (FTI) Abbatoir were positive for *Sarcocystis* infection. Numerous white-creamy elliptic-shaped soft-bodied macrocysts (Fig 1) and microcysts (Fig 2) were observed in the throat, and in both the skeletal and cardiac muscle tissues, respectively.

A summary of our survey on bovine sarcocystosis is presented in Table 1. Of the 608 slaughtered cattle, 99 (16%) were positive for sarcocysts. Infection was commonly noted among 3-5 years old cattle, and sarcocysts were predominantly found in skeletal and to a lesser extent in cardiac muscles. Slaughtered cattle at the FTI abbatoir had the highest prevalence rate of 26%, compared to 19% of Pasay Abbatoir (PA), and 10% of San Juan Municipality Slaughter House (SJMSH). Despite the exceedingly small sample size of female cattle surveyed, no significant difference was noted in prevalence rates between the sexes (Table 2). Of the 577 Brahman cattle examined which represents about 95% of the entire sample size, 98 (17%) had sarcocysts, while only one native cattle was positive (Table 3).

Developing bovine sarcocysts (=metrocytes) are shown in Fig 3. They vary in morphology from thick-walled spherical (Fig 3a) to spherical or oval thin-walled young sarcocysts (Fig 3b, 3c). Also, noted were young sarcocysts with septate arrangement of daughter cysts (Fig 3d).

At least two morphologically varied types of fully-formed microcysts were noted in skeletal muscle tissues. One type is characterized as spherical or rounded in shape with thick-radially striated cyst wall or hirsute-like thick-walled cysts (Fig 4a, 4b). Another type of cysts contains very prominent daughter cysts with transverse septal partitions and exhibiting either an off -rounded (Fig 5a, 5b) or fusiform/elongate (Fig 5c, 5d) shape.

Examination of muscle tissues obtained from 225 slaughtered swine (Source: SJMSH, FTI Abbatoir, Lipa City Slaughter House) yielded only one six-month swine with developing sarcocysts (Fig 6).

Fig 1 - Macrocysts in throat muscles of water buffalos.

Fig 2 a,b - Fusiform-shaped microcyst in skeletal muscle-tissue (2a; x100) and cyst wall showing radials-triations (2b; x400).

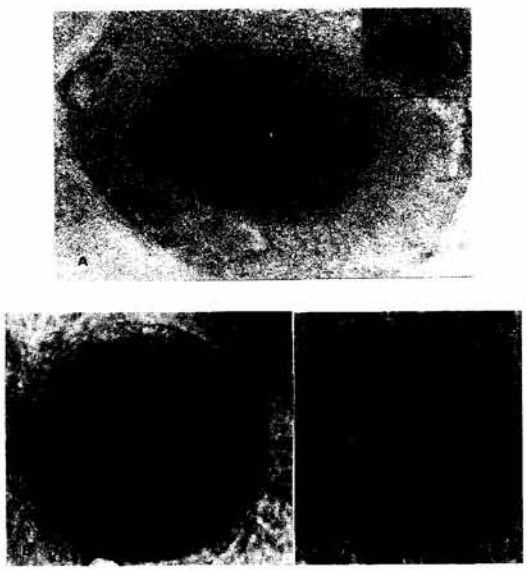

Fig 3 a,b,c - Metrocytes (*ie* developing sarcocysts) in heart and skeletal muscle tissues of cattle. Thick-walled spherical (3a; x400), Inset (x40). Thin- walled-circular to oval sarcocysts (3b and 3c; x100).

Fig 3d - Young bubaline sarcocyst with transverse septal partitions (x400).

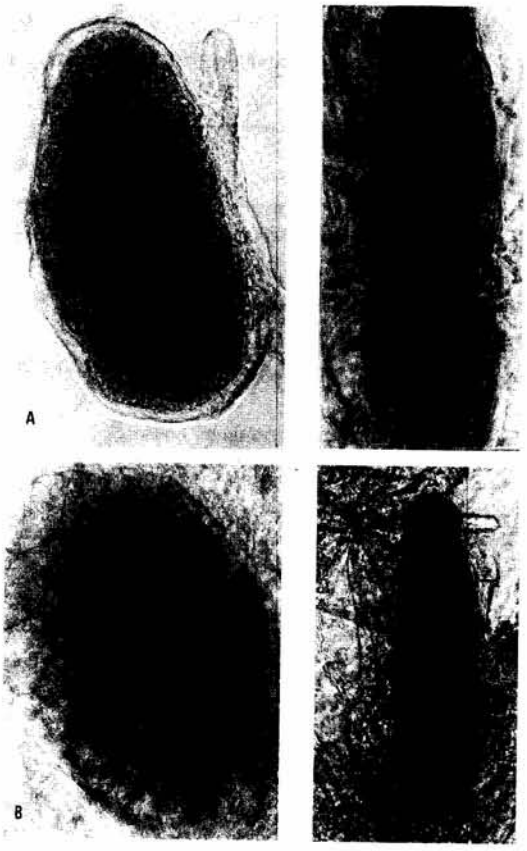

Fig 5 a,b,c,d - Bovine sarcocysts in skeletal muscles with a thick-wall (5a; x100 and 5b; x400) and fusiform elongate cysts (5c;x400 and 5d;x100). Note septate arrangement of daughter cysts.

Fig 4 - Sarcocyst in bovine skeletal muscle tissues. Note spherical shaped cysts with thick-radially striated wall (arrows; x200) .

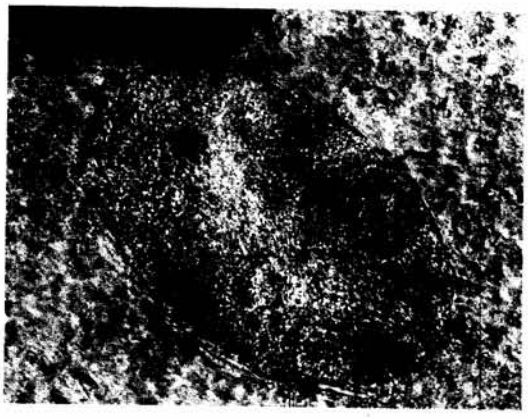

Fig 6 - Metrocyte in skeletal muscle of a 6-month old swine. Note whin wall (x400).

Table 1

Prevalence of bovine sarcocystosis in four different slaughter houses (January - December 1994).

Source	Age of host (Yrs)	No. examined	No. infected (%)
Pasay Abbatoir (Origin: Batangas, Cebu, Palawan)	1.5 - 10	125	24 (19.20)
San Juan Municipality Slaughter House (Origin: Batangas, Pangasinan	2 - 5	125	13 (10.40)
Food terminal incorporated slaughter house (Origin: laguna, batangas, palawan, bukidnon, dadiangas, Cagayan de Oro)	3-5	238	62 (26.05)
Mother earth's prime beff slaughter house (Source: direct import from australia)	3-5	120	0 (0.00)
Total		608	99 (16.28)

Table 2

Prevalence of bovine sarcocystosis: sex distribution.

Source	Male No. positive (%)	Female No. positive (%)	Total No. positive (%)
Pasay abbatoir	$\frac{21}{108}$ (19.44)	$\frac{3}{17}$ (17.64)	$\frac{24}{125}$ (19.20)
San Juan municipal slaughter house	$\frac{11}{120}$ (9.16)	$\frac{2}{5}$ (40.0)	$\frac{13}{125}$ (10.40)
Food Terminal Inc, slaughter house	$\frac{59}{214}$ (27.57)	$\frac{3}{24}$ (12.5)	$\frac{62}{238}$ (26.05)
Mother earth's prime beef slaughter house	$\frac{0}{116}$ (0.00)	$\frac{0}{4}$ (0.00)	$\frac{0}{120}$ (0.00)
Total	$\frac{91}{558}$ (16.30)	$\frac{8}{50}$ (16.00)	$\frac{99}{608}$ (16.28)

Table 3

Prevalence of bovine sarcocystosis according to cattle breed.

Source	Imported Australian cattle No. infected (%)	Native No. infected (%)	Total No. infected (%)
Pasay abbatoir	$\frac{23}{115}$ (20.0)	$\frac{1}{10}$ (10.0)	$\frac{24}{125}$ (19.20)
San Juan municipal slaughter house	$\frac{13}{125}$ (10.40)	None	$\frac{13}{125}$ (10.40)
Food Terminal Inc, slaughter house	$\frac{62}{217}$ (28.57)	$\frac{0}{24}$ (0.00)	$\frac{62}{238}$ (0.00)
Mother earth's prime beef slaughter house	$\frac{0}{120}$ (0.00)	None	$\frac{0}{120}$ (0.00)
Total	$\frac{98}{577}$ (16.30)	$\frac{1}{31}$ (3.22)	$\frac{99}{608}$ (16.28)

DISCUSSION

Our findings on the prevalence of *Sarcocystis* among water buffalos are consistent with those reported by Arambulo *et al* (1972), Tongson (1960) and Tongson and Pelagio (1978). Based on the studies on the ultrastructure of both microcysts and macrocysts (Tongson and Molina, 1979) the microcysts were considered developing forms of macrocysts of *Sarcocystis fusiformis* of either canine origin or human origin (Heydorn *et al*, 1975). In a related study, however, Manuel *et al* (1983) noted a difference in the histomorphological characteristics of the microcysts and macrocysts. They opined that carabaos may be infected with at least two of the *Sarcocystis* spp commonly reported to infect cattle worldwide namely: *S. fusiformis, S. levinei* or *S. cruzi.* In the present study, we noted macrocysts in the esophageal/throat muscles only, and microcysts in skeletal and cardiac muscle tissues. In the absence of histological examination of the cysts, it is highly probable that the cattle are infected with more than one agent with *S. fusiformis* as the more prevalent bubaline sarcocystosis in the country . We do not discount the probability though that the microcysts could be those of *S. levinei* (Dubey *et al,* 1989) or are developing forms of the macrocysts of *S. fusiformis.*

While, we noted in the present study no significant difference in the prevalence of infection between male and female carabaos, the findings of Arambulo *et al* (1972) and Manuel *et al* (1983) showed a higher prevalence rate among male (78%) relative to female (22%) carabaos.

Our findings on bovine sarcocystosis may represent the first documented report in the Philippines. Muscle tissue samples obtained from FTI Abbatoir registered the highest prevalence rate of 26%, followed by 19% of Pasay Abbatoir and 10% of SJMSH. These three abbatoirs obtain their supply of cattle from different provinces (Table 1) where cattle are kept in ranches or open fields for several months prior to slaughter. None of the slaughtered cattle at Mother's Best Abbatoir where cattle are obtained directly from Australia were infected. The absence of any infection may be attributed to the excellent facility that houses imported cattle prior to slaughter. Sarcocysts were predominantly noted in skeletal muscles and to a lesser extent in cardiac, esophageal and diaphragm muscle tissues. Our findings are consistent with those of Dubey *et al* (1989) who reported fewer cases of sarcocystosis involving cardiac muscle tissues. Examination of the gross morphology of mature and young sarcocysts suggest two possible etiologic agents of bovine sarcocystosis, namely: *S. cruzi,* characterized as having elongate and septate cysts and is commonly reported in cattle worldwide (Dubey *et al,* 1976; Carrigan, 1986; Saito *et al,* 1993) and *S. hirsuta* (Dubey *et al,* 1990) or *S. hominis,* characterized as having spherical or rounded cysts with thick radially striated cyst wall (Dubey *et al,* 1989).

Infections rates were significantly higher in imported cattle. While, this may be interpreted to imply either greater susceptibility of Brahman cattle to *Sarcocystis* spp infection or greater resistance of native cattle to infection, one has to consider the small sampling of native cattle used in the present study.

The presence of *Sarcocystis* spp infection in cattle may be attributed to the importation of cattle having been infected prior to transport to the Philippines and/or they may have been exposed to infection within the period of 3-4 months on the farm where they are kept temporarily prior to slaughter. Tongson and Pablo (1978) and Tongson and Calingasan (1980) demonstrated the primary role of puppies and mature dogs, as well as cats in the natural transmission of bubaline sarcocystosis. If the infection were imported, this may suggests that the government is apparently not strict in the implementation of quarantive procedures in allowing entry or importation of infected cattle.

Infection in swine was demonstrated by the presence of developing sarcocysts (=metrocytes). Saito *et al* (1986) and Omata *et al* (1993) had reported cases of swine sarcocystosis in Japan with the incidence of infection increasing with age of hosts. In India swine sarcocystosis caused by *S. miescheriana* and *S. suihominis* is highly prevalent (Saleque and Bhatia, 1991). In the present study, the absence of mature sarcocysts in the single positive case made it very difficult to identify the species. Similar studies must be carried out on muscle tissues obtained from both hybrid and backyard swine.

For future surveys, we strongly recommend that a larger sample population representing different cattle breeds and age and sex be examined . Tissue smear or

squash preparation must be supplemented with digestion technic to increase the chances of finding positive cases. Appropriate agencies must assume the responsibility of proper dissemination of information on the risk of exposure of humans to *Sarcocystis* spp infection, as well as the institution of preventive measures against exposure.

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