ISSN (Print) 0023-4001
ISSN (Online) 1738-0006

Korean J Parasitol. Vol. 48, No. 4: 347-349, December 2010
DOI: 10.3347/kjp.2010.48.4.347

▣ BRIEF COMMUNICATION

Intestinal Parasite Infections in Pigs and Beef Cattle in Rural Areas of Chungcheongnam-do, Korea

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Abstract: The present study was performed to investigate the infection status of intestinal parasites in pigs and beef cattle in rural areas of Chungcheongnam-do, Korea. From November 2009 to April 2010, a total of 241 fecal samples of pigs and beef cattle (136 and 105, respectively) were examined by direct smear and centrifugal sedimentation methods. The overall positive rates of intestinal parasites among pigs and beef cattle were 73.5% and 4.8%, respectively, and the double-infection rate was 10.3% in pigs. Of 136 specimens from pigs, *Balantidium coli*, *Ascaris suum*, and *Entamoeba* spp. infections were found in 88 (64.7%), 24 (17.6%), and 5 cases (3.7%), respectively. Of 105 beef cattle, *Entamoeba* spp. infections were detected in 5 cases (4.8%). From these results, it is shown that pigs raised on rural farms in Chungcheongnam-do had a high *B. coli* infection rate and a moderate *A. suum* infection rate. These results demonstrate that environmentally resistant cysts or eggs could be widespread on the farms examined, and thus an effective hygienic management system is needed to prevent them from serving as the source of infection for human beings.

Key words: prevalence, intestinal parasite, beef cattle, pig

Zoonoses can be transmitted directly by contact with an animal, via contaminated environment, or food, and they can be transmitted indirectly via vectors. The diseases they cause in humans range from mild and self-limiting to fatal. Livestock, such as pigs and cattle, are known to be important sources of zoonoses. Parasitic infections of pigs and cattle, such as *Toxoplasma gondii*, *Cryptosporidium* spp., *Ascaris suum*, and *Balantidium coli*, are increasingly attracting attention due to their pathogenic and zoonotic impacts [1]. The prevalence of intestinal parasites in Korea in the 1980s was 55.4% for *Entamoeba* spp., 66.6% for *B. coli*, 25.6% for *A. suum*, 55.4% for *Eimeria* and *Isospora* spp., and 1.0% for *Giardia lamblia* [2]. Furthermore, the infection rates of nematodes, coccidia, and trematodes in cattle were 49.0%, 10.9%, and 14.6%, respectively [3].

However, environments for keeping pigs and cattle have undergone major changes in the past few decades. For example, pigs are now kept confined in pigpens with concrete as opposed to earth floors. Thus, pigs now have a lower risk of direct contact with arthropods harboring parasites or soil contaminated with environmentally resistant forms of parasites. In addition, cattle are raised on hay with concrete floors. Furthermore, drug and vaccine treatments for animals, breeding programs intended to introduce resistance to pathogenic microorganisms, and cleaning of sheds with disinfectants are now commonplace. Although the number of pig and cattle farmers in Korea is now decreasing, the number of animals per farmer is increasing. The high number of animals per farm is an important factor in the outbreak and persistence of infectious diseases. Insufficient information exists regarding parasitic infections among pigs and cattle in Korea, despite the implementation of many environmental changes in raising the animals. Thus, we tried to estimate the prevalence of intestinal parasites in pigs and beef cattle raised on farms in Chungcheongnam-do using a coproscopic approach.

We surveyed the farms of 6 villages of Chungcheongnam-do, Korea between November 2009 and April 2010. Of 241 fecal samples collected, 136 were from pigs and 105 were from beef cattle. The samples were stored at 4℃ and examined within 5 days of sample collection. Fecal samples were examined

• Received 16 June 2010, revised 22 November 2010, accepted 23 November 2010.

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for the presence of helminth eggs and protozoan cysts, oocysts, and/or trophozoites using direct smear and centrifugal sedimentation methods. The centrifugal sedimentation method was performed according to Zajac and Conboy [1]. Briefly, 1 g of fecal material was diluted in 9 ml of tap water in a 15-ml centrifugal tube and centrifuged at 800 *g* for 5 min. After centrifugation, 10 ml of 10% formalin solution was added to the sediment and mixed with 4 ml of ethyl acetate followed by centrifugation at 800 g for 5 min. Sediment on the bottom was recovered and placed onto a glass slide. The entire smear was examined by light microscopy at magnifications of 200 × or 400 ×. An animal was determined to be infected with an intestinal parasite if at least one egg, oocyst, cyst, or trophozoite was found in the fecal smear.

The results of the pig fecal examinations are shown in Table 1. Of 136 pigs, 100 (73.5%) had parasite eggs and/or cysts in their feces. *B. coli* cysts were found in 88 (64.7%), and *A. suum* eggs and *Entamoeba* spp. cysts were detected in 24 (17.6%) and 5 animals (3.7%), respectively. Of the 100 infected pigs, more than 2 species of parasites were observed in 14 (10.3%) (*A. suum* and *B. coli*: 12 cases; *A. suum* and *Entamoeba* spp: 3 cases; *B. coli* and *Entamoeba* spp: 5 cases; *A. suum*, *B. coli*, and *Entamoeba* spp: 3 cases). Parasites were detected in the pigs from all farms examined. The highest positive rate was seen in the pigs from Tancheon-myeon, Gongju-si (80.6%), followed by Gwangcheon-eup, Hongseong-gun (73.5%). On the cattle coprological examinations, 5 of 105 beef cattle (4.8%) examined were infected with *Entamoeba* spp. (Table 2).

B. coli is the largest protozoan parasite and the only ciliate parasitic to humans. Ingestion of *B. coli* cysts from pig feces through water and food intake results in transmission [4,5]. Its prevalence among pigs has been reported as 47.2% in China [6] and 1.6% in Turkey [7], but the highest prevalence is found in tropical and subtropical regions of the world [4,5]. In a study from Denmark, the prevalence of *B. coli* was found to increase from 57% to 100% with increasing age [8]. The prevalence of *B. coli* was 64.7% in the present study, which is higher than that in other studies [6,7]. It is thought that contaminated feed buckets or pens as well as a lack of careful treatment of feces from infected animals are the reasons for the high prevalence of these parasites. Further study is needed to evaluate the key factors involved in the high prevalence of *B. coli* in pigs. Estimates of the worldwide prevalence of *B. coli* infection are usually less than 1% [4,5]. However, the infection rates among swine herders and slaughterhouse workers are as high as 28% in Papua New Guinea [9]. In recent years, there have been some reports of *B. coli* infection in immunocompromised patients, including HIV/AIDS patients, patients with malignancies, and patients who have undergone organ transplantations [10].

A. suum is a causative agent of visceral larva migrans in humans. Humans with liver and lung lesions as well as cases and epidemics of eosinophilic pneumonia have been reported, and *A. suum*-specific antibodies were present in all cases [11-13]. In Japan and Turkey, 14.7% and 3.7% of pigs, respectively, were estimated to be infected with *A. suum* [7,14]. The prevalence of *A. suum* infection in the present study was 17.6%, which was lower than that in a previous report in Korea by Jang [2]. However, *Ascaris* in pigs is an important zoonotic parasite, as genetic analysis has indicated that pig *Ascaris* may infect humans [11-13]. Thus, we need a detailed epidemiological survey to clarify the relationship between environmental factors and the

Table 2. Prevalence of intestinal parasites infection in beef cattle examined by the direct smear method and the centrifugal sedimentation method in Chungcheongnam-do, Korea

Localities	No. of exam.	No. of positive (%)	
		Entamoeba spp.	Subtotal
Jeongan-myeon, Gongju-si	35	0 (0.0)	0 (0.0)
Uidang-myeon, Gongju-si	30	2 (6.6)	2 (6.6)
Bujeok-myeon, Nonsan-si	35	3 (8.6)	3 (8.6)
Total	105	5 (4.8)	5 (4.8)

Table 1. Prevalence of intestinal parasites infection in pigs examined by the direct smear method and the centrifugal sedimentation method in Chungcheongnam-do, Korea

Localities	No. exam.	No. of positive (%)							
		As	Bc	Ep	As+Bc	As+Ep	Bc+Ep	As+Bc+Ep	Subtotal
Gyeryong-myeon, Gongju-si	66	24 (36.4)	34 (51.5)	3 (4.5)	12 (18.2)	3 (4.5)	3 (4.5)	3 (4.5)	46 (69.7)
Tancheon-myeon, Gongju-si	36	0 (0.0)	29 (80.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	29 (80.6)
Gwangcheon-eup, Hongseong-gun	34	0 (0.0)	25 (73.5)	2 (5.9)	0 (0.0)	0 (0.0)	2 (5.9)	0 (0.0)	25 (73.5)
Total	136	24 (17.6)	88 (64.7)	5 (3.7)	12 (8.8)	3 (4.5)	5 (3.7)	3 (2.2)	100 (73.5)

As, *Ascaris suum*; Bc, *Balantidium coli*; Ep, *Entamoeba* spp.

prevalence of parasites on farms.

Cattle are known to be important sources of zoonotic parasites, such as *C. parvum*. Matsubayashi et al. [14] recently reported that the prevalence of parasite infections in cattle were 76.5% for *Eimeria* spp., 7.0% for *Capillaria bovis*, and 3.8% for *Trichuris* spp. The prevalence of cryptosporidiosis in Korea was 8.9-98.2% in cattle and 9.9-47.7% in pigs [15]. In this study, we found *Amoeba* spp. in 5 beef cattle in Chungcheongnam-do, which was a lower parasite infection rate than that previously reported in Korea [3]. The prevalence of infectious diseases in animals is related to several factors, including types of food and water, food supply systems, hygienic conditions, location of pens, administration of drugs or vaccinations, and so on. We examined hygienically well-managed beef cattle on farms. However, cysts of *Cryptosporidium* spp. were not detected in either pigs or beef cattle because acid-fast staining was not performed on the feces.

The results of the present study demonstrate that pigs raised on farms in Chungcheongnam-do had a high *B. coli* infection rate and a moderate *A. suum* infection rate, whereas the prevalence of intestinal parasite infections in beef cattle was low. These results demonstrate that environmentally resistant cysts or eggs could be widespread on the farms examined, and pig feces may serve as a source for a group of parasites capable of infecting human beings. Thus, an effective hygienic management system must be based on appropriate knowledge of the epidemiological conditions of the prevailing parasitic infections. This survey is meaningful as a farm-based study to reveal the prevalence of intestinal parasite infection in the rural areas of Korea. However, the study has some limitations in its determination of the exact prevalence of intestinal parasites in pigs and beef cattle, such as excluding the acid-fast staining of feces. Further surveys from various areas will be necessary to clarify the exact prevalence.

ACKNOWLEDGEMENTS

This work was carried out with the support of "Cooperative Research Program for Agriculture Science & Technology Development (Project No. PJ006600)" Rural Development Administration, Republic of Korea.

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