Original Article:

Prevalence of Brucellosis in Hawtat Sudair City, Riyadh Province, Saudi Arabia

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Abstract

Background: Brucellosis is a zoonotic disease caused by the bacterium known as Brucella. Consumption of unpasteurized dairy products, inhalation of aerosol carrying the bacteria and occupational contact with infected livestock are the main causes of infection. This paper discusses the brucellosis prevalence among patients visiting the Howtat Sudair General Hospital during the period from December 2012 to January 2017.
Methods: The data of samples tested serologically for Brucella spp. infection were collected from the microbiology laboratory at Hawtat Sudair General Hospital, Riyadh, Saudi Arabia and analyzed statistically looking at socio-demographic (i.e. age) in relation to cases of brucellosis.
Results: 1286 samples tested for Brucella spp. (B. melitensis and B. abortus), 489 (38.03%) samples were positive for Brucella spp. with various age groups having different levels of infected cases. The majority of cases were in the age group from 30 to < 50 years with less cases in the younger age groups <18 and from 18 to < 30 years. We found more cases of B. abortus infection compared to B. melitensis infection with 88.1% of the samples were positive for both B. melitensis and B. abortus.
Conclusion: The study confirms that brucellosis is still endemic in Hawtat Sudair city, Riyadh, Saudi Arabia.

Keywords: Brucella spp., brucellosis, zoonotic, prevalence, Hawtat Sudair city.

الملخص:

الخلفية: الحمى المالطية هي مرض يصيب الحيوان تسببه البكتيريا المعروفة باسم البروسيلا. ويعد استهلاك منتجات الألبان غير المبسترة واستنشاق الهواء الجوي الذي يحمل البكتيريا بالإضافة الي الاتصال المهني مع الماشية المصابة من الأسباب الرئيسية للعدوى.
تناقش هذه الورقة انتشار الحمى المالطية بين المرضى الذين يعاودون مستشفى حوطة سدير العام خلال الفترة من ديسمبر ٢٠١٢ إلى يناير ٢٠١٧.

الطريقة: تم جمع عينات الدراسة من مختبر الاحياء الدقيقة في مستشفى حوطة سدير العام، الرياض، المملكة العربية السعودية.
تم جمع البيانات من عينات اختبرت سيرولوجيا للتحقق من الاصابة بعدوي البروسيلا. كما تم تحليل البيانات إحصائيا للنظر في العلاقة الديموغرافية الاجتماعية (العمر) والاصابة بداء البروسيلا.

النتائج: تم اختبار ١٢٨٦ عينة لنوعين من البروسيلا (بروسيلا مليتنسيس وبروسيلا أبورتوس)، كانت ٤٨٩ (٣٨,٠٣٪) من العينات بمختلف الفئات العمرية لديها إيجابية البروسيلا بمستويات مختلفة من حالات الاصابة. وكانت غالبية الحالات في الفئة العمرية من ٣٠ إلى ٥٠ سنة مع حالات أقل في الفئات العمرية الأصغر سنا من ١٨ سنة، ومن ١٨ إلى اقل من ٣٠ سنة. وجدنا المزيد من حالات عدوى البروسيلا أبورتوس بالمقارنة مع عدوى البروسيلا مليتنسيس مع ٨٨,١٪ من العينات كانت إيجابية لكل من البروسيلا مليتنسيس والبر وسيلا أبورتوس.

الخلاصة: تؤكد الدراسة أن الحمى المالطية مازالت مستوطنة في مدينة حوطة سدير، الرياض، المملكة العربية السعودية.

الكلمات الرئيسية: بروسيلا، الحمى المالطية، الحيوانية المنشأ، انتشار، مدينة حوطة سدير.

Introduction

Brucellosis is one of the most important worldwide zoonotic bacterial infection affecting livestock and humans [1, 2]. It is caused by the Gram-negative facultative intracellular bacterium of the genus Brucella. The four important species of Brucella that are pathogenic to humans are Brucella melitensis; found primarily in goats, sheep and camels; Brucella abortus found in cows; Brucella suis found in pigs; and Brucella canis found in dogs [3.4]. For humans, Brucella melitensis is the most pathogenic and invasive among the different Brucella spp., followed by Brucella suis, Brucella abortus, and Brucella canis [5].

Brucellosis remains an important public health concern in many parts of the world [6,7]. The bacterial transmission to humans occurs by the ingestion of raw or unpasteurized milk and other dairy products, direct contact with infected animal tissues, or the accidental inhalation, ingestion or injection of Brucella [8,9].

Humans infected with Brucella spp. may develop various symptoms including irregular fever, profound sweating, fatigue, anemia, depression and headache [10,11]. The most common diagnostic method for the identification of Brucella spp. infection is the serological screening method (i.e. the serum agglutination test; SAT). However, this needs further confirmation by the isolation of the bacteria from the blood. Other diagnostic approaches include the indirect fluorescence antibody assay (IFA), the anti-human globulin test and the enzyme-linked immunosorbent assay (ELISA) [11,12].

Brucellosis causes more than 500,000 human infections annually worldwide [13]. Although, brucellosis has a limited geographic distribution, it remains endemic causing major public health problems in areas such as western Asia, the Mediterranean region, Africa and Latin America [2,13]. The majority of developed countries were successful in implementing disease eradication protocols. However, brucellosis remains a health concern, as there is no human vaccination available yet and the difficulty of controlling the huge number of livestock importation between counties [14,15]. In Saudi Arabia, different regions have different prevalence of brucellosis, with values of about 8% had been reported [16]. Brucellosis in Saudi Arabia is highly endemic, with an estimated incidence of 5.4 per 1000 per year was reported [9]. In addition, Memish and Mah (2001) reported that there is an annual estimation of more than 8000 cases of brucellosis reported by the Saudi Arabian Ministry of Health. The majority of incidence found in the Riyadh province and the area around it. These areas are famous for farms owners where they keep and raise livestock animals such as camels, goats, and cows. Furthermore, it is a very strong part of the people tradition in these areas to consume the animal milk and dairy products raw or unpasteurized, which makes the persistent of the disease in such areas [3,17,18].

In Saudi Arabia, there is a lack of prevalence data on brucellosis for most provinces. Therefore, this study will assess the disease prevalence in Hawtat Sudair city,

northern part of Riyadh province. In this study, an estimate of the prevalence of human brucellosis in Hawtat Sudair city from samples tested for Brucella infection in Hawtat Sudair General Hospital (HSGH) is reported.

Methods:

Data collection

This study was carried out in HSGH, Hawtat Sudair city, Riyadh, Saudi Arabia. Data were collected from the logbook of the hospital's microbiology laboratory covering the period from December 2012 to January 2017. Data collected are serological testing of the Brucella spp. (B. melitensis and B. abortus) using the tube agglutination test from Crescent Diagnostics (Febrile antigens used were; FB850-10 B. melitensis and FB850-9 B. abortus). According to the manufacture instructions, titers >/= 1/180 indicate infection. In addition, sociodemographic data (i.e. age) of the patients were obtained from laboratory logbook.

Statistical analysis

Descriptive statistics were used to estimate the prevalence of brucellosis screening and demographic characteristics. Frequencies and cross-tabulations were used by Chi-square and Spearman Correlation tests were also used to assess these relationships. Statistical significance was evaluated at $\alpha = 0.05$ (see supplementary data). Statistical percentages were calculated and schematically presented using the Microsoft excel program.

Results:

In this study a total number of 1286 samples tested for Brucella spp. (B. melitensis and B. abortus) were collected including 204 (15.86%) samples in the age group <18, 246 (19.13%) samples in the age group from 18 to < 30, 535 (41.6%) samples in the age group from 30 to < 50, 297 (23.09%) samples in the age group from 50 to < 90 and 4 (0.31%) sample in the age group >90(Table 1).

Table 1. Samples represented as age groups and the total number of the negative and positive tests with their percentages.

Parameters		Frequency	Percentage
Age	< 18	204	15.86%
	From 18 to < 30	246	19.13%
	From 30 to < 50	535	41.60%
	From 50 to < 90	297	23.09%
	> 90	4	0.31%
B. melitensis	Negative	1049	81.57%
	Positive	237	18.43%
B. abortus	Negative	1034	80.40%
	Positive	252	19.60%

Out of 1286 samples tested for Brucella spp. (B. melitensis and B. abortus), 489 (38.03%) samples were positive for Brucella spp.; 237 (18.43%) were positive for B. melitensis and 252 (19.6%) were positive for B. abortus (Table 1).

Out of the 237 B. melitensis positive cases, 48 samples (3.73%) were in the age group less than 18 years, 49 samples (3.81%) were in the age group 18 to <30 years, 96 samples (7.47%) were in the age group 30 to <50 years, 44 samples (3.42%) were in the age group 50 to <90 years (Table 2 and Fig 1).

Table 2. Samples tested for B. melitensis represented as age groups showing the numbers of the negative and positive tests with their percentages.

Parameters	B. melitensis	
	Negative	Positive
< 18	156 (12.13%)	48 (3.73%)
From 18 to < 30	197 (15.32%)	49 (3.81%)
From 30 to < 50	439 (34.14%)	96 (7.47%)
From 50 to < 90	253 (19.67%)	44 (3.42%)
> 90	4 (0.31%)	0 (0.00%)
Total	1049 (81.57%)	237 (18.43%)

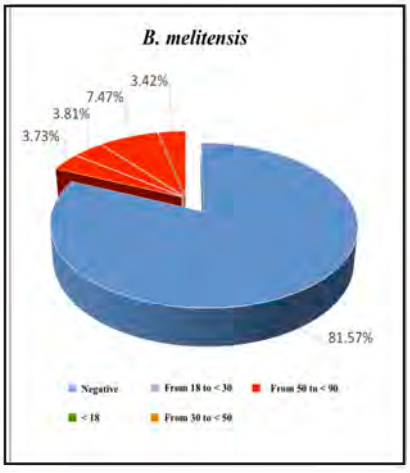

Fig 1. Samples tested for B. melitensis represented as age groups showing the percentages of the negative and positive tests in a schematic diagram.

Out of the 252 B. abortus positive cases, 43 samples (3.34%) were in the age group less than 18 years, 54 samples (4.2%) were in the age group 18 to <30 years, 104 samples (8.09%) were in the age group 30 to <50 years, 51 samples (3.97%) were in the age group 50 to <90 years (Table 3 and Fig 2).

Table 3. Samples tested for B. abortus represented as age groups showing the numbers of the negative and positive tests with their percentages.

Parameters	B. abortus	
	Negative	Positive
< 18	161 (12.52%)	43 (3.34%)
From 18 to < 30	192 (14.93%)	54 (4.20%)
From 30 to < 50	431 (33.51%)	104 (8.09%)
From 50 to < 90	246 (19.13%)	51 (3.97%)
> 90	4 (0.31%)	0 (0.00%)
Total	1034 (80.40%)	252 (19.60%)

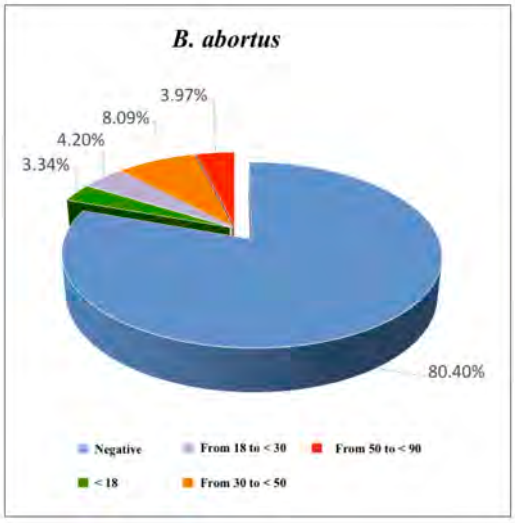

Fig 2. Samples tested for B. abortus represented as age groups showing the percentages of the negative and positive tests in a schematic diagram.

Table 4 shows that out of the 1286

samples tested for Brucella spp. (B. melitensis and B. abortus), 222 (88.1%) samples were positive for both B. melitensis and B. abortus. In the age group less than 18 years, 3.2% (41 samples) were positive for both B. melitensis and B. abortus. In the age group 18 to <30 years, 3.7% (47 samples) were positive for B. melitensis and B. abortus. In the age group 30 to <50 years, 7.1% (91 samples) were positive for both B. melitensis and B. abortus. In the age group 50 to <90 years, 3.3% (43 samples) were positive for both B. melitensis and B. abortus.

Table 4. Frequencies and percentages of single-strain infection and double-strain infection represented in age groups.

Parameters			B. melitensis	
			Negative	Positive
< 18	B. abortus	Negative	154 (12.0%)	7 (.5%)
		Positive	2 (.2%)	41 (3.2%)
From 18 to < 30		Negative	190 (14.8%)	2 (.2%)
		Positive	7 (.5%)	47 (3.7%)
From 30 to < 50		Negative	426 (33.1%)	5 (.4%)
		Positive	13 (1.0%)	91 (7.1%)
From 50 to < 90		Negative	245 (19.1%)	1 (.1%)
		Positive	8 (.6%)	43 (3.3%)
> 90		Negative	4 (.3%)	0 (.0%)
Total	B. abortus	Negative	1019 (98.5%)	15 (1.5%)
		Positive	30 (11.9%)	222 (88.1%)

Discussion

This study is one of the first studies discussing the prevalence of brucellosis in Hawtat Sudair city. Hawtat Sudair city is part of the northern Riyadh province in Saudi Arabia covering an area of 700 km^2 with a total population of 28,954. It is based at the side of a very important international road linking Saudi Arabia to the northern provinces and countries. The city has only one governmental hospital, which is Hawtat Sudair General Hospital (HSGH). In this study, data of 1286 samples tested for Brucella spp. (B. melitensis and B. abortus) collected from the HSGH microbiology laboratory during the period from December 2102 to January 2017 was analyzed. Results reveal that overall preva-

lence of brucellosis in Hawtat Sudair city is 38.03% from the overall samples for Brucella spp. (B. melitensis and B. abortus) in HSGH during the period from December 2012 to January 2017. Although Saudi Arabia had implemented compulsory regulations for animal vaccination against Brucella infection, brucellosis still remains endemic in many areas in Saudi Arabia [9,14-15,19-20]. This is more likely to be caused by the lifestyle of many populations around Saudi Arabia where a combination of modern and traditional lifestyle is an integral part of the peoples' life [19]. Hawtat Sudair city is considered a rural area compared to big modernized cities like Riyadh in the Riyadh province, Saudi Arabia [9,14-15,19]. A huge number of families in Hawtat Sudair city tend to own their farms and barns where they keep animals such as sheep, cows and camels. Actually, it is a part of an important tradition to have such farms. People in these areas tend to consume unpasteurized animal milk directly from the female and use fewer precautions when slaughtering their animals for meat consumption. These practices are the main sources for Brucella infection infecting local families and farmers. In addition, brucellosis is considered as an occupational disease and the most common zoonotic disease that infect laboratory workers [21]. Therefore, it is likely that some of the cases we have may include laboratory workers in the hospital in addition to families, farmers, and travelers. In this study, most cases were in the age group of 30 to < 50 years. Several recent studies showed the prevalence of brucellosis in different regions in Saudi Arabia having similar age group [9,15,19]. These studies also confirmed that younger aged cases have lower indecent of brucellosis, which is consistent with observations made in neighboring countries such as Kuwait, Lebanon, Iran and Jordan [22,23]. These data are consistent with our study where we showed that cases having an age <30 years are less infected compared to ages 30 to < 50 years (Table 2 and 3, and Fig 1 and 2). This is most likely because people are coming into contact with infected animals (i.e. livestock) more often when they become adults. Moreover, according to several studies conducted in Saudi Arabia, males have higher cases of brucellosis compared to females [9,15,19]. Males are more likely to come into contact with infected livestock. This is because males in Saudi Arabia go out more, travel more, work in farms more compared to females, which makes them more vulnerable to infection especially when drinking unpasteurized milk.

In contrast, a study by Ageely (2016) reported that B. melitensis remains the principle cause of human brucellosis, with less frequent infections by B. abortus in Saudi Arabia, our study suggests that B. abortus have higher positive cases (30 cases; a single-strain infection) compared to B. melitensis (15 cases; as single-strain infection) (Table 4). In addition, our study found that there are more cases with double-strains infection (B. melitensis and B. abortus) compared to single strain infection in all age groups (Table 4). This is may be because of the lower specify of the agglutination test. Therefore, a more specific and

sensitive molecular diagnostic test could be used to confirm these results such as PCR.

Conclusion

This study is one of the first studies discussing the prevalence of brucellosis in Hawtat Sudair city, Riyadh, Saudi Arabia. The results confirm the endemicity of brucellosis in the region. However, we do not think this study gives a clear estimation of the prevalence of brucellosis in a broader area such as the north part of Riyadh province. Future studies need to cover more hospitals in different cities in Riyadh province. More studies are needed to get detailed socio-demographic data for the brucellosis prevalence among families, farmers, travelers and laboratory workers. We recommend HSGH to improve their data records to cover more details about their patients and visitors for future statistical analysis. In addition, more rigorous regulations are needed for livestock vaccination and importation protocols. Health sectors in Saudi Arabia need to perform public awareness campaign to educate the community on how to deal with livestock to reduce the risks of infection. Furthermore, researchers need to get motivated to perform broader studies about the epidemiology, molecular pathogenicity, and molecular diagnostics and vaccination to eradicate the Brucella infection in the country.

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Conflict of interest statement

There is no conflict of interest to be declared.

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