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SHORT COMMUNICATION

Seroprevalence of Cystic Echinococcosis in Chinese Merino and Duolang Sheep in Xinjiang, China

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ABSTRACT

The purpose of this present study was to investigate the seroprevalence of cystic echinococcosis (CE) in Chinese merino sheep and Duolang sheep in Xinjiang, northwestern China. A total of 1219 serum samples of sheep (including 868 Chinese merino sheep from 6 farms in Ili, Tacheng and Shihezi as well as 351 Duolang sheep from 4 farms in Kashgar) were detected by ELISA assay. The chi-square test was used to analyze the data and the area differences for CE prevalence were compared. Results showed that the overall seropositive percentage for CE was 31.1% in Chinese merino sheep, and sheep from Ili area (of which 48.8% were seropositive) were significantly more likely to be seropositive than either sheep from Shihezi area (6.9%) ($P<0.01$) or ones from Tacheng area (12.7%) ($P<0.01$). In addition, seroprevalence for CE in Duolang sheep varied from 3.3% (farm No.45) to 30.7% (farm No.50A), with the average percentage of 21.7%, which was lower than that of Chinese merino sheep (31.1%), and statistically significant difference was observed between the two breeds in seroprevalence of CE ($P<0.05$). In conclusion, in Xinjiang, CE prevails differently in different areas in Chinese merino sheep and Duolang sheep. And also, serologically, Chinese merino sheep was more susceptible to CE than Duolang sheep. Comprehensive measures are needed to strengthen further prevention and control of disease in two breeds in Xinjiang.

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INTRODUCTION

Cystic echinococcosis (CE), a cosmopolitan zoonotic infection, is caused by the larval stages of the tapeworm *Echinococcus granulosus* (*E. granulosus*), which requires two mammalian hosts to complete its life cycle. Dogs and other carnivores are the definitive hosts while a wide range of ruminants (sheep, goats, cattle and camels) and humans act as the intermediate hosts (Zhang *et al*., 2003). The adult parasites are found in the small intestine of a carnivore and produces eggs in cestode segments (proglottids), then, the eggs are released from the tract of the carnivore into the environment. After oral uptake of eggs by the intermediate host, a larval stage (oncosphere), penetrate the intestinal wall and reach viceral organs such as liver, lung, heart, and kidney of animals and humans (Fakhar and Sadjjadi, 2007). In these internal organs, the larva grow and develop hydatid cysts, which act as unilocular fluid-filled bladders (Zhang *et al*., 2003).

CE causes a long-lasting infection that affects humans and domestic animals, thus posing a serious public health problem worldwide (Eckert *et al*., 2000; Garippa *et al*., 2004). CE is hyperendemic in China, especially in western areas, including Xinjiang, Ningxia, Qinghai, Sichuan and so on (Zhang *et al.,* 2009). The disease is regarded as one of the major public health problems in these areas (Wen and Yang, 1997). It is reported that six million inhabitants are currently at risk of infection of the disease, with an estimated one million requiring significant medical treatment (Jiang, 2002). In addition, more than 50% of 170 million domestic animals (58% being sheep) were infected with CE (Chi *et al.,* 1989), which causes considerable health problems in animals and economical disadvantages because of production loss, as animals infected with this disease often suffer from reductions in live weight gain, in milk

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yielding, in the fertility rates, in the value of wool or other products (Torgerson, 2003).

Xinjiang is one of the main sheep-raising areas in China, but unfortunately, CE is hyperendemic in this region. A variety of investigations performed at an abattoir were focused on CE prevalence in Xinjiang (Tasitan, 2010), to provide baseline data for CE control programs. Although it is generally accepted that abattoir surveys, based on postmortem examination, are reliable diagnosis methods which could reflect the actual status of hydatid cysts, abattoir surveys may not yield an accurate assessment of CE prevalence for the region, since a biased population of sick and debilitated animals may be over represented to the slaughtering house (Sage *et al*., 1998). On the other hand, using postmortem examination as a regular and mass screening method for CE prevalence in terms of some special sheep breed would hardly be accepted by sheep owners because of economic, cultural and zootechnic reasons (Lahmar *et al*., 2007). Alternatively, serologic tests based on Echinococcus antibody detection have been historically effective used in large scale screening for CE in a population basis (Tabar *et al*., 2011).

Chinese merino sheep is famous for both well wool and meat production, which is beneficial for local sheep husbandary. Duolang sheep is a native sheep breed of Xinjiang. To our knowledge, no reports have shown infection rates of CE for these two sheep breeds in Xinjiang. It is essential to understand the current prevalence of the disease in every sheep breed so as to provide baseline data for contemplating to breed CE resistance sheep. The present study, therefore, was designed to investigate and compare the seroprevalence of CE in Chinese merino sheep and Duolang sheep in different farms from different areas of Xinjiang, north- western China.

MATERIALS AND METHODS

Study area and animals: The study was focused on 10 farms located in 4 prefectures including Ili, Tacheng, Shihezi and Kashgar. Except for Kashgar area located in the south of Xinjiang, others are all posited in the north. A total of 1219 animals were investigated and summarized in Table 1.

Sera collection: From June to August in 2006, a total of 1219 blood samples were collected from Chinese merino sheep and Duolang sheep, with the animal numbers of 868 and 351, respectively. The samples were centrifuged at 2000 × g at room temperature for five min to separate sera in Parasitology laboratory, college of animal science and medicine technology, Shihezi University. Sera were stored at -20ºC until used.

ELISA assay: ELISA assay was performed to detect the presence of antibody against *E. granulosus* in sera, using a commercial ovine CE ELISA kit (Hyd 040227) according to the manufacture's instruction (Shenzhen Combined Biotech Co.,China), the usefulness of which including sensitivity and specificity have been reported by Yu *et al*. (2006).

Data analysis: Data were analyzed with the Statistical Package for Social Science version 13.0 for Windows. The $\chi 2$ test was used to explore the statistical significances. P-value<0.05 indicated significant difference.

RESULTS

The seroprevalence of CE in Chinese merino sheep from different areas is summarized in Table 2. The overall seropositive percentage for CE was 31.1% in Chinese merino sheep. The sheep from farm No.167 showed the highest seropositive percentage, peaking at 58.1%, followed by sheep from farm No.74, with the seropositive percentage of 48.8%. The lowest seropositive percentage occurred in farm No.168, which was 2.4%. The results of the ELISA indicated that sheep from Ili (of which 48.8% were seropositive) were significantly more likely to be seropositive than either sheep from the Shihezi area (6.9%) or ones from Tacheng area (12.7%) (P<0.01). However, no significant difference was observed, in terms of CE seroprevalece, between sheep from Shihezi area and individuals from Tacheng area (P<0.05).

Seropositive percentage of Duolang sheep in different farms, belonging to Kashgar area was assessed and described (Table 2). We found that seropositive percentage ranged from 3.3% (farm No.45) to 30.7% (farm No.50A), with the average of 21.7%. Comparatively, statistically significant difference was found between the two breeds in seroprevalence of CE (P<0.05) (Table 3).

DISCUSSION

As expected, the findings of this study showed the existence of relative lower seroprevalence in Chinese merino sheep, with the overall seropositive percentage of 31.1%, compared with the data reported by Li *et al.* (2005). However, we found that the prevalence of CE in different areas tended to show variable scales, ranging from 6.9% (Shihezi area) to 48.8% (Ili area). This variation could be due to the differences in management of sheep, occupation and climate. In this study, sheep investigated from Ili area showed high seropositive percentage (48.8%), which is in part due to the pastoral system in Ili, compared with the sheep management of semi-pastoral type in

Table 1: Introduction of the basic information of the study area/ farm and sheep numbers

Geography area	Study area	Farm #	The number of animals	Farming type	Sheep breed
The north	Tacheng	165	182	Semi-pastoral system	Chinese Merino (868)
	(agriculture and	167	43	Semi-pastoral system	
	pastoral mixed area)	168	83	Semi-pastoral system	
	Shihezi	142	51	Housing system	
	(agriculture area)	151	50	Housing system	
	Ili (pastoral area)	74	459	Pastoral system	
The south	Kashgar	44	30	Housing system	Duolang (351)
	(agriculture area)	45	60	Housing system	
		50A	130	Housing system	
		50B	131	Housing system	
Total			1219		

Table 2: Seroprevalence of CE in Chinese Merino and Duolang sheep

Study area	Farm #	Total Nos.	Positive	%	Average %
Chinese Merino sheep					
Tacheng	165	182	12	6.5	12.7
	167	43	25	58.1	
	168	83	2	2.4	
Shihezi	142	51	4	7.8	6.9
	151	50	6	6.0	
Ili	42	459	224	48.8	48.8
Duolang sheep					
Kashgar	44	30	4	6.66	21.7
	45	60	2	3.33	
	50A	130	40	30.77	
	50B	131	30	22.90	

Table 3: Seroprevalence of CE between the two breeds

Breed	Total Sheep	Positive		$\chi 2$	*P* value
		No.	%		
Chinese merino sheep	868	270	31.1	10.988	0.01
Duolang sheep	351	76	21.7		

Tacheng and the Housing type in Shihezi. Previous study showed that the prevalence of CE in sheep was highest in the pastoral areas of the northwest of Xinjiang (Chi *et al*., 1989), the consistent result was observed in the present study. And also, it may be due to the climate in Ili area, for the low temperature and the high humidity favor survival and development of the eggs of the parasite support the above idea (Erbeto *et al*., 2010).

Surprisingly, in sheep investigated from Tacheng area, we found the highest seroprevalence of 58.1% in farm No. 167 whilst the lowest seroprevalence of 2.6% was found in farm No. 168. This is probably due to the fact that the individual performance differently when exposed to the same level of parasite.

A total of 351 Duolang sheep was investigated in four farms, belonging to Kashgar, which is located in the south of Xinjiang. We found that seropositive percentage ranged from 3.3% (farm No. 45) to 30.7% (farm No. 50A), with the average of 21.7%. It is surprising that the relatively higher seropositive percentage was observed in farm No. 50B (22.9%) and farm No. 50A (30.77%), compared with that of farm No. 45 (3.3%) and farm No. 44 (6.6%), although the sheep management systems are all housing type. The most probable explanation for this variation in Duolang sheep in our study could be attributed to the large number of owned and stray dogs in farm No.50A and farm No. 50B.

In the current study, the prevalence of Duolang sheep was 21.7%, lower than that of Chinese merino sheep (31.1%). Published data showed that CE prevalence in north of Xinjiang was higher than those in the south (Li *et al*., 2005). This is in agreement with the findings of this survey. In addition, statistically significant difference was found in seroprevalence of CE between two breeds ($P<0.05$), suggesting that the breed of investigated sheep has effect on infection by *E. granulosus* infection, which may lay a base for establishing CE resistance breeding programs.

This study is our first attempt to investigate the seroprevalence of CE in Chinese merino sheep and Duolang sheep, using ELISA assay. It can be concluded that CE prevails differently in different farm or areas for one special breed, and Chinese merino sheep were more susceptible to CE than Duolang sheep. Ideally, serological assays in these endemic areas should be assessed along with necropsy data (from slaughtered animals). However, this is very difficult to do due to the prevalent practice of home slaughtering. Alternatively, further analysis (e.g., immunoblotting, immunoelectrophoresis or the indirect immunofluorescence antibody test) should be carried out to represent a complementary assay, which may give more confirmatory tests for the seroprevalence of CE in sheep. On the other hand, it is essential to carry out more studies to obtain baseline data concerning CE prevalence in these two sheep breeds or other sheep breeds, before contemplating any rational control programs.

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