Prevalence of bovine tuberculosis in the Aksu Region of Xinjiang, China, between 1985 and 2016

[*Prevalência de tuberculose bovina na região Aksu de Xinjiang, China, entre 1985 e 2016*]

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ABSTRACT

Prevalence of bovine tuberculosis infection in cattle in Aksu Prefecture determined by intradermal tuberculin skin test (TST), between 1985 and 2016. Cattle were analyzed according to region, feeding pattern, herds and age. A total of 890,009 cattle were tested, with overall bovine tuberculosis prevalence of 0.13% (1172/890009). Statistically significant difference was found in feeding pattern and herds. Prevalence in cows (0.19%, 615/327022) was higher than that in beeves (P< 0.01, OR= 1.903, 95% CI = 1.696 to 2.134). Significant difference (P< 0.01; OR= 2.238, 95%; CI= 1.937 to 2.585) was evident for rates for bovine tuberculosis in the peasant household (0.12%, 942/802343) and farm groups (0.26%, 230/87666). The overall prevalence of bTB was decreased in the Aksu Prefecture, especially the positive rate was under 0.1% in 2010s. We concluded that the control measures forbovine tuberculosis in the Aksu region cattle herds are effective.

Keywords: prevalence, bovine tuberculosis, aksu prefecture

RESUMO

Prevalência de infecção por tuberculose bovina em gado na prefeitura de Aksu determinada por teste cutâneo tuberculínico (TST) entre 1985 e 2016 foi avaliada. O gado foi analisado de acordo com região, padrão alimentar, rebanho e idade. Um total de 890009 animais foram testados, com prevalência de 0,13% de tuberculose bovina (1172/890009). Diferença estatisticamente significativa foi encontrada em padrão alimentar e rebanhos. Prevalência em vacas (0,19%, 615/327022) foi mais alta que em bois (P< 0,01, OR= 1,903, 95% CI = 1,696 a 2,134). Diferenças significativas (P< 0,01; OR= 2,238, 95%; CI= 1,937 a 2,585) foram evidentes em taxas para tuberculose bovina em casas de camponeses (0,12%, 942/802343) e grupos de fazendeiros (0,26%, 230/87666). A prevalência de bTB caiu na prefeitura Aksu, a taxa positiva se encontrava abaixo de 0.1% a partir de 2010. Conclui-se que as medidas de controle para tuberculose bovina na região de Aksu foram eficazes.

Palavras-chave: prevalência, tuberculose bovina, aksu

INTRODUCTION

Infectious diseases are important factors affecting the health of populations. Bacterial zoonoses still represent a serious medical problem (Wang *et al*., 2012; Karabay *et al*., 2004). Bovine tuberculosis (bTB) is a chronic debilitating and contagious disease of livestock, wildlife and humans, mainly due to *Mycobacterium bovis* (Humblet *et al*., 2009; Katale *et al*., 2013). Cattle may serve as the main host for *M. bovis* worldwide (Gumi *et al*., 2011), while many or most domestic animals such as pigs, dogs, cats, horses and sheep are considered to be spill-over hosts (Franck *et al*., 2005; Dejene *et al*., 2016). Aerosol is considered to be the primary transmission pathway of infection in animals (Gumi *et al*., 2011; Franck *et al*., 2005).

Other transmission pathways of infection such as ingestion of contaminated feeds, water and fomites have been confirmed (Gumi *et al*., 2011).

While most cattle infected with *M. bovis* usually exhibit a chronic disease often characterized by lesions in the lungs and the lymph nodes of the head and thoracic cavity, progressive emaciation, diarrhea and reduced milk yields can also occur. Most cases of bovine tuberculosis infection are inapparent and lack clinical symptoms. The main pathologic changes of bovine tuberculosis are tuberculous nodules and caseous necrosis or calcified nodules in variety of tissues and organs.

Bovine tuberculosis is a serious disease with potential public health and economic costs to society, since it can significantly affect international trade of animals and their products and create productivity losses (Ayele *et al*., 2004; Dejene *et al*., 2016). Bovine tuberculosis, which is currently ranked as the 7th highest in the world (Gumi *et al*., 2012), is a significant public health and food safety concern and considered as a second-class animal epidemic disease in China.

Several surveys on bovine tuberculosis in cow were conducted in some provinces in China in recent years (Ma *et al*., 2012; Li *et al*., 2012; Xin and An, 2007; Gan, 2008; Fu *et al*., 2004). However, no studies have been reported on the prevalence of bovine tuberculosis in the Aksu region. The current study determined to estimate the risk factors associated with exposure to the pathogen of bovine tuberculosis infection in cow in this region.

MATERIALS AND METHODS

The Aksu Prefecture, which comprises 1 city (Aksu) and 8 counties (Xayar, Kuqa, Baicheng, Xinhe, Wensu, Uqturpan, Kalpin and Awat), is an important area in South Xinjiang. The district of study (Figure 1) is located at 78°03′ to 84°07′ N and 39°30′ to 42°41′ E. The Aksu Prefecture has a total land area of 132,500km^2 and a human population of approximately 2.5 million. The annual rainfall in this region varies between 42.4 and 94.4mm. Currently, the livestock population consists of 354,200 head of cattle, 208,500 pigs, 4.11 million sheep and 1.35 million goats. Livestock husbandry is regarded as an important source of income in the Aksu Prefecture.
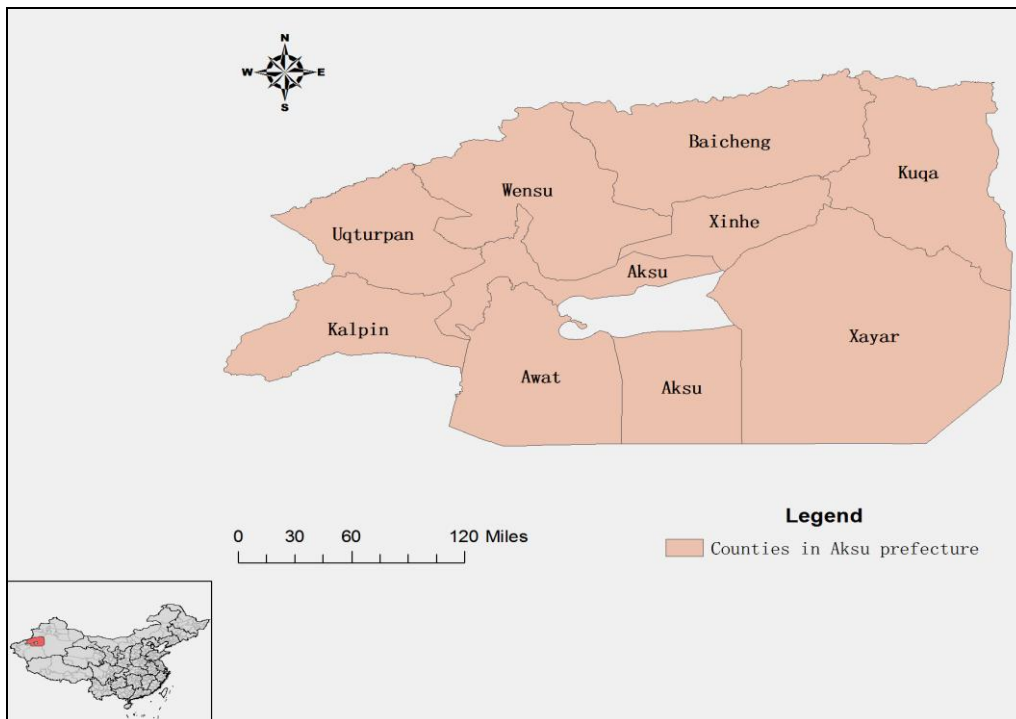

Figure 1. Aksu Prefecture administrative map.

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The current survey was implemented from 1985 to 2016, and 890,009 samples were collected from dairy herds and 10% beef cattle in the whole Aksu Prefecture (total approximate 6 million cattle, including cows and beef). All tasks were conducted by Animal Loimia Controlling and Diagnostic Center of Aksu Region. The experiment was performed with pure bovine tuberculin (PPD, produced by Harbin Pharmaceutical Group Bio-vaccine Co, Ltd.) skin allergy test (TST), according to the diagnostic techniques for tuberculosis of animal (GB/T18645-2002) methods. Biometric data from the cattle, including variety and feeding patterns were acquired from the animal owners or medical records.

The data were analyzed (χ^2-test) using the statistical software package SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). The risk factors, including variety and feeding pattern were noted in present survey. Identification of a risk factor required a 95% confidence level ($P < 0.05$) as well as a biologically plausible association between the factor and rate of allergic reaction to bovine tuberculosis.

RESULTS

The results of the TST detections on bovine tuberculosis positive samples are shown in Table 1. Among the 890,009 cattle, 1172 (0.13%) were positive by TST. The prevalence in cows (0.19%, 615/327022) and in farm group (0.26%, 230/87666) were higher than that in beeves (AFe= 0.300; OR= 1.903, 95%; CI= 1.696 to 2.134) and in peasant household groups (AFe= 0.499; OR= 2.238, 95%; CI= 1.937 to 2.585) (Table 1).

Table 1. Prevalence of bovine tuberculosis infection in cattle in Aksu Prefecture determined by TST

Variable	Number of cattle (%)	Positive cattle (%)	single-factor analysis	
			OR (95% CI)	AFe/P
Total	890009 (100)	1172 (0.13)		
Variety				
Cows	327022 (36.74)	615 (0.19)	1	
Beeves	562987 (63.26)	557 (0.10)	1.903 (1.696-2.134)	0.300/<0.01
Feeding pattern				
Farm (≥ 20)	87666 (9.85)	230 (0.26)	1	
Peasant household	802343 (90.15)	942 (0.12)	2.238 (1.937-2.585)	0.499/<0.01

The prevalence of bovine tuberculosis infection from 1980s to 2010s was 0.04% (39/104462) in Aksu, 0.19% (156/82529) in Xayar, 0.21% (304/145964) in Kuqa, 0.10% (88/88183) in Baicheng, 0.08% (41/49426) in Xinhe, 0.12% (240/201567) in Wensu, 0.11% (72/68189) in Uqturpan, 0.10% (37/35883) in Kalpin and 0.17% (195/113806) in Awat (Table 2).

The prevalence of bovine tuberculosis infection in Aksu Prefecture was 0.18% (222/120847) in 1980s, 0.12% in 1990s (208/175962), 0.19% in 2000s (687/352938) and 0.02% in 2010s (55/240262).

Table 2. Prevalence of bovine tuberculosis infection in cattle in different region in Aksu Prefecture determined by TST

Area Age	Aksu	Xayar	Kuqa	Baicheng	Xinhe	Wensu	Uqturpan	Kalpin	Awat	Total
	Prevalence (%, total tested)									
1980s	0.13 (12279)	0.14 (11356)	0.43 (21513)	0.05 (13975)	0.01 (6993)	0.20 (21120)	0.19 (14575)	0.05 (1954)	0.12 (17082)	0.18 (120847)
1990s	0.02 (18637)	0.03 (21333)	0.52 (24547)	0.10 (17555)	0 (10218)	0.09 (36415)	0.02 (25108)	0.09 (2151)	0.07 (19998)	0.12 (175962)
2000s	0.04 (40884)	0.45 (28368)	0.13 (59836)	0.20 (26406)	0.29 (12630)	0.15 (105405)	0.22 (15817)	0.20 (15106)	0.31 (48486)	0.19 (352938)
2010s	0.003 (32662)	0.03 (21472)	0.01 (40068)	0.03 (30247)	0.02 (19585)	0.02 (38627)	0.05 (12689)	0.02 (16672)	0.04 (28240)	0.02 (240262)
Total	0.04 (104462)	0.19 (82529)	0.21 (145964)	0.10 (88183)	0.08 (49426)	0.12 (201567)	0.11 (68189)	0.10 (35883)	0.17 (113806)	0.13 (890009)

DISCUSSION

The overall prevalence in cows in the Aksu Prefecture was 0.13% (1172/890009), comparatively higher than those observed in Hui Autonomous Prefecture of Changji in Xinjiang (0.12%) (Ma *et al*., 2012). However, the obtained prevalence in the Aksu Prefecture is lower than those in Hui Autonomous Prefecture of Changji at 0.27% from 2008 to 2011, Urumqi city at 0.52% from 2007 to 2011 (Li *et al*., 2012) and Bole city at 3.82% from 2002 to 2004 (Xin and An, 2007) in Xinjiang, and Guangxi Zhuang Autonomous Region at 0.48% (Gan, 2008), as well as those in Qinghai province at 0.18% (Fu *et al*., 2004).

The bovine tuberculosis in cattle was widespread in the 1940s, and outbreak in the 1950s, the highest infection rate of province reached 41.3% in China. In the 1970s, the epidemic of bovine tuberculosis achieved the historical high point, the infection rate of some area reached 67.4%. In the 1980s, the positive rate of tuberculin skin allergy test achieved 2.68%, and 28 P/A/M (provinces, autonomous regions and municipalities) of China detected TB positive cattle, Xinjiang is particularly severe (Gan, 2008). In the study, the high prevalence of bTB was Kuqa in the 1980s and 1990s. In the 2000s, the prevalence of bTB in the Aksu Prefecture increased, except in Kuqa. The overall prevalence of bTB decreased in the Aksu Prefecture; the positive rate was under 0.1% in 2010s.

Tuberculin skin allergy test is the only recommended TB diagnosis method in the world organization for animal health (OIE). It has generally been used to determine the prevalence of bovine tuberculosis in China. The present study provides the first information on bovine tuberculosis infection in cattle in the Aksu Prefecture. In the current research, the prevalence in cows was 0.19% (615/327022), higher than that in beeves ($P< 0.01$, OR= 1.903, 95% CI= 1.696 to 2.134) at 0.10% (557/562987), possibly due to the susceptibility in difference between different breeds of cattle. Cows are more susceptible to TB.

Feeding pattern was another important risk factor for cow in the present survey. The prevalence of bovine tuberculosis infection was 0.26% and 0.12% in the farm and peasant household groups, respectively. Statistically significant differences between these values were obtained ($P< 0.01$; OR= 2.238, 95%; CI= 1.937 to 2.585). Cattle in most of the farm are pastoralism, based on transhumance, which refers to a pattern of seasonal movement between dry season and wet season pastures. Given the feeding patterns and proximity to wildlife, studies are needed to explore the disease status, dynamics in the ecosystem and risk factors for bTB infection in animals and ultimately also humans.

The elimination of bTB from cattle is likely to be a difficult goal, but it is an extremely important one to accomplish. In Xinjiang, bTB has been controlled through "a test-and slaughter measures" for cattle and made major progress in decreasing the positive rate. Nevertheless, bTB remains a problem in some regions where surveillance and control activities are often inadequate or unavailable possibly due to lack of funds to support the whole exercise and compensate for tested and slaughtered animals (Katale *et al*., 2013). In conclusion, current control measures for bovine tuberculosis of Aksu Prefecture cattle herds might be valuated as effective.

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