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Prevention of Brucellosis in Saudi Arabia: A Narrative Review

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Abstract

This review provides a detailed description of brucellosis infection in the Kingdom of Saudi Arabia. Four databases were searched for journal articles, reviews, and case reports in the English language; the search was performed on June 2022. The aim of the current review is to enrich the literature on the brucellosis infection in the kingdom. Brucellosis was reported as a prevailing endemic infection in the kingdom that represents a health problem and socio-economic burden in all parts of the country. The endemicity of brucellosis in this country might be explained due to difficulty in controlling the importation of animals for slaughtering during the Hajj and Umra periods and for several other predisposing factors. The distribution of the disease is over the country and the most prevalent part is the south followed by the north and then the east and central parts. There are two main types of brucellosis species reported in Saudi Arabia include; *Brucella abortus*, and *Brucella melitensis*. The brucellosis clinical features range from asymptomatic to acute clinical features, the most frequent signs and symptoms include fever, joint pain, muscle pain, headache, nausea/vomiting, anorexia, and malaise in addition to the subsequent complications that might occur. However, the complexity of brucellosis control measures, there are several activities that have been implemented to tackle the disease such as mass vaccination of animals, regulating importation of slaughtered animals, and improving public awareness.

Keywords: *Infection, Brucellosis, Practices, Mass gathering, Saudi*

Introduction

Brucellosis is a usual chronic contagious disease which is caused by aerobic gram adverse coccobacilli labelled *Brucella* types, and possibly the common anthrozoonotic infection around the world [1, 2]. The World Health Organization (WHO) affirms that brucellosis persists to be one of the significant and prevailing global zoonotic infections [3]. The brucellosis has a global circulation; but nowadays its incidence has become rare especially in the developed countries because of improvement in the domestic livestock precautions and protection, starting a mass vaccination programs for animals and the strict legislations for animal importation in addition to many other protective measures. Nevertheless, the brucellosis remains at the top leading zoonotic infection in low-income countries of the Eastern Mediterranean Region (EMRO). Brucellosis has an endemic features, since it has been reported in specific geographical areas including the EMRO and Southern American countries. It was primarily reported in human in the island of Malta in the late 19th and early 20th centuries [4]. There has been an obvious decline in the incidence and occurrence of brucellosis worldwide, it stays a public health and wellness problem for global and also neighborhood wellness agencies.

The transmission of brucellosis infection could be happened either directly or indirectly through the contact with contaminated animals or infected dairy products. Its medical symptoms vary from asymptomatic infection to persistent types. The four *brucella* types that have human pathogenicity are *Brucella abortus*, *Brucellaisuis*, *Brucella melitensis*, and *Brucella canis*. The diagnosis of brucellosis is made by the selection of *Brucella* types, however this is achieved only in 40 to 70% of cases [1, 2]. The brucellosis has seasonal influences and mainly occur among those aged 20 - 45 years [3].

The Kingdom of Saudi Arabia (KSA) is also a vast reservoir of human brucellosis. The kingdom endemicity varies partially according to climate changes: The rain time would produce an enlarged grass and thus attract the shepherds and flocks [5]. The

high occurrence rate of brucellosis within the country is additionally attributed to other factors like unregulated importations of animals and insufficient quarantine measures [6]. The deficiency in health literacy, that may disrupt the direct relation of animals and human infection, is also crucial [7]. Saudi Arabia had the highest occurrence of human brucellosis between East countries throughout the late 1990s, the rate has actually lowered in recent times because of the implementation of laws by the Saudi Ministry of Agriculture that make brucellosis inoculations for cattle required, enhanced control of imported livestock, and also boosted participation in between vets as well as the general public wellness field. Even though its occurrence has actually gone down, brucellosis is still taken into consideration endemic in Saudi Arabia. The brucellosis is native in Saudi Arabia with a high occurrence among human [8, 9]. The evidences that have been investigated the brucellosis in the country are insufficient and/or not clear. This review aims to summarize the brucellosis in the Saudi Arabia.

Epidemiology of brucellosis:

The brucellosis has a global circulation; but nowadays its incidence has become rare especially in the developed countries [4]. Only a few countries in the world are considered free of the disease, although cases still occur in people returning from endemic countries. There has been an obvious decline in the incidence and occurrence of brucellosis worldwide, it stays a public health and wellness problem for global and also neighborhood wellness agencies. A lot of cases occur during the spring and summer seasons among those aged 20 - 45 years [3]. The brucellosis has a wide distribution over all geographical areas of Saudi Arabia. It has been reported by Aloufi, 2016, as highest prevalence in the northern (Al-Qassim), followed by southern areas (Jazan) and then the east and central parts of the country [10]. The Saudi Arabia is also a vast reservoir of human brucellosis. Regional endemicity varies in Saudi Arabia, partially according to climate influences: a rainy season in an area would

result in increased grass growth and thus influx of shepherds and flocks [5]. The high infection rate of brucellosis in the kingdom is additionally linked to huge importations of animals and insufficient quarantine measures [6]. The absence of health literacy, which could interrupt the direct link between animal and human disease, is also crucial. Saudi Arabia had the highest occurrence rate of human brucellosis between East throughout the late 1990s, the price has actually lowered in recent times because of the implementation of laws by the Saudi Ministry of Agriculture that make brucellosis inoculations for cattle required, enhanced control of imported livestock, and also boosted participation in between vets as well as the general public wellness field Even though its occurrence has actually gone down, brucellosis is still taken into consideration endemic in Saudi Arabia. B Brucellosis is native in Saudi Arabia with a reported occurrence of 18:100,000 populations per year, as reported by the Ministry of Health [8, 9].

An overall seroprevalence of 15% was discovered in the Saudi population, and also the seroprevalence in children aged 0-14 years was 10% [9]. However, several studies reported situations got to 8000 cases (22.5%) [11, 12], previous studies on human brucellosis in Saudi Arabia showed that the disease incidents recorded a vital point. The disease was reported in Central Northern Southern Saudi Arabia [13, 14]. Several lines of works are the major target of human brucellosis in Saudi Arabia. Brucellosis is thought about a significant threat for the laboratory workers of the Saudi healthcare facilities [6]. A study on 1290 abattoir employees indicated that human brucellosis among the veterinarian and also vet assistants was 5.4%, butchers 8.9% as well as 1.1% amongst the administrative personnel [15]. Aloufi et. el., (2015) found that major number of brucellosis cases in KSA since 2004-2012 with a high rate of cases in man compared to women, most cases from Al-Qassim, Aseer and Hial respectively in high risk [10].

Brucellosis types and species:

Brucella types are small, gram-negative, nonmotile, nonspore-forming, and rod-shaped (coccobacilli) bacterial organisms, eight species of them have actually been identified. Four of them have moderate

to significant human pathogenicity and consist of *Brucella abortus*, *Brucellaisuis*, *Brucella melitensis*, and *Brucellacanis*. Precise medical diagnosis of brucellosis is made by the selection of *Brucella* types, however this is achieved only in 40 to 70% of cases [15]. Various studies have investigated the types of brucellosis in desert climate [1, 8, 10, 11, 16-24]. Two species of brucellosis have been reported by the studies conducted in Saudi Arabia, which include *Brucella abortus*, and *Brucella melitensis*, and in one study conducted in Qatar, Garcell, et. el, 2016, reported that the brucella infection of *brucella abortus* and *Brucella melitensis* was isolated from milk of an infected camels [16]. In one study conducted in Dawadmi Governate (central region of Saudi Arabia), Alrheam A., et. el. 2015, reported that *B. melitensis* prevails is the prevalent causative organism of brucellosis in human [17].

Alshaalan et.el., 2014, in the study conducted among children in Saudi Arabia, reported that the most prevalent species of brucellosis causing pathogen is *brucella melitensis* followed by *brucella abortus* [1], in a case report conducted in Saudi Arabia, Alnemri, 2017, found that *Brucella abortus* was isolated from baby blood while both *B. abortus* and *B. melitensis* were isolated from mother blood [19], and also Algahtani, 2017 isolated *B. melitensis* from cerebrospinal fluid of a case of brucellosis in Saudi Arabia [20] *B. melitensis* was also reported in a case of breast brucellosis study by Nemenqani, 2009 in Taif, Saudi Arabia [22]. Furthermore, a case report by Jokhdor, 2009, it was found that the investigation of blood sample for brucella was positive *B. Melitensis* and *B. Abortus* [8]. In a study conducted in Western region of Saudi Arabia, Kamal et al, 2013, reported that both *B. abortus* and *B. melitensis*, are the most prevalent species of brucellosis [21]. The *B. suis* was not reported in all studies conducted in Saudi Arabia, since it is mainly found and transmitted from swine which are not found in Saudi Arabia.

Predisposing factors of brucellosis:

The epidemiology of brucellosis in Saudi Arabia is not similar to situation in other countries, it is complicated and not easy to control, since there many unique characters and influencing factors such as the constant

entry of pilgrims during the Hajj and Umra periods and the need for millions animals to be imported annually for slaughter. The brucellosis is transmitted directly or indirectly by contact with contaminated animals or infected dairy items. There are many other influencing factors have been reported in the studies conducted in desert climate areas. Furthermore, the justification for the high distribution of brucellosis in Saudi Arabia is attributed, and not restricted, to the travelling life style of some tribes, the traditional trust of the large advantage of drinking raw milk, especially the camel ones, the unregulated importation of animals from Africa, with lack of national and international legislations and laws for screening and quarantine, the availability of different animal herds in one place, and inadequate public awareness regarding the risks of brucellosis [1].

Garcell H. et al., 2016, in Qatar, reported that drinking fresh camel milk and males are predominant [16]. In the other studies conducted in Saudi Arabia; many predisposing factors have been reported. Alrheam A. et al 2015, reported that males are more than females and the most affected age group is 13 to 40 years [17]. Aloufi A. et al (2016), in the countrywide registry data in the kingdom, reported that the most brucella cases have been found in spring and summer seasons and the citizens were significantly more infected with brucellosis than other people [10] and similar results were reported by Alsoghair et al., 2017 [25]. Ageely 2016 in the study conducted in southern area (Jazan) reported that the main influencing factor was get in touch with animal cadavers. Brucellosis was significantly linked to keeping goats/sheep in the house, and drinking any type of fresh animal milk [26]. The drinking of fresh or raw animal milk has been reported as the main source of human brucellosis in Saudi Arabia [1, 8, 10, 18, 23, 25-27]. An extra risk is related to contact with infected animals [1, 8, 10, 25-28] and the most susceptible hosts include farmer, slaughters and animal owners. Aloufi A. et al., 2016, found that the highest brucellosis prevalence was reported in western of Saudi Arabia such as Al-Qassim in the central part of the country and the lowest prevalence was in Northern areas of the Kingdom and most frequently in March to August each year [10]. Another contradicting findings were reported by Asaad et al, 2012, who reported that the northern

region is the second top prevalent of brucellosis in the kingdom after southern region [28]. Alshaalan M. et al, 2014, reported that the use of fresh milk and, get in touch with infected animals are the main factors for infection. Furthermore, Alshaalan M. et al reported a traditional practices such as using fresh camel milk which held highly nutritional benefits [1]. Elfaki 2015, in the literature review mentioned that the most infected animals in KSA are living in home with people in rural areas where extreme human contact with animals in addition to the nomadic lifestyle help the brucella transmission [11].

Clinical features of brucellosis:

According to previous studies in Saudi Arabia, the clinical features of brucellosis in human are not specific and could range from asymptomatic to sever form of disease and complications. A small number of cases have been reported with complications and some rare case have been also reported [1, 8, 17, 18, 20, 25, 28-30]. The brucellosis characteristics vary from asymptomatic infection to persistent clinical features. Brucellosis is characterized by fever, joint pain, headache, muscle pain, anorexia malaise and nausea or vomiting as reported in several studies and case reports conducted in Saudi Arabia and the fever is the most common persistent symptom of brucellosis [1, 8, 17, 18, 25, 28, 29].

In addition to aforementioned signs and symptoms, the brucellosis in Saudi Arabia has been reported with specific complications such as abortion which has been reported by Al-Tawfiq A. 2013 et al, [31] and Almajid 2017, has mentioned bursitis as one of the clinical features of brucellosis [32], Elzien 2016 has reported that brucellosis could characterized by septic arthritis [33], hypochondrial pain and splenic infarction by Alyousef, 2015 [30], involvement of neurological symptoms such as partial seizure has been reported by Algahtani 2017 [20], and Guillain-Barre´ syndrome by Elzien 2014, c and breast lump (abscess like background) in breast brucellosis has been also documented by Nemenqani 2009 [22]. The table 1 summarize the clinical features of brucellosis with refer to the studies in which signs and symptoms reported.

Table (1): the most common signs and symptoms reported by the studies on brucellosis in KSA

No.	Signs/symptoms	Studies reported signs/symptoms
1.	Fever	(Alrheam et al., 2015, Alshaalan et al., 2014, Kiel and Khan, 1989, Alyousef et al., 2015, Jokhdar, 2009, Alsoghair, 2017, Elzein and Mursi, 2014, Asaad and Alqahtani, 2012, Al-Tawfiq, 2008) [1, 8, 17, 18, 25, 27-30]
2.	Malaise/Fatigue	(Alrheam et al., 2015, Kiel and Khan, 1989, Jokhdar, 2009, Alsoghair, 2017, Elzein and Mursi, 2014, Al-Tawfiq, 2008) [8, 17, 18, 25, 27, 29]
3.	Muscle pain	(Jokhdar, 2009, Alsoghair, 2017) [8, 25]
4.	Joint pain	(Alrheam et al., 2015, Alshaalan et al., 2014, Alsoghair, 2017, Asaad and Alqahtani, 2012) [1, 17, 25, 28]
5.	Headache	(Alsoghair, 2017, Alqahtani et al., 2017, Elzein and Mursi, 2014, Asaad and Alqahtani, 2012) [20, 25, 28, 29]
6.	Sweating	(Alshaalan et al., 2014, Kiel and Khan, 1989) [1, 18]
7.	Nausea/vomiting	(Alyousef et al., 2015, Asaad and Alqahtani, 2012) [28, 30]
8.	Anorexia	(Jokhdar, 2009, Alsoghair, 2017, Al-Tawfiq, 2008) [8, 25, 27]
9.	Splenomegally	(Alrheam et al., 2015, Alshaalan et al., 2014, Alyousef et al., 2015) [1, 17, 30]
10.	Hepatomegally	(Alrheam et al., 2015, Alshaalan et al., 2014, Alyousef et al., 2015) [1, 17, 30]
11.	Neurological effects	(Alqahtani et al., 2017, Elzein and Mursi, 2014) [20, 29]
12.	Breast lump	(Nemenqani et al., 2009) [22]
13.	Septic arthritis	(Elzein and Sherbeeni, 2016) [33]

Control measures and eradication of brucellosis:

However, the successful intensive health control measures to control and eradicate brucellosis in many developed countries such as United States of America (USA) and some countries in North Europe, the disease is still widely spread in other developed countries such as the Kingdom of Saudi Arabia among the wild and domestic animals which causes economic burden for the countries [34]. Because brucellosis is a

native infection in Saudi Arabia with a highly reported occurrence of 18:100,000 population per year, as reported by the Ministry of health in 2011 [8, 9], it is recommended to apply intensive control measures and raise some legislations to control the infection of brucellosis. Furthermore, the breakdown of the chain of transmission of brucellosis in highly endemic areas needs collaborative interventions.

In the studies on brucellosis in Saudi Arabia, several studies provided a suggested interventions and control measures to control and/or eradicate the disease. As reported above the situation in Saudi Arabia is unique and the factors predisposing the diseases are many and difficult to control. Alrheam et al., 2015, reported that the situation of brucellosis in KSA should be tackled through collaborative interventions and application of specific control measures [17]. The collaborative interventions should be taken to control human brucellosis are dependent on eradication of animals brucellosis. The recommended action that can help to eliminate animal brucellosis comprise enhancing the alarming system of emergent brucella cases to the health authorities; increasing awareness among the susceptible groups; vaccinating herds; adherence to hygienic precautions in farms; applying legislations and rules for animal importation; initiating strategic plan to quarantine suspected animals; raising guidelines or early detection and isolation of infected animals [17]. Aloufi A. et al. 2016, focused on the preventive measures for transmission of brucellosis from animal to human in two main actions; vaccinating animals and improving the public awareness [10].

Furthermore, Ashaalan et al., 2014, mentioned some interventions required for eradicating and controlling brucellosis such as treating infected animals, increase public awareness, regular animal check-up, screening and avoiding mixing different herds of animals [1]. Some researchers recommended use of antimicrobial in animals for the purpose of prevention and control to human [19, 22, 25, 27, 30, 33] and treating brucellosis in pregnant women [31]. There are many other interventions have been recommended by researchers which include; environmental sanitation [8], enhancing reporting system [8], mass livestock vaccination [8, 26], milk pasteurizing [18],

implementing national brucellosis control program [8], implementing strict biological safety in the laboratories [20].

Conclusion:

Brucellosis is one of the most common endemic infections in the Kingdom of Saudi Arabia that represent a prevailing health problem and socio-economic influences in all parts of the kingdom and the most prevalent part is the south followed by north and then the east and central parts. There are two main types of brucellosis reported in Saudi Arabia include; *Brucella abortus*, and *Brucella melitensis*. The brucellosis epidemiology in the kingdom is unique and many predisposing factors related to Hajj and Umra might influence the situation. However, the complexity of brucellosis control measures, there are several activities have been implemented to tackle the disease. One of the limitations of this review is in reality that only English literature has been searched and thus articles or researches published in any other language might not have been included.

Conflict of interests

The authors declared no conflict of interests.

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