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Dilshad Jaff
Advisor, Research Gillings School of Global Public Health at the University of North Carolina, Chapel Hill NC 27516, United States

Correspondence
Dilshad Jaff
Gillings School of Global Public Health at the University of North Carolina, Chapel Hill NC 27516, United States

Brucellosis in Iraqi Kurdistan: An overview

Dilshad Jaff

Abstract
Brucellosis, known as Malta fever in the region, is one of the most common bacterial zoonotic infections. In Iraqi Kurdistan, that is, the three Kurdish northern Iraqi Provinces, Erbil, Dohuk and Sulaimani, it is a widely spread disease and remains a challenging health problem. Sharing borders with Iran, Turkey, and Syria, wars and conflicts, insufficient preventive measures, the lack of adequate control programs, and uncontrolled animal transportation through "open" borders increase the risk that brucellosis will spread, although few studies on human seroprevalence of brucellosis have been conducted in the region. This article calls for collaborations between veterinary and public health authorities, establishing a surveillance program, conducting and prioritizing research, and implementing public health and other preventive measures and interventions.

Keywords: Brucellosis, zoonotic infection, surveillance, research, Iraqi Kurdistan

1. Introduction
Brucellosis is one of the most common bacterial zoonotic infections. Globally, more than 500,000 human cases are reported each year and its eradication is a major public health challenge in many countries [1]. Research and evidence show that it is more common in countries with poorly standardized animal and public health programs and interventions [2]. First discovered by David Bruce among British soldiers who served on Malta Island in 1887, it is known as Malta fever in the region [1]. Human brucellosis was first confirmed in Iraq in 1938 [3]. In Iraqi Kurdistan, that is, the three Kurdish northern Iraqi Provinces, Erbil, Dahuk and Sulaimani, it is a widely spread disease and remains a challenging health problem [4]. Sharing borders with Iran, Turkey, and Syria, wars and conflicts, insufficient preventive measures, the lack of adequate control programs, and uncontrolled animal transportation through "open" borders increase the risk that brucellosis will spread [5] although few studies on human Seroprevalence of brucellosis have been conducted in the region.
Brucellosis is transmitted to humans through consumption of unpasteurized dairy products or by direct contact with infected animals, placentas or aborted fetuses [6]. The disease is caused by different species of the genus *Brucella*, which they are facultative intracellular gram-negative coccobacilli non-spore-forming and non-capsulated [1]. Five out of the nine known *Brucella* species can infect humans and the most pathogenic and invasive species for human is *B. melitensis*, followed by *B. suis*, *B. abortus* and *B. canis* [7]. The incubation period of brucellosis normally is 1 to 3 weeks, but it can be several months before showing any sign of infection [1]. It has wide clinical signs and symptoms ranging from asymptomatic disease to severe illness. Initial symptoms may include fever, sweating, malaise, anorexia, Headache, pain in muscles, joints, and/or back and fatigue [8]. Some signs and symptoms may persist for longer periods of time and others may never go away or reoccur, including recurrent fevers, arthritis, swelling of the testicles and scrotum area, swelling of the heart (endocarditis), neurologic symptoms (in up to 5% of all cases), chronic fatigue, depression, and swelling of the liver and/or spleen [8]. Treatment failure and relapse rates are high and depend on the medication combination and patient compliance due to intracellular localization of *Brucella* and its ability to adapt to environmental conditions encountered in its replication [1]. The disease also has major economic consequences due to time lost by patients from normal daily activities [9] and losses in animal production [10]. Vaccination of animals is the most effective way to control and eradicate this zoonosis disease especially in high prevalence regions [1]. Not consuming undercooked meat and unpasteurized dairy products and using protective gears when handle tissues are best ways to prevent the infection in human [8]. This article calls for collaborations between veterinary and public health authorities, establishing a surveillance

Program, Conducting and prioritizing research, and implementing public health and other preventive measures and interventions.

2. Epidemiology of brucellosis in Iraqi Kurdistan

Brucellosis is constantly emerging or re-emerging globally and its epidemiology has changed over the last decade. It is estimated that the number of human brucellosis cases may be up to 26 times higher than the 500,000 cases reported annually [11]. Major endemic areas include countries of the Mediterranean basin, Middle East, including Iraq and Iraqi Kurdistan, the Indian subcontinent, and parts of Mexico and Central and South America. New foci that have emerged include the Balkan Peninsula and many of the former Soviet Union Asian Republics, such as Kazakhstan, Kyrgyzstan, and Tajikistan [12]. Despite the advances made in surveillance and control, the prevalence of brucellosis is increasing in many developing countries due to various sanitary, socioeconomic, and political factors [12]. Incidence of the disease varies widely not only between countries but also within countries. This suggests that demographic, occupational, and socioeconomic factors are playing a significant role [6]. The prevalence and incidence of human brucellosis in Iraqi Kurdistan are still high and it has been reported from all three Iraqi Kurdistan provinces. In 2012 in Erbil city the prevalence rate was reported 10.7%, [13] and in Dohuk was 6.36% in 2011 [4]. In 2013, 976 cases were recorded in Sulaimani province which is highest incidence of brucellosis in Kurdistan and Iraq [14]. These records are higher than records from neighboring countries. For example, in Turkey the prevalence of brucellosis varies between 2% and 6% [15]. However, these numbers are underestimated as diagnosis is occasionally confounded due to non-specific clinical manifestations, wide use of the Rose Bengal Test, which is imprecise, underreporting, lack of proper laboratory facilities in rural and remote areas, and poor cooperation and exchange of information between veterinary and public health services [16-19]. Women are more likely than men involved in household and agricultural activities in Kurdistan and due to that they come more in contact with domestic livestock. Research in the region has shown that prevalence of brucellosis is greater in rural areas and among women [13, 20].

3. Recommended strategies for prevention and control of Brucellosis in Iraqi Kurdistan

3.1 The need for public health intervention

Prevalence of brucellosis can be reduced by multi-sectorial collaborations between veterinary and public health authorities to increase awareness and education about the disease with the focus on rural areas. The focus should be on robust public health preventive interventions, because the rural health infrastructures are underdeveloped, there are insufficient community health workers in the region; brucellosis creates a dual burden on human and as well on animal health. These public health efforts should create awareness about the disease, its mode of transmission, avoidance of consuming unpasteurized dairy products, and safe livestock practices to decrease exposure. These efforts should include and highlight the importance of livestock vaccination as well. Further, increasing awareness among local health professionals will improve the diagnosis and management of brucellosis cases.

3.2 The role of local academic institutions

Epidemiological research on infectious diseases in general and on brucellosis specifically can provide the necessary information and knowledge on how to implement effective preventive interventions. Without generating and making estimates on the health impacts of brucellosis in Kurdistan having an effective public health approach would be challenging. Conducting applied research will help health authorities to design and implement effective interventions, while failing to deliver and prioritize research will leave the population highly vulnerable. Enhancing coordination and partnerships between academia, health service delivery institutions and policy makers in the region should be a high priority.

3.3 A required strong surveillance program

Effective brucellosis prevention and control in Iraqi Kurdistan requires a strong disease surveillance program by the veterinary and health authorities. Such a program will indicate the early signs of problems and alert key authorities about it. Through early detection of the disease effective responses to brucellosis in human and animal populations can minimize its risk and improve its control. Systems for infectious disease surveillance in general and for brucellosis specially are essential. These systems will provide valuable data and information to stakeholders planning and response in both human and animal.

3.4 Effective biosecurity measures at the regional and community levels

Biosecurity measures can be the most effective mean of the disease control. Implementing these measures can reduce the introduction of the disease into healthy livestock and also will limit the spread of the disease. Veterinary authorities should create recommendations and guidelines to increase animal biosecurity at regional and community levels.

3.5 Effective border control measures and policies

In the Iraqi Kurdistan, especially in border areas, uncontrolled trans-border animal trade and movement are common. This is an important factor contributing in the endemic spread of brucellosis in the region. There is a need for effective border control laws and regulations to control this disease and other infectious diseases as well. The region and all its neighboring countries should collaborate and exchange information, knowledge, and strategies regarding infectious disease control.

4. Conclusion

Brucellosis poses a very significant public health challenge for Iraqi Kurdistan. Making the population healthier requires a great deal of collaboration between key players. Multi-sectorial collaborations, surveillance programs and implementing public health preventive interventions are crucial and will allow preventing and controlling brucellosis effectively. Systematic research is essential for an accurate assessment of disease burden in Iraqi Kurdistan where data are inaccurate and eradication strategies were not effectively implemented.

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