

Original Article

## Seroprevalence of Q Fever and Brucellosis in Domestic and Imported Cattle of Southeastern Iran

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**Introduction:** Q fever and brucellosis caused by *Coxiella burnetii* and *Brucella* spp., respectively are among the significant zoonotic infectious diseases worldwide affecting both humans and domestic animals. Iran and its neighboring countries in the east are endemic for these diseases. This study, conducted in 2011-2012, aimed to determine the seroprevalence of Q fever and brucellosis among domestic and imported cattle slaughtered in Zabol city of Sistan and Baluchistan province, eastern Iran. **Methods:** We collected blood samples from 103 imported and 62 domestic animals. The Sera were separated and examined by an ELISA test for the presence of IgG against the two causative agents. **Results:** The seroprevalence of brucellosis in imported cattle was 0.97%, while none of the domestic animals turned positive. Seroprevalence of Q fever in domestic cattle was 3.23%, whereas all imported cattle were negative. **Conclusion:** In this study, brucellosis and Q fever exhibited a very low seroprevalence in domestic and imported animals. Further studies on other livestock would provide more information on the status of these diseases in the southeast of Iran. Furthermore, studies on the prevalence of these diseases in border regions and neighboring countries of Sistan and Baluchistan would provide more in-depth insights into these diseases and the possibility of their importation to Iran. *J Med Microbiol Infec Dis, 2018, 6 (2-3): 48-52.*

**Keywords:** Q Fever, Zoonoses, *Coxiella burnetii*, *Brucella*, Iran.

### INTRODUCTION

About 60 to 75% of infectious diseases in humans are zoonotic. These diseases are of great concern worldwide due to their increasing public health threat and their negative impact on livestock production, trade, travel and economy [1-3].

Q fever is one of the controversial zoonotic diseases with a global distribution. The causative agent, *Coxiella burnetii*, occurs in a wide range of domestic and wild animals [4, 5]. This bacteria is relatively resistant to environmental conditions and can spread by wind [6]. In nature, livestock (cattle, goats, sheep, and camels) are the primary reservoir of this bacteria [7]. This pathogen occurs with high concentrations in the placenta, amniotic fluid and birth products of infected animals [8]. Infection with this agent in animals can lead to abortion and stillbirth, infertility, the birth of weak calves and pneumonia [8, 9]. The primary route of human infection by this organism is via aerosols, *i.e.*, inhalation of aerosols. Also, the disease transmission can occur by consumption of the contaminated foods including dairy products, eggs, and other livestock products, and rarely by tick bites [6]. This disease is regarded as an occupational disease of the ranchers, farmers, veterinarians and slaughterhouse workers [8].

The bacterium, *C. burnetii*, is a highly infectious pathogen of humans and infection with it appears in two

forms of the disease, acute and chronic. Acute Q fever is a self-limiting disease with manifestations of fever, chills, headache, muscle aches and weakness. It is mostly characterized by pneumonia, hepatitis, prolonged fever and meningoencephalitis [8]. Chronic Q fever is mainly associated with endocarditis causing 6 to 65% mortality [6, 8]. Both forms of acute and chronic, are recognized by detection of IgGs developed against the bacterial antigens in phase I and II of the disease [4, 10].

Q fever is endemic to Iran, and there are reports of both forms of the disease, chronic and acute Q fever, among humans [11]. Moreover, there are many reports on livestock infections from different parts of the country [11-18].

*Brucella* spp. are gram-negative intracellular bacteria [19]. The incidence of brucellosis has significantly declined

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in industrialized countries, but in most developing countries the disease remains a significant public health concern [20, 21]. The human infections exhibit various symptoms whereas in livestock the infection mainly results in abortion in late pregnancy, infertility, testicular swelling and impaired fertility [10, 22]. *Brucella abortus* is the primary cause of abortion in cattle, and the material from ruminants' miscarriages are the primary source of bacteria for humans and animals infection [7, 23].

Annually, more than 500 thousand human infections of brucellosis are reported worldwide, mostly from developing countries [24]. This infection can be transmitted through consumption of contaminated foods, direct contact with broken skin and mucosal membranes (including conjunctivitis), and inhalation of aerosols (in slaughterhouse and laboratories) [19, 21]. In humans, the disease causes a wide range of symptoms including the typical undulant fever. The most common manifestation in humans is a flu-like illness appearing as atypical pneumonia [7, 23]. This bacterial infection causes a very severe debilitating disease, with clinical presentations like fever, sweats, weakness, weight loss, headache, and continuous joint pain lasting few weeks to years. Neurological complications, endocarditis, and testis infection or bone abscesses can also occur [22]. The disease has substantial economic impacts on animal productivity in the affected countries [15, 25, 26]. In Iran, brucellosis is a significant infectious disease affecting more than 20 thousand people annually, which reflect the high burden of the disease in the country [27].

Brucellosis is endemic to the neighboring countries, *e.g.*, Afghanistan and Pakistan in the east of Iran [28]. In Afghanistan, brucellosis was reported among 1.3% of livestock (1.4% in sheep, 1.5% in goats, 0.3% in cattle) by ELISA methods and Q fever exhibited a prevalence of 41.3% among these animals (43.4% in sheep, 52.7% in goats, and 5.2% in cattle) [29]. In Pakistan, Q fever infection was detected in 17.9% of the sheep and 16.4% of goats by ELISA methods, and brucellosis was reported in 6% of livestock [30, 31].

Many livestock from Afghanistan and Pakistan are imported to Iran via the borders of Sistan and Baluchistan province, and Zabol city in the north of this province is one of the main transit points for the importation of the livestock. Regarding the possibility of the introduction of Q fever and brucellosis-infected livestock to Iran through Zabol city, we prompted to investigate the seroprevalence of these diseases in domestic and imported cattle in this region.

## MATERIAL AND METHODS

**Sample collection.** Samples were collected during 2011-2012 from the industrial slaughterhouse of Zabol city. Blood samples were obtained from the jugular vein using Venoject tubes before slaughtering of the animals. A questionnaire was filled containing the information about age, gender, history of abortion and illness of the animals. Blood samples were transferred to the laboratory at the ambient temperature and were centrifuged at 3000 rpm for

10 min to separate the sera. The sera were kept at -20°C until they were transferred to Pasteur Institute of Iran.

**Detection of anti-*C. burnetii* IgGs.** Sera were tested to detect IgG antibodies against *C. burnetii* using a commercial ELISA kit (US, IDEXX) according to the manufacturer's recommendations. The optical density at 450 nm (OD450) was measured by an ELISA reader. A cut-off was defined as specified by the kit manufacturer and the positive, negative and suspicious samples were identified accordingly.

**Detection of anti-*Brucella* IgGs.** A commercial ELISA kit (US IDEXX) was used to detect *Brucella* spp antibodies. The ELISA was performed according to the manufacturer's instructions. The optical density of the samples at 450 nm (OD450) was measured by an ELISA reader. Based on a cut-off specified by the kit manufacturer, the positive, negative and suspicious samples were identified.

**Statistical analysis of data.** Stata software version 11 was used for data analysis. For comparison of the results, chi-square and Fisher's exact test were used and *P*-values less than 0.05 were considered statistically significant.

## RESULTS

In this study, sera of 165 cattle (103 imported and 62 domestic) were tested; 80.6% belonged to male animals, and 43% were over two years old.

Out of 165 livestock, only one imported cattle (0.97%) had anti-*Brucella* IgGs, and the rest of the animals were negative. Our results also showed that in domestic animals, two cases (3.23%) were positive and four (6.45%) had antibodies at borderline for Q fever. No positive Q fever livestock was observed among the imported animals, but four cases (3.88%) had IgG antibodies at borderline.

There were no significant correlations between the type of cattle (domestic and imported) and the infection rate. Also, between gender and age and the prevalence of diseases, no significant correlation was observed (Table 1). While 3.23% of the domestic cattle and none of the imported animals were seropositive for brucellosis, and also no domestic cattle and 0.97% of imported cattle were seropositive for Q fever, these difference were not statistically significant.

## DISCUSSION

This study aimed to investigate the seroprevalence of two major zoonotic bacterial diseases, brucellosis and Q fever among the slaughtered cattle in Zabol city. The seroprevalence of Q fever and brucellosis was 1.27% and 0.61%, respectively. There was no significant relationship between age, gender, and the animal species with the prevalence of the two infections.

This finding was consistent with other similar studies in Iran and the world [32, 33]. In some studies, age showed to be as risk factor for contraction of infectious diseases [22, 34].

Several studies conducted in different countries showed that gender was not a risk factor for Q fever, which is in

**Table 1.** Prevalence of brucellosis and Q fever based on livestock species, age, and sex

Variable	No.	Brucellosis		Q fever	
		No. of positive sera (%)	P-value	No. of positive sera (%)	P-value
Type of studied cattle	Domestic	62	2 (3.23)	0 (0.00)	1
	Imported	103	0 (0.00)	1 (0.97)	
Gender	Male	133	1 (0.75)	1 (0.75)	1
	Female	32	1 (3.13)	0 (0.00)	
Age (year)	≥	71	1 (1.41)	1 (1.41)	0.43
	≤	94	1 (1.06)	0 (0.00)	
Total	-	165	2 (0.61)	1 (1.21)	-

parallel to the results obtained in our study [22, 32]. Some other studies considered the gender as a risk factor that dairy cows aged three years had the highest seroprevalence [35].

In this study, no significant correlation was observed between age and seroprevalence of brucellosis, which was consistent with similar studies in Iran [36]. However, in some studies, age showed to be a risk factor and rate of infection increased with the age [37, 38].

In this study, there was no significant association ( $p=0.35$ ) between *Brucella* seropositivity and the animals'

gender, while the rate of infection in the females was higher than males, which matched the results of a similar study in Zimbabwe [38], but in contrast to a study in Nigeria [39].

The seroprevalence rate of Q fever (1.27%) and brucellosis (0.61%) obtained in the present study was much lower than the similar studies in Iran and neighboring countries (Table 2). The low prevalence of Q fever and Brucellosis in both the imported and domestic cattle in this study was surprising and unexpected and demands further studies in this region to gain a better insight of the status of these diseases.

**Table 2.** The results of studies on the prevalence of Q fever and brucellosis among cattle in Iran and neighboring countries

Location	Time	Number of studied cattle	Prevalence of infection (%)		Reference	
			Q fever	Brucellosis		
Iran	Mazandaran	2008	102	0	-	[40]
	Kerman	2009	93	10.75	-	[41]
	Hamadan	2015	120	0.83	-	[32]
	Isfahan	2011	247	3.2	-	[42]
Turkey	2000	416	5.8	-	[43]	
Afghanistan	2015	334	5.2	0.3	[29]	
Iran	Sarab	2011	600	-	3.66	[44]
	Urmia	2010	256	-	1.77	[45]
	Shabestar	2013	50	-	10	[46]
Pakistan	2013	1168	-	6.9	[47]	
Pakistan	2013	275	-	4.7	[48]	
Afghanistan	2013		5.2	0.29	[49]	

One of the flaws of this study was the lack of access to the information on the slaughtered cattle such as the parturitions, history of abortion, and vaccination. This limitation was because the purchasers of the cows were not aware of the history of the animals.

Further studies on the other domestic and imported livestock such as sheep and goat in southeastern provinces would provide a better insight into the epidemiological status of these diseases in this area and the possibility of their importation to Iran from neighboring countries.

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## CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

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