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SHORT COMMUNICATION

A seroepidemiological survey of Q fever among sheep in Mazandaran province, northern Iran

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Abstract

Q fever is a zoonosis caused by *Coxiella burnetii* which infects various hosts, including humans and animals. As Q fever is considered a public health problem and there is little epidemiological information on the status of the disease in various parts of Iran, the presented study was carried out to evaluate the seroepidemiology of Q fever among sheep in the province of Mazandaran, northern Iran. 253 samples from sheep were collected from the western, central and eastern regions of Mazandaran province in 2010–2011. Serum samples were analyzed by IgG ELISA test. The seroconversion rate was 23.7%. A significant statistical difference (P<0.001) was seen between the seroconversion rate of the central (33.8%) and eastern (27.2%) regions, compared to the western regions (8.5%). Seroprevalence of Q fever IgG in sheep did not vary by age and gender.

Key words

Coxiella burnetti, Q fever, Seroprevalence, ELISA, Animal, Iran

INTRODUCTION

Q fever is a zoonosis caused by *Coxiella burnetii*, an obligate gram-negative intracellular bacterium that is able to infect a wide range of animals as well as humans [1, 2]. Inhalation of contaminated aerosols is the main route of Q fever transmission to humans. Other routes of transmission include: consumption of milk and dairy products, skin contact, and maternal [1]. About half of the human cases infected with this bacterium show clinical symptoms of the disease. The disease initially is presented with influenza-like symptoms. The fatality rate of Q fever in its acute form is reported to be 1 – 2% [1, 2]. The symptoms of the disease in its chronic form include fatigue, endocarditis, vascular infection, abortion and stillbirth [1, 3, 4].

The reservoirs of this disease are widespread, but the main reservoirs are generally considered to be mammals, birds and arthropods (mainly ticks) [2], while cattle, sheep and goats are considered the most common sources for human infection [5]. Generally, Q fever infection in animals is asymptomatic. *C. burnetii* can cause abortion, stillbirth, infertility, metritis and endometritis in domestic animals (cattle, sheep and goats). Infected animals shed this bacterium through milk, urine, faeces, vaginal mucus and birth products (placenta and foetal fluids) [6]. People working with farm animals, such as livestock handlers, farmers, veterinarians, slaughterhouse workers, and laboratory personnel are at higher risk of infection [5, 7]. Since the report of several cases of the disease among American soldiers in Afghanistan [8], the infection has also become important among the armed forces commissioned to other countries.

Although Q fever is considered an important aspect of public health, there is still little epidemiological information regarding the status of the disease in many parts of Iran, such as in the province of Mazandaran, which has a high level of livestock. Therefore the presented research was been carried out in different geographical regions of Mazandaran to survey the seroprevalence of Q fever among sheep.

MATERIALD AND METHOD

The study was carried out in the province of Mazandaran, northern Iran, during which sheep samples were collected from the western, central and eastern regions of the province. In each region, cities were randomly selected. Sheep samples were collected from the western, central and eastern regions of province of Mazandaran. Sampling was performed in December 2010 to March 2011. Blood samples were taken from the jugular veins of sheep, and their history, including age, gender and location, was recorded. Samples were transported immediately to the laboratory and their serum extracted. Serum samples were analyzed by ELISA test using *Coxiella burnetii* antibody (IgG) diagnosis kit (CHEKIT Q fever ELISA kit, Idexx, USA.) in the Department of Epidemiology in the Pasteur Institute of Iran.

Data were analyzed with statistical software SPSS (16th version). Chi-square test was used to compare the variables in analysis, and the regression logistic test was performed for analyzing the effects of different variables on the disease. $p<0.05$ were considered statistically significant.

RESULTS

In the presented study, 253 serum samples were collected from 3 regions of the province (Fig. 1). The infection rate with Q fever in the survey was 23.7%.

The chi-square test showed a significant statistical difference between the regions studied ($p<0.001$); Central (33.8%) and eastern (27.2%) regions showed a higher rate of infection compared to western regions (8.5%). The highest

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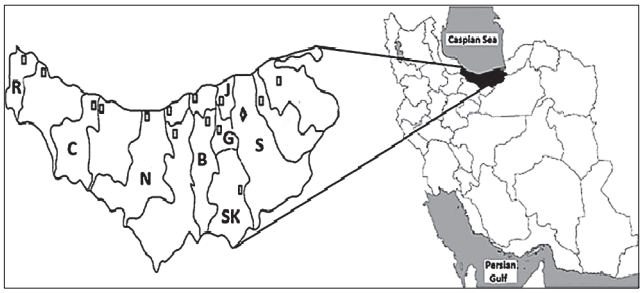

Figure 1. In this survey, the province for sampling (Mazandaran) is shown by a dark colour in the original map. Sampling was carried out in Ramsar (R), Chaloos (C), Noor (N), Babol (B), Savad Kooh (SK), Sari (S) Jooybar (J) and Ghaemshahr (G) townships.

infection rate was observed in Babol (40.5%) and Savad Kooh (35%) and the lowest infection rate observed in Ramsar (2.6%) (Tab. 1).

Table 1. Q fever seroconversion rate in 2010–2011among sheep in eastern, western and central parts of Mazandaran province, northern Iran.

Region	No. tested (% seropositive)	Odds Ratio (95% CI)	Distinct Name	No. tested (% seropositive)
West	71 (8.5%)	0.18 (0.07–0.48)	Ramsar	38 (2.6%)
			Chaloos	33 (15.2%)
Central	68 (33.8%)	1.00*	Noor	31 (25.8%)
			Babol	37 (40.5%)
East	114 (27.2%)	0.73(0.38–1.4)	Sari	46 (26.1%)
			Savad Kooh	40 (35.0%)
			Jooybar	19 (15.8%)
			Ghaemshahr	9 (22.2%)
Total	253 (23.7%)			

* Reference value

Regression logistic analysis showed that there was no significant difference between the 3 groups of sheep. Furthermore, in the presented study, no significant relationship was found between gender and infection rate (p=0.393) (Tab. 2).

Table 2. Seroprevalence of Q fever among sheep in different age and gender groups of Mazandaran province.

Variable	Category	No. tested (% seropositive)
Gender	Male	24 (16.7%)
	Female	229 (24.5%)
Age	Younger than 3 years old	98 (21.4%)
	3–5 years old	72 (26.5%)
	over 5 years old	83 (23.6%)
Total		253 (23.7%)

DISCUSSION

In the presented study, 23.7% of the sheep population in the province of Mazandaran had a history of infection with *C. burnetii,* which is an infection rate similar to the results of other studies carried out in other regions of Iran. In recent studies carried out in Iran, the serological prevalence rate of Q fever in sheep in the province of Kerman (southern Iran) was 29.42% [9], and in southeast Iran, the infection rate among goats and cattle was 65.78% and 10.75%, respectively [10]. In research carried out in 2004–2005 in the west of Mazandaran, to survey infection with *C. burnetii* by the PCR method on 447 blood samples (humans, sheep, cattle, goats, dogs and porcupines) and 605 ticks, there were no positive cases of infection with *C. burnetii* [11]. With respect to the results of this research, it is probable that Q fever disease is emerging in this area. In other countries, a seroprevalence rate of Q fever was reported among livestock (8.7% of sheep in Japan [12], 20% of sheep in Turkey [13] and 6.2% of cattle in Germany) [14].

Despite the fact that a significant relationship between an increase in age of the animals and the likelihood of having IgG antibody was expected, and also that similar research has proved this hypothesis, in the presented study, no significant relationship between age and infection rate was found. This means that in the presented study there was no significant difference of infection rate with respect to age range, and in this regard, the probability that this disease is emerging in this area seems more certain as the disease has affected all ages equally.

Regarding the fact that there is a higher infection rate in the eastern and central regions of the province, compared to the western region, and also taking into account the illegal and legal import of livestock from Afghanistan into Iran, as well as recent reports of Q fever infection in Afghanistan[8], the hypothesis that the disease is spreading from the eastern boundaries is highly probable.

In the presented study there was no significant relationship between gender and infection rate, results similar to those of previous studies, but the lower number of samples of males (n=24), compared to females (n=229) made it difficult to reach a valid conclusion with regards to this finding.

Sheep breeders, veterinarians and farmers are the high risk occupational groups for *C. burnetii* infection. It is recommended that complementary studies are carried out on these high-risk groups, ticks and other kinds of livestock, to delineate the status of Q fever disease in this province. In addition, further studies should be carried out in the northern neighbouring provinces (Golestan, Gilan, etc.) to highlight the epidemiological feature of this disease in the Caspian Sea border provinces. Turkmenistan is the nearest country to the province of Mazandaran and has a close relationship with other northern provinces.

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