Epidemiological and clinical features of human brucellosis

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Abstract

Original Article

BACKGROUND: Human brucellosis is an infectious disease and a global issue. Animal sources of brucellosis can contribute to the occurrence of disease in human population. Regarding high incidence of brucellosis in Khaf, Khorasan Razavi Province, Iran, this study aimed to investigate the epidemiological and clinical features of this disease.

METHODS: This was a cross-sectional study. We reviewed all reports in Health Network of Khaf related to patients diagnosed with brucellosis in the period of 2014-2016. We analyzed data using SPSS software and descriptive statistics (frequency and percentages)

RESULTS: Patients' mean age was 32.00 + 17.23 years, 51.5% of patients were male, 89.5% of them had animal contact, and more than 90.0% of patients had consumed dairy products. According to serological reports, the Wright test showed that the titer of antibody was 1:160 in 35.4% of patients and 1:320 in 27.7% of them. The 2-mercaptoethanol (2ME) test showed that the titer of antibody was 1:80 in 30.0% of patients and 1:160 in 23.8% of them.

CONCLUSION: This study revealed a high incidence of brucellosis among young adults and consumers of unpasteurized dairy products. Therefore, it seems to be necessary to develop preventive strategies and educational programs to reduce the incidence of brucellosis.

KEYWORDS: Brucellosis; Human; Epidemiology

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Introduction

Human brucellosis around the world is one of the most important and widespread infectious diseases, whose occurrence is related to animal reservoirs.[1] This infection is commonly seen in cattle, goats, wild cows, buffalos, camels, horses, and pigs, and it causes abortion, reduces milk production, and imposes economic burden on communities.[2] Transmission of this disease from animal to humans is usually due to consumption of milk and unpasteurized dairy products or direct contact and occupational exposure to infectious animals.[1,3] The most common clinical symptoms of this disease are fever, chills, muscular pain, anorexia, sweating, headache, joint pain, and heart attacks.[4] Human brucellosis commonly presents as a systemic febrile illness associated with tissue and bone infections. On the other hand, the disease is one of the causes of disability, the need for long-term treatment with multiple antibiotics, permanent complications, loss of working hours, and medical expenses. Raw milk and unpasteurized dairy products such as soft cheese, butter, and ice cream may have a high bacteria count and may be pathogenic to humans.[2,4-6] The disease in animals due to

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abortion and fertility problems leads to significant loss of financial resources.[7,8] In developed countries, brucellosis is mainly an occupational disease and occurs most commonly in middle-aged men who are in contact with milk or livestock products. In developing countries such as Iran, especially people in rural areas are in close contact with domestic animals; also, they tend to consume fresh milk and homemade cheese.[2] Approximately, 16000 cases of brucellosis are reported annually in Iran, and this brings a huge burden on society.[9,10] The burden of the disease is due to underestimation and low diagnosis due to inadequate care systems for humans and patients.[4,11] Considering that no study has been conducted so far on patients with brucellosis in Khaf City, Khorasan Razavi Province, Iran, this study was therefore conducted to evaluate the epidemiological and clinical features of brucellosis in this city, between 2014 and 2016.

Materials and Methods

This cross-sectional study examined the information on patients diagnosed with brucellosis from 2014 to 2016 in Khaf City which is located in 250 km southwest of Mashhad. The city, with a population over 110 thousand, is located in the eastern border of Iran and has a 123-kilometer border with Afghanistan. The survey collected the required information using a checklist of variables including age, sex (men/women), occupation (farmer/rancher/homemaker/student/self-employed/other), educational level (illiterate/primary school/secondary school/high school/diploma/ higher), history of contact with animals (yes/no), unpasteurized dairy consumption (yes/no), type of unpasteurized dairy (milk, cheese, cream/ Milk + cheese ،Milk + cream /not consumed), livestock at home (yes/no), history of livestock vaccination (yes/no), history of other family members (yes/no), type of drug

used (rifampin, cotrimoxazole, doxycycline, etc.), type of drug regimen (one-drug, two-drug, multi-drug), residence (urban/rural), condition of the disease (new/recurrent), clinical tests [Wright and 2-mercaptoethanol (2ME)], and interval between the onset of clinical symptoms and a definitive diagnosis (less than one month/more than one month). Given that the data used in this study were collected from reports on the health centers of the city, there was no particular ethical problem in this study. The collected data were inserted in Excel and were analyzed using descriptive statistics (frequency and percentage) in SPSS software (version 22, IBM Corporation, Armonk, NY, USA).

Results

51.5% of cases were male and 48.5% were female. The mean age of patients was 32.62 ± 17.23 years with an age range of 2 to 78 years. The lowest and highest outbreaks were in the age range of 0-4 years (2.3%) and 15-24 years (23.1%), respectively. In this study, the majority of cases were homemaker (41.7%) and rancher (22.8%). Most of them had primary school education (47.6%). Most people were rural (81.5%) and 27.6% had a history of disease in the family (Table 1).

According to the results, 96.1% had a history of contact with the animals, 33.6% of animals had a history of abortion, 70.8% had a history of animal vaccination, and 97.7% had a history of dairy consumption. The highest-used dairy product was milk (57.6%) and colostrum (20.0%). The most cases of illness were observed in the spring (43.1%) compared to summer (32.3%), autumn (13.8%), and winter (10.8%). The majority of cases were in April (20.0%) and May (16.0%), respectively (Figure 1).

In the first and second six months, 75.4% and 24.6% of cases of brucellosis were observed each year, respectively, indicating a higher prevalence of the disease in the first 6 months.

Table 1. Frequency distribution of demographic variables and risk factors for patients with brucellosis

Variables	n (%)
Age (year)	
0-4	3 (2.3)
5-14	18 (13.8)
15-24	26 (20.0)
25-34	30 (23.1)
35-44	20 (15.4)
45-54	13 (10.0)
55-64	14 (10.8)
65 and over	6 (4.6)
Sex	
Male	67 (51.5)
Female	63 (48.5)
Occupation	
Farmer	6 (4.7)
Rancher	29 (22.8)
Homemaker	53 (41.7)
Student	19 (15.0)
Self-employed	20 (15.8)
Educational level	
Illiterate	6 (14.3)
Primary school	20 (47.6)
Secondary school	6 (14.3)
High school and higher	10 (23.8)
Residence	24 (18.5)
Urban	
Rural	106 (81.5)
History of other family members	
Yes	34 (27.6)
No	89 (72.4)

Also, the interval from the onset of disease to diagnosis was less than one month in 72.3% of cases and 91.3% were new cases of disease (Table 2).
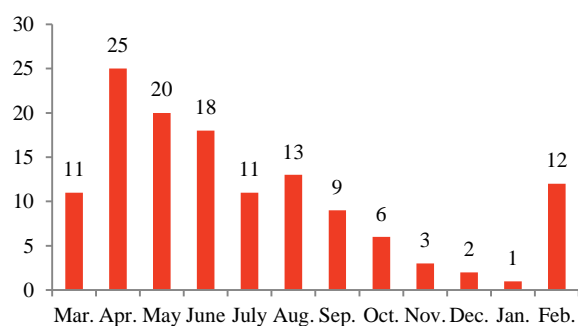
Figure 1. Reported cases of human brucellosis by month of the year, Khaf, Iran, 2014-2016

Based on the serological findings of the Wright titer, the majority of patients (35.4%) had an antibody titer of 1:160, 27.7% had an antibody titer equal to 1:320, and 13.1% had an antibody titer equal to 1:80. The antibody titer of the 2ME test was also 1:80 in 30.0% of cases and 1:160 in 23.8% of cases. Furthermore, the majority of cases (94.7%) had two-drug regimen (Table 3). Based on the serological findings of the Wright and 2ME titers, the majority of patients with age range of 15-24 and 25-34 years had antibody titer equal to 1:80.

Table 2. Frequency distribution of risk factors for patients with brucellosis

Variables	n (%)
Contact with animals	
Yes	124 (96.1)
No	5 (3.9)
History of abortion in animals	
Yes	36 (33.6)
No	71 (66.4)
History of animal vaccination	
Yes	75 (70.8)
No	31 (29.2)
Use of animal products	
Yes	125 (97.7)
No	3 (2.3)
Type of unpasteurized dairy products	
Milk	72 (57.6)
Cheese	3 (2.4)
Milk + cheese	10 (8.0)
Milk + cream	10 (8.0)
Colostrum	25 (20.0)
Other	3 (4.0)
Vaccination	
Yes	36 (33.6)
No	71 (66.4)
Season of illness	
Spring	56 (43.1)
Summer	42 (32.3)
Autumn	18 (13.8)
Winter	14 (10.8)
Interval from baseline to diagnosis	
Less than one month	94 (72.3)
More than one month	36 (27.7)
Case of disease	
New	94 (91.3)
Recurrent	9 (8.7)

Also, the results showed that rifampin and doxycycline (57.7%) and rifampin and cotrimoxazole (27.7%) regimens were the main drugs prescribed by doctors for the patients with brucellosis.

Table 3. Frequency distribution of drug regimen and clinical tests in patients with brucellosis

Variables	n (%)
Type of drug regimen	
One-drug	2 (1.5)
Two-drug	123 (94.7)
Multi-drug	5 (3.8)
Wright test	
1:40	2 (1.5)
1:80	17 (13.1)
1:160	46 (35.4)
1:180	2 (1.5)
1:320	36 (27.7)
1:640	13 (10.0)
1:1280	11 (8.5)
1:2560	3 (2.3)
2ME test	
1:20	1 (0.8)
1:40	18 (13.8)
1:80	39 (30.0)
1:120	1 (0.8)
1:160	31 (23.8)
1:180	4 (3.1)
1:320	19 (14.6)
1:640	10 (7.0)
1:1280	2 (1.5)
1:2560	1 (0.8)
Negative	4 (3.1)

2ME: 2-mercaptoethanol

According to the results, the most commonly-reported clinical symptoms were joint pain (77.5%), fever (76.7%), low back pain (57.4%), and anorexia (51.2%) (Table 4).

Discussion

This study examined the epidemiological and clinical features of human brucellosis. According to the present findings, the majority of patients were male and in the age range of 15 to 24 years; the most frequency of occupation among the patients was related to homemaker and rancher, consistent with other studies.[1,8,11-14] The results showed that the

prevalence of the disease was higher among the homemakers, because women also work along with men to care and breed the animals. On the other hand, the high incidence rate of disease in men can be attributed to the high level of contact with the animals and the high availability of unpasteurized milk in spring and summer.[8]

Table 4. Frequency distribution of clinical symptoms in patients with brucellosis

Variables	n (%)
Fever	
Yes	99 (76.7)
No	33 (23.3)
Sweating	
Yes	16 (12.4)
No	113 (87.6)
Weakness and fatigue	
Yes	20 (15.5)
No	109 (84.5)
Joint pain	
Yes	100 (77.5)
No	29 (22.5)
Constipation	
Yes	2 (1.6)
No	127 (98.4)
Anorexia	
Yes	66 (51.2)
No	63 (48.8)
Insomnia	
Yes	2 (1.6)
No	127 (98.4)
Low back pain	
Yes	74 (57.4)
No	55 (42.6)

In general, the environmental and behavioral factors in this disease are related to occupation and leisure activities of individuals. In countries that consume healthy food, the incidence rate of food-borne brucellosis is low; this is an occupational disease. The majority of cases are observed among men and ages of 20 to 45 years, while in countries consuming unpasteurized dairy products, the disease cases are often seen in women and children.[1]

The results showed that most of the cases had primary school education and were rural; 27.6% reported the history of disease among

other family members. In the rural regions, adults are often in contact with infected animals or abortions and thus are exposed to increased risk of brucellosis.[15] In addition, according to studies, the incidence of brucellosis in rural population is significantly higher than urban population.[16-19] In the rural regions, lack or shortage of knowledge or awareness among people about the routes of transmission, lower education level, lower sanitation, unpasteurized dairy consumption, poor hygiene, and being away from health centers lead to an increase in cases of human brucellosis.[12]

Brucellosis transmission to humans is highly dependent on Brucella species. Brucella abortus is often transmitted through unpasteurized cow's milk, which has a lower pathogenicity than Brucella melitensis that is a dominant species transmitted through the consumption of milk or unpasteurized dairy produced by sheep and goats.[20] Various studies have shown that the contact with animals and livestock products is one of the most important routes of transmitting disease.[17] In this study, more than 90% of cases reported history of contact with animals and consumption of dairy products; milk and colostrum were the most frequent dairy products consumed by the patients, in line with the results of other studies.[15-21] In general, a different lifestyle in multiple population subgroups plays a key role in the transmission of disease. People who are in contact with infected animals or consume non-hygienic dairy products are at high risk for the disease.[8] According to the results, it can be said that improving the level of awareness among people about the transmission of disease through unpasteurized dairy products and the recommendation to consume pasteurized dairy products are essential in reducing the frequency of cases of the disease. Additionally, it is necessary to conduct extensive research in the field of disease control.

In the current study, as in other studies, the maximum cases of the disease were observed in summer and spring.[5] Considering that the usual time of pregnancy and delivery of livestock is in spring and their lactation in summer and autumn, the high incidence of disease in these seasons is due to the high exposure to livestock and delivery products.[5] Based on serological findings, the most Wright titer was reported at 1:160 and 1:320, as well as 1:80 and 1:160 in the 2ME test. In the study of Kassiri et al., the Wright titer of 1:320 and 2ME titer of 1:160 were the highest ratios;[12] and in the study of Farahani et al., the majority of patients had the highest Wright titer of 1:320 and the 2ME titer of 1:80.[22]

In the present study, the two-drug regimen was the maximum and the most commonly-used drugs were rifampin + doxycycline and rifampin + cotrimoxazole. In the study of Kassiri et al.,[12] the percentage of two-drug regimen of doxycycline and rifampin was 60.4% and other drug regimens had a small percentage. In the study of Eini et al. in Koohrang in Iran, the majority of drug regimens in the patients were rifampin + cotrimoxazole (59.8%) and doxycycline + rifampin (17.5%), respectively.[4]

In human brucellosis, the incidence of symptoms and clinical findings is dependent on the immune response, the duration of the disease, and the age of the patients.[12,21] Among the cases of human brucellosis in this study, the most common systemic symptoms were joint pain, fever, low back pain, and anorexia, which is consistent with the results of other studies.[15,23,24].

Conclusion

The findings of the present study showed that the human brucellosis was more common in men, especially adolescents aged 15 to 24 years. In addition, a high percentage of patients reported unpasteurized dairy consumption, including milk and colostrum, indicating high consumption of unpasteurized

dairy products and gastrointestinal (GI) transmission of brucellosis. Moreover, the rifampin and doxycycline regimen and the rifampin and cotrimoxazole regimen are the main drugs prescribed by physicians for patients with brucellosis. Therefore, extensive research is needed to determine the epidemiological characteristics of brucellosis and to clarify the possible routes of transmitting the disease for detecting the disease etiology and prevention.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

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