The Korean Journal of Parasitology
Vol. 42, No. 1, 45-47, March 2004

□ Brief Communication □

Infection status of pigs with *Cryptosporidium parvum*

Jae-Ran YU[1] and Min SEO[2]*

[1]*Department of Parasitology, College of Medicine, Konkuk University, Chungju, 380-701,*
[2]*Department of Parasitology, College of Medicine, Dankook University, Cheonan 330-714, Korea*

Abstract: To investigate the infection status of pigs with *Cryptosporidium parvum*, 589 fecal samples were collected from pigs raised at farm in Chungcheongbuk-do and Chungcheongnam-do. Of the 589 pig fecal samples, 62 (10.5%) were positive for *C. parvum*. The area showing the highest positive rate was Dangjin-gun, Chungcheongnam-do (14.0%), and the lowest (0%) Salmi-myon, Chungcheongbuk-do. The positive rate of *C. parvum* in Judok-eup increased from 12.7% in the winter to 22.1% in the summer. The results of this study suggest that the pigs may be a source of human *C. parvum* infection.

Key words: *Cryptosporidium parvum*, pig, infection status

Cryptosporidium parvum is a zoonotic pathogen, which causes life-threatening diarrhea in immunocompromised hosts (Adegbola et al., 1994). After the study made by Cho et al. (1990), which found reported a 22% fecal oocyst positive rate among 230 randomly selected out-patients of a university hospital in Seoul, many papers have been published on human infections of *C. parvum* in Korea. Kang et al. (1995) reported a leukemic child infected with *C. parvum*, determined by electron microscopy of the resected appendix, and Seo et al. (2001) found a frequency 1.9% among 461 inhabitants residing in Chorwon-gun, Gangwon-do. According to Chai et al. (1996), the oocyts positive rate was higher in rural areas (10.6%) than in urban areas (0.5%), and a small village in Jeollanam-do (Hwasun-gun) was identified as the endemic focus of cryptosporidiosis.

Livestock such as cattle, and drinking water are known to be important sources of infection. Hence, direct contact with infected animals and the contraction of oocysts from polluted water seem to be important modes of transmission in Korea. However, investigations on cattle or other animals have not been performed actively in Korea. The oocysts of *Cryptosporidium* were detected from 22.2% of dairy cattle in Jeollabuk-do (Rhee et al., 1991), and Chai et al. (1996) reported that 93.3% of 15 cattle reared in Hwasun-gun, Jeollanam-do, were positive for *C. parvum* oocysts, but no nationwide survey of cattle has been performed.

Although cattle are known to be the most important source of *C. parvum* infection, other animals can act as cryptosporidiosis sources. It was suggested that Norwegian rats have the potential to spread *C. parvum*, with a positive rate of 24% in 438 (Quy et al., 1999). In another study, 22.7% of *Rattus* rats were found to be infected with *C. parvum* (Abd el Wahed et

• Received 17 October 2003, accepted after revision 6 January 2004.
• This study was supported by a research grant provided by Dankook University in 2001.
*Corresponding author (e-mail: bbbenji@freechal.com)

Table 1. Infection rates of *Cryptosporidium parvum* in pigs raised at farms in some areas of Chungcheong-do

Surveyed area	No. of samples	No. of positive (%)
Judok-eup, Chungcheongbuk-do	379	46 (12.1)
Dangjin-gun, Chungcheongnam-do	107	15 (14.0)
Hongseong-gun, Chungcheongnam-do	58	1 (1.7)
Salmi-myon, Chungcheongbuk-do	45	0 (0.0)
Total	589	62 (10.5)

al., 1999). Chalmers et al. (1997) reported that wild rodents can also act as a significant reservoir with a high potential for infecting man and livestock due to cohabitation. The role of dogs in the transmission of *C. parvum* is controversial, but Abe et al. (2002) denied the possibility of dogs transmission by using PCR.

Atwill et al.(1997) suggested that feral pigs may serve as an environmental reservoir of *C. parvum*, and Quilez et al. (1996) detected *C. parvum* oocysts from 21.9% of pigs. Izumiyama et al. (2001) observed that weaned piglets excreted more oocysts than older pigs, suggesting weaned piglets are important reservoirs of *C. parvum* by contaminating drinking water. Since pork is a popular food for many Koreans, many pigs have been raised at farms all over the country, and Rhee et al. (1991) reported that 19.9% of pigs in Chollabuk-do were infected with *Cryptosporidium*. This study was conducted to determine the infection status of pigs in rural areas of Chungcheong-do with *C. parvum*.

During the period from November 2000 to June 2001, fecal samples were collected at a butchery in Chungju-shi, among pigs raised at a nearby farm. The number of specimens was 589, which included 379 from Judok-eup, Chungcheongbuk-do, 107 from Dangjin-gun, Chungcheongnam-do, 58 from Hongseong-gun, Chungcheongnam-do, and 45 from Salmi-myon, Chungcheongbuk-do. For comparison purpose, 61 cattle from Eumseong-gun, Chungcheongbuk-do, were also examined.

Fecal samples were directly smeared, and examined after modified acid fast staining (Garcia et al., 1983). The smears were observed under a light microscope at high magnification (x 1,000). The presence of *Cryptosporidium* oocysts of 4-5 μm in diameter, red in color and containing sporozoites, deemed positive.

Of the 589 porcine fecal samples, 62 (10.5%) were positive for *Cryptosporidium* oocysts. All the detected oocysts could be identified as those of *C. parvum* by observing the morphology. The highest positive rate was shown in the pigs from Dangjin-gun, Chungcheongnam-do (14.0%), followed by Judok-eup, Chungcheongbuk-do (12.1%). The area showing the lowest infection rate was Hongseong-gun, Chungcheongnam-do (1.7%), and no pig was infected in Salmi-myon, Chungcheongbuk-do (Table 1). In Judok-eup, the oocyst positive rate was 6.8% (15 positives out of 220 pigs) in November, but this increased to 17.2% (11 of 64 ones) in December, and further increased to 22.1% (21 of 95) in June. The positive rate of the cattle, 19.7%, was higher than that of the pigs.

In Korea, efforts to identify sources of cryptosporidiosis are insufficient. Researchers presume that cattle were one of the important sources, but our study demonstrates that other animals can act as reservoir hosts for *C. parvum* in Korea. In this study, overall positivity among pigs was more than 10%, suggesting that naturally infected pigs may be a significant reservoir for *C. parvum* in human, and that pigs should be viewed as being more important than calves, because the number of pigs overwhelms the number of calves.

According to some reports (Wolfson et al., 1985; Chai et al., 2001), the prevalence of cryptosporidiosis is generally higher in the summer. Considering that the present study was done in the winter, our results probably understimate positivity during the other seasons. In fact, the infection rate at Judok-eup increased from 12.7% in the winter to 22.1% in the summer. Chai et al. (2001) suggested that lower prevalence during the winter may be due to low

rainfall and decreased humidity. The higher prevalence rate during the summer season may be due to the practice of applying composted bovine fecal material to the soil predominantly during the spring to summer period.

Unlike overseas reports, which claim that this protozoan infection occurs preferentially in children under 5 years (Mata et al., 1984), the majority of positive patients in Korea elderly (Chai et al., 2001) which may be because most of the rural population are elderly, and thus they are more exposed to the reservoir host.

The results of the present study demonstrate that farmed pigs raised at farm were infected with *C. parvum* oocysts, and might serve as a source of cryptosporidiosis in Korea. In addition, this results also underline the importance of investigating the possibility that other animals also act as reservoirs for *C. parvum*.

REFERENCES

Abd el-Wahed MM, Salem GH, el-Assaly TM (1999) The role of wild rats as a reservoir of some internal parasites in Qalyobia governoate. *J Egypt Soc Parasitol* **29:** 495-503.

Abe N, Sawano Y, Yamada K, Kimata I, Iseki M (2002) *Cryptosporidium* infection in dogs in Osaka, Japan. *Vet Parasitol* **108:** 185-193.

Adegbola RA, Demba E, De Veer G, Todd J (1994) *Cryptosporidium* infection in Gambian children less than 5 years of age. *Am J Trop Med Hyg* **97:** 103-107.

Atwill ER, Sweitzer RA, Pereira MG, et al. (1997) Prevalence of and associated risk factors for shedding *Cryptosporidium parvum* oocysts and *Giardia* cysts within feral pig population in California. *Appl Environ Microbiol* **63:** 3946-3949.

Chai JY, Lee SH, Guk SM, Lee SH (1996) An epidemiological survey of *Cryptosporidium parvum* infection in randomly selected inhabitants of Seoul and Chollanam-do. *Korea J Parasitol* **34:** 113-119.

Chai JY, Kim NY, Guk SM, et al. (2001) High prevalence and seasonality of cryptosporidiosis in a small rural village occupied predominantly by aged people in the Republic of Korea. *Am J Trop Med Hyg* **65:** 518-522.

Chalmers RM, Sturdee AP, Bull SA, Miller A, Wright SE (1997) The prevalence of *Cryptosporidium parvum* and *C. muris* in *Mus domesticus, Apodemus sylvaticus* and *Clethrionomys glareolus* in an agricultural system. *Parasitol Res* **83:** 478-482.

Cho MH, Kim AK, Im K (1993) Detection of *Cryptosporidium* oocysts from out-patients of the Severance hospital, Korea. *Korean J Parasitol* **31:** 193-199.

Garcia LS, Bruckner DA, Brewer TC, Shimizu RY (1983) Techniques of the recovery and identification of *Cryptosporidium* oocysts from stool specimens. *J Clin Microbiol* **18:** 185-190.

Izumiyama S, Furukawa I, Kuroki T, et al. (2001) Prevalence of *Cryptosporidium parvum* infections in weaned piglets and fattening porkers in Kanagawa Prefecture, Japan. *Jpn J Infect Dis* **54:** 23-26.

Kang YK, Lee HK, Kim SW (1995) Cryptosporidiosis in leukemia child with severe diarrhea. *Seoul J Med* **36:** 29-34.

Mata L, Bolanos H, Plazarro D, Vives M (1984) Cryptosporidiosis in children from some highland Costa Rican rural and urban areas. *Am J Trop Med Hyg* **33:** 24-29.

Quilez J, Sanchez-Acedo C, Clavel A, del Cacho E, Lopez-Bernad F (1996) Prevalence of *Cryptosporidium* infections in pigs in Aragon (northeastern Spain). *Vet Parasitol* **67:** 83-88.

Quy RJ, Cowan DP, Haynes PJ, et al. (1999) The Norway rat as a reservoir host of *Cryptosporidium parvum. J Wildl Dis* **35:** 660-670.

Rhee JK, Seu YS, Park BK (1991) Isolation and identification of *Cryptosporidium* from various animals in Korea. I. Prevalence of *Cryptosporidium* in various animals. *Korean J Parasitol* **29:** 139-148.

Seo M, Huh S, Chai JY, Yu JR (2001) An epidemiological survey on *Cryptosporidium parvum* infection of inhabitants in Chorwon-gun, Kangwon-do. *Korean J Parasitol* **39:** 201-203.

Wolfson JS, Richter JM, Waldron MA, et al. (1985) Cryptosporidiosis in immunocompetent patients. *N Engl J Med* **312:** 1278-1282.