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Seroepidemiological survey of tularemia among different groups in western Iran

Saber Esmaeili [a], Mohammad Mehdi Gooya [b], Mohammad Reza Shirzadi [b], Behzad Esfandiari [a], Fahimeh Bagheri Amiri [a,c], Manijeh Yousefi Behzadi [a], Omid Banafshi [d], Ehsan Mostafavi [a,*]

[a] Department of Epidemiology, Pasteur Institute of Iran, No. 69, Pasteur Ave., Postal Code 1316943551, Tehran, Iran
[b] Center of Disease Control (CDC), Ministry of Health, Tehran, Iran
[c] Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran
[d] Kurdistan University of Medical Sciences, Sanandaj, Iran

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SUMMARY

Background: The first human case of tularemia in Iran was reported in 1980 and there have been no subsequent reports of tularemia in the country. The aim of this study was to carry out a survey of tularemia among different groups in the province of Kurdistan in western Iran.
Methods: The following information was collected by means of an in-house questionnaire: participant demographic characteristics, exposure to risks, and use of appropriate personal protective equipment and disinfectant in their occupation. A blood sample was collected from each participant. Sera were tested using an ELISA kit (Virion\Serion) to detect specific IgG antibodies against *Francisella tularensis*.
Results: Of a total of 250 serum samples, 14.40% had anti-tularemia IgG antibodies. The highest seroprevalence was found in hunters (18%) and the lowest in health care workers (12%). Age had a significant positive association with tularemia seroprevalence ($p < 0.001$). The seroprevalence of tularemia in people exposed to foxes (hunting or eating the meat) (25%) was significantly higher than in others (8.65%) ($p = 0.01$).
Conclusions: According to the findings of this study, it is highly recommended that physicians and health care workers are informed about bacteria circulating in this area. By sensitizing the health system, it is expected that some cases of the clinical disease will be reported in the near future. Similar studies in other parts of the country and on domestic and wild animals will clarify the epidemiology of tularemia in Iran.

1. Introduction

Tularemia is a zoonotic disease caused by the Gram-negative and intracellular bacterium *Francisella tularensis*. Because of its high infectivity and low infection dose, *F. tularensis* has been classified as one of the most dangerous pathogens by the US Centers for Disease Control and Prevention (Category A, CDC).[1,2] Clinical signs of the disease are more relevant to the subspecies *tularensis* and *holarctica* of *F. tularensis*.[1] Subspecies *tularensis* (type A) is the predominant cause of tularemia infection in the USA, and is the cause of an average of 124 new cases of tularemia in the USA annually.[3] Type A is reported to have a terrestrial cycle; the main reservoirs are rabbits and ticks.[4] Subspecies *holarctica* (type B) is responsible for almost all tularemia infections in Europe and Asia. Type B is reported to have a mainly water-borne cycle with aquatic rodents as reservoirs. Type B is associated with water and animals living near water.[4,5]

F. tularensis infection has been noted in a staggering number of wildlife species, including lagomorphs, rodents, arthropods (mainly ticks), carnivores, ungulates, marsupials, birds, amphibians, fish, and invertebrates, and also livestock, but the main sources of infection for humans are rodents and rabbits and the arthropods.[4,6] Tularemia can be transmitted to humans by direct contact with infected animals or their tissues, ingesting

* Corresponding author. Fax: +98 21 66496448.
E-mail addresses: mostafavi@pasteur.ac.ir, mostafavi.ehsan@gmail.com (E. Mostafavi).

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undercooked infected meat, or via contaminated water, animal bites or scratches, arthropod bites, and inhalation of aerosol or contaminated dust.[7,8] Tularemia causes a wide variety of clinical symptoms, usually related to the route of entry of the pathogen, and can manifest in asymptomatic to severe forms.[5] The common clinical forms of the disease include ulceroglandular, glandular, oculoglandular, oropharyngeal, pneumonic, and typhoidal (systemic) tularemia.[9] Clinical symptoms and virulence of the disease in type A is more frequent than in type B, and in general, mortality associated with untreated tularemia is 10–40% for type A and 1% for type B.[1,10] Although early identification of the pathogen is important, isolation by culture, detection of antigens, and molecular approaches are not always successful or appropriate.[11] Antibodies against tularemia appear 1 to 2 weeks after infection and these antibodies are detectable for several years after infection (10 to 20 years).[12,13] Therefore, the detection of antibodies against *F. tularensis* by serological tests such as ELISA is suitable for epidemiological studies on tularemia.[14]

In a study in 1973, tularemia antibodies were detected for the first time in Iran, in domestic animals (cattle and sheep) in the northwest and in a porcupine in the southeast.[15] The first report of human tularemia (glandular tularemia) in Iran was in the city of Marivan in the southwest of Kurdistan Province (in the west of Iran) in 1980. The patient was a soldier working in deserts and the clinical symptoms were fatigue, myalgia, headache, anorexia, chills, and enlarged inguinal lymph nodes.[16]

Due to the fact that tularemia is an endemic disease in Turkey (Iran's northwest neighbor) and several clinical cases of tularemia are reported annually from that country,[17] and because of the recent detection of tularemia antibodies in the human population of the Republic of Azerbaijan (Iran's northern neighbor),[18] and taking into account the fact that there is no updated information with respect to tularemia in Iran, the aim of this study was to investigate tularemia IgG among different groups in Kurdistan Province in western Iran.

2. Materials and methods

2.1. Study area and sampling

This study was carried out during 2011–2012 among different populations in Kurdistan Province, western Iran. Approximately 700 000 people lived in the study area. The sample units were selected based on a convenience sampling method. The sampling of this survey was from the western regions of this province, with a focus on the counties of Sanandaj, Marivan, and Sarvabad (Figure 1). The different groups of people surveyed included hunters and their families, butchers and slaughterhouse workers, health care workers, and those referred to medical diagnostic laboratories. All individuals enrolled in this study were over 18 years of age and were selected at random among their groups. After consent to participate in the study was obtained, the following information was collected by means of an in-house questionnaire: participant demographic characteristics (such as occupation, age, gender, and area of residence), exposure to risks (keeping animals, hunting or eating the meat of wild animals, length of employment, exposure to ill or dying animals, splashing animal fluids on face/body, and cuts to the hands during work), and the use of appropriate personal protective equipment and disinfectant in their occupation. On completion of the questionnaire, an 8-ml blood sample was collected from each participant and immediately transferred to the laboratory for separation of the serum. Serum samples were kept below −20 °C and transferred to the Department of Epidemiology of the Pasteur Institute of Iran (Tehran, Iran).

The proposal of this study was approved by the Ethics Committee of the Pasteur Institute of Iran.

2.2. Serological tests

Collected sera were tested for the detection of anti-tularemia IgG antibodies using a commercial ELISA kit (Virion\Serion GmbH,

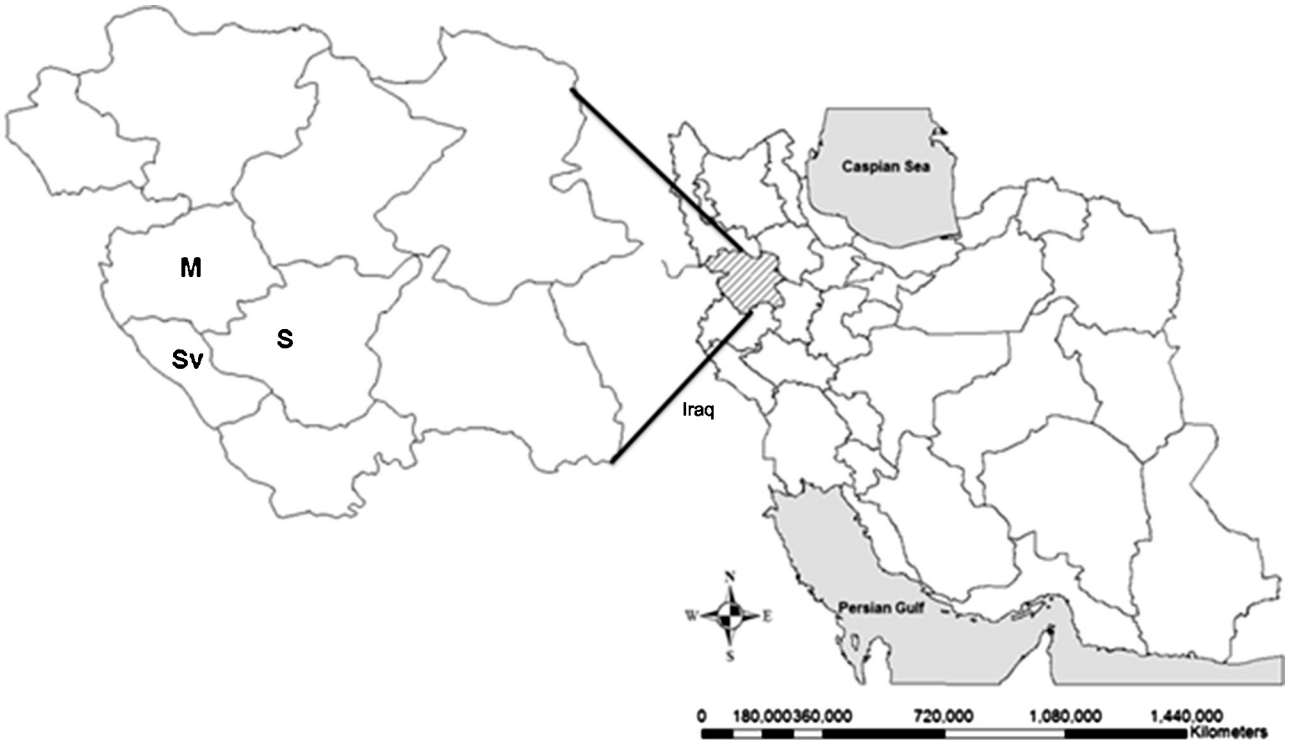

Figure 1. Location of Kurdistan Province on a map of Iran. Sampling was conducted in the counties of Marivan (M), Sarvabad (Sv), and Sanandaj (S) in 2011–2012.