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# **Research Article**

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# Epidemiological characteristics of human brucellosis in Al-Qassim region, Saudi Arabia, between 2010 and 2014

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## **ABSTRACT**

**Background:** Brucellosis, a zoonotic infection having an important public health issue in endemic countries; Saudi Arabia is one of these countries. The incidence of brucellosis in AlQassim region is much higher than the national one. Evaluation of the epidemiological situation of brucellosis is the first step in prevention and control. The objective was to describe the epidemiological characteristics of brucellosis in Al-Qassim region during the period between 2010 and 2014.

**Methods:** All epidemiological surveillance forms from 2010 to 2014 were analyzed for epidemiological characteristics.

**Results:** There were 4283 notified cases of human brucellosis in AL-Qassim region between 2010 and 2014, the annual incidence decreased from 84.5 to 48.7 per 100,000 populations. The highest number of cases was reported from Uyoon Al-Jawa followed by Buraidah. The number of cases was highest from March to June. and lowest was in November; the male to female ratio was 3:1. Saudis represents 51.1% of cases. The mean age of the cases was 34±15 years; the most common age group was middle age. Shepherds and farmers represent 46.5% of cases. The most common presenting symptoms were fever (79.7%), joint pain (72.7%), and muscle pain (70.9%). The most common antibiotics used as treatment were doxycycline (80.9%) and streptomycin (63.2%). A history of animal contact was the most common risk factor (80.7%), followed by consumption of raw milk (55.6%).

**Conclusions:** There was a marked decrease in the incidence of brucellosis from 2010 to 2014 in the Al-Qassim region. However, continued efforts are needed to eliminate the disease.

Keywords: Brucellosis, AlQassim, Zoonotic, Epidemiology

# **INTRODUCTION**

Brucellosis is a zoonotic infection caused by Brucella, a type of Gram-negative bacteria, and it is transmited to humans by direct or indirect contact with infected animals or their products. Brucellosis affects both sexes and all age groups. It is a systemic infection and may present in many atypical forms, varying from mild to severe acute infections.<sup>1</sup>

Brucellosis is one of the most common zoonotic infections worldwide,<sup>2</sup> with more than half a million cases reported annually, although brucellosis is a

nationally notifiable disease in most countries, many experts believes that; the number of reported cases is only a small fraction of the real number owing to misdiagnosis and underreporting.<sup>3</sup>

Because of sanitary, socioeconomic, and political reasons as well as increasing international travel, the epidemiology of human brucellosis has been changing.<sup>4,5</sup> The disease remains endemic in the Mediterranean Region, Arabian Peninsula, Balkan Peninsula, India, and Central and South America.<sup>6-8</sup>

Brucellosis is a major public health issue in endemic countries, Owing to its extensive economic burden worldwide due to both losses in animal related industries (reduced milk production, increased abortion and delayed conception) and in public health (cost of treatment and loss of productivity). For example, the annual economic loss due to bovine brucellosis in Latin America has been estimated to be approximately 600 million US dollars. While brucellosis eradication programs can be very expensive, they are estimated to save \$7 for each \$1 spent on eradication efforts. 5

Saudi Arabia is one of the highly endemic countries for brucellosis, with more than 8000 case reported annually. The highest incidence of brucellosis cases was observed in Al-Qassim region.<sup>12</sup>

People from Al-Qassim region which is located in the center of Saudi Arabia, are mostly involved in agriculture and animal husbandry. The population of Al-Qassim region has been reported to be 1,370,727. Passive surveillance for brucellosis in Al-Qassim region was established in 1983, and the total number of reported human brucellosis cases in Al-Qassim region was 26,271 between 1983 and 2014 with a mean of 847 notified cases per year.

Evaluation of the epidemiological situation of brucellosis is the first step in prevention and control. To our knowledge, evaluation of the epidemiological characteristics of human brucellosis in Al-Qassim region has not been performed previously; although such studies have been conducted in other parts of Saudi Arabia 13-17 The purposes of the present study were to better understand the epidemiological characteristics of human brucellosis in Al-Qassim region over the past five years (2010-2014).

### **METHODS**

A retrospective review was performed to evaluate the epidemiological characteristics of brucellosis in Al-Qassim region. The epidemiological data for brucellosis obtained from the epidemiological surveillance form. These data includes,

- 1. *Demographic Information*: Age, Sex, City of residence, Nationality and Occupation.
- 2. *Signs and symptoms*: fever, chills, sweating, headache, myalgia, backache, arthrlagia, fatigue, loss of appetite, weight loss, depression and specify if there is other.
- 3. *Therapeutic information*: site of treatment and treatment regimen name.
- 4. Information about exposure to risk factors in the previous month:
  - Contact with animal and the location of contact (house, farm, workplace or other).
  - Direct contact with animal tissues (blood, fetus, placenta or other).

- Slaughter of animals in the house.
- Consumption of raw or undercooked meat or liver.
- Consumption of unpasteurized milk products and the type of product (milk, cheese, butter, and Leben).
- Any previous history of human brucellosis?

From 1 January 2010 to 31 December 2014, there were 4283 notified case of human brucellosis in Al-Qassim region; of these, there were 1198 cases with epidemiological surveillance forms, and all of these cases were included in this study.

Data coded, entered and managed using Statistical Package for Social Sciences (SPSS) version 18, categorical variables were presented in frequency and percentage while continues variables were presented as a mean and standard deviation.

## **RESULTS**

The number of cases, geographical and time distribution of cases was assessed for all reported patients with brucellosis (4283 patients), while the remaining characteristics were assessed for the patients with available epidemiological surveillance forms (1198 patients).

#### Incidence

A total of 4283 patients were reported with brucellosis between 2010 and 2014 in the Al-Qassim region (Table 1). The highest incidence was reported in 2010 (84.7 per 100,000 population) while the lowest incidence was reported in 2014 (48.7 per 100,000 population). The mean incidence rate was 66.12 per 100,000 populations. A substantial decrease in the incidence of brucellosis was observed from 2010 to 2014, though a slight increase was noted in 2012.

Table 1: Number of cases and incidence of brucellosis per year.

| Year | Number<br>of cases | Population (26) | Incidence<br>/100000 |
|------|--------------------|-----------------|----------------------|
| 2010 | 1043               | 1234531         | 84.5                 |
| 2011 | 838                | 1268958         | 66.0                 |
| 2012 | 907                | 1303623         | 69.6                 |
| 2013 | 827                | 1337563         | 61.8                 |
| 2014 | 668                | 1370727         | 48.7                 |

## Geographical distribution

Al-Qassim region has 16 health sectors, and more than half of the patients (55.2%) were distributed in the following 5 health sectors: Uyoon Al-Jawa(622 patients, 14.5%), Buraidah (570 patients, 13.3%), Asiah (418 patients, 9.8%), Bukaireyah (399 patients, 9.3%), and

Hamjah (354patients, 8.3%). The other patients were distributed among the remaining 11 health sectors (Figure 1).



Figure 1: Geographical distributions of brucellosis cases in Al-Qassim region between 2010 and 2014 (n=4283).

## Time distribution of cases

The monthly distribution of cases is presented in Figure 2. The largest number of cases was reported in the period between March and June (n=1991; 46.5%). The highest number of cases was reported in April while the lowest number of cases was reported in November.

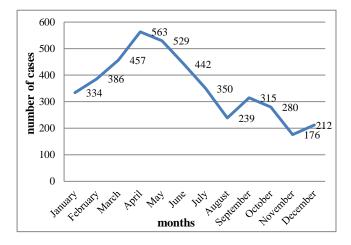


Figure 2: Monthly distribution of the brucellosis cases in Al-Qassim between 2010-2014.

# Demographic characteristics of cases

The demographic characteristics of the patients are presented in Table 2. Almost three-quarters of the patients (75.9%) were males. Additionally, more than half of the patients (51.1%) were Saudi. Among non-Saudi nationalities, the common nationalities were Indian

(35.1%), Sudanese (31.6%), Bangladeshi (10.1%), and Pakistani (7.3%). The mean age of the patients was 34 years  $\pm 15$  (range, two months to 97 years). Almost half of the patients (49.6%) were from the age groups 30–39 (25.5%) and 20–29 years (24.1%). Children (<10 years) and elderly individuals ( $\geq$ 60 years) accounted for 4.5% and 5.1% of the cases, respectively.

Table 2: Demographic characteristics of the study population (n=1198).

| Characteristic       | Number of patients | %    |  |  |  |  |  |
|----------------------|--------------------|------|--|--|--|--|--|
| Sex (n=1198)         |                    |      |  |  |  |  |  |
| Male                 | 909                | 75.9 |  |  |  |  |  |
| Female               | 289                | 24.1 |  |  |  |  |  |
| Nationality (n=1198) |                    |      |  |  |  |  |  |
| Saudi                | 612                | 51.1 |  |  |  |  |  |
| Non-Saudi            | 586                | 48.9 |  |  |  |  |  |
| Indian               | 206                | 35.1 |  |  |  |  |  |
| Sudanese             | 185                | 31.6 |  |  |  |  |  |
| Bangladeshi          | 59                 | 10.1 |  |  |  |  |  |
| Pakistani            | 43                 | 7.3  |  |  |  |  |  |
| Others               | 56                 | 9.6  |  |  |  |  |  |
| Not specified        | 37                 | 6.3  |  |  |  |  |  |
| Age (n=1187)         |                    |      |  |  |  |  |  |
| <10 years            | 53                 | 4.5  |  |  |  |  |  |
| 10–19 years          | 138                | 11.6 |  |  |  |  |  |
| 20–29 years          | 286                | 24.1 |  |  |  |  |  |
| 30–39 years          | 303                | 25.5 |  |  |  |  |  |
| 40–49 years          | 223                | 18.8 |  |  |  |  |  |
| 50–59 years          | 123                | 10.4 |  |  |  |  |  |
| ≥60 years            | 61                 | 5.1  |  |  |  |  |  |
| Mean (SD) age, year  | rs 34 (15)         |      |  |  |  |  |  |
| Occupation (n=1109)  |                    |      |  |  |  |  |  |
| Shepherd             | 287                | 25.9 |  |  |  |  |  |
| Farmer               | 206                | 18.6 |  |  |  |  |  |
| Student              | 188                | 16.9 |  |  |  |  |  |
| Housewife            | 148                | 13.3 |  |  |  |  |  |
| Unemployed           | 72                 | 6.5  |  |  |  |  |  |
| Others               | 208                | 18.8 |  |  |  |  |  |

## Signs and symptoms

Data on signs and symptoms were available for 1108 patients. Fever was the most common symptom (79.7%), followed by arthralgia (72.7%) and myalgia (70.9%). Headache, backache, and fatigue were noted in more than one half of the patients.

## Antibiotics used

A total of 1048 patients were treated with antibiotics. A single antibiotic was used in 6.6% of these patients, a combination of two antibiotics was used in 88.4%, and a combination of three antibiotics was used in 5%. The most common antibiotics used were doxycycline

(80.9%), streptomycin (63.2%), trimethoprim sulfamethoxazole (30.7%), and rifampicin (20.8%).

## Exposure to risk factors

Information about exposure to risk factors is presented in Table 3. Among the patients, 80.7% reported a history of animal contact one month before the diagnosis, and of these patients, 29.8% reported direct contact with animal tissues. Animal slaughter in the house was reported by 12% of the patients. More than one half of the patients (55.6%) reported consumption of unpasteurized milk products (milk, 88.4%; Leben, 39%; butter, 11.7%; and cheese, 5.5%), and 5% reported consumption of raw meat. A previous history of brucellosis was noted in 81 patients (7.1%).

Table 3: Exposure to risk factors.

| Risk factor                                 | Number of patients | %    |  |  |  |  |  |
|---|--------------------|------|--|--|--|--|--|
| Animal contact (n=1173)                     |                    |      |  |  |  |  |  |
| Yes   | 947                | 80.7 |  |  |  |  |  |
| No  | 226                | 19.3 |  |  |  |  |  |
| Direct contact with animal tissues (n=1025) |                    |      |  |  |  |  |  |
| Yes   | 282                | 27.5 |  |  |  |  |  |
| No  | 743                | 72.5 |  |  |  |  |  |
| Slaughter in the house(n=1129)              |                    |      |  |  |  |  |  |
| Yes   | 136                | 12   |  |  |  |  |  |
| No  | 993                | 88   |  |  |  |  |  |
| Consumption of raw meat (n=1091)            |                    |      |  |  |  |  |  |
| Yes   | 55                 | 5    |  |  |  |  |  |
| No  | 1036               | 95   |  |  |  |  |  |
| Consumption of unpasteurized milk products  |                    |      |  |  |  |  |  |
| (n=1135)                                    |                    |      |  |  |  |  |  |
| Yes   | 631                | 55.6 |  |  |  |  |  |
| No  | 504                | 44.4 |  |  |  |  |  |
| Previous history of brucellosis (n=1134)    |                    |      |  |  |  |  |  |
| Yes   | 81                 | 7.1  |  |  |  |  |  |
| No  | 1053               | 92.9 |  |  |  |  |  |

## **DISCUSSION**

The incidence of brucellosis in the Al-Qassim region between 2010 and 2014 was found to range from 48.7 to 84.5 per 100,000 populations, which is much higher than the incidence of 12.54 to 22.8 per 100,000 population reported for the entire country (Saudi Arabia). The possible reason for this difference is that the Al-Qassim region is a highly enzootic region. The incidence of brucellosis varies between countries and within countries, this variation may be owing to demographic, occupational, and socioeconomic factors.

The incidence of brucellosis showed a decreasing trend from 2010 to 2014, with a slight increase in 2012 and a marked decrease in 2011 and 2014. The marked decline in 2014 may had occurred because people were fearful of contracting the Middle East respiratory syndrome from

camels.<sup>19</sup> The World Health Organization and the Ministry of Health of Saudi Arabia encouraged people to cook properly camel meat, drink pasteurized camel milk, and practice general hygiene after contact with camels in order to prevent Middle East respiratory syndrome.<sup>20</sup>

The health sectors that had a high incidence of brucellosis, including Uyoon Al-Jawa, Buraidah, Asiah, and Bukaireyah, are located in the north-eastern region of AL-Qassim, which has a high number of farms.

A high number of cases were reported from March to June, with the highest number in April, the disease in humans usually peaks in April and May. 14,15,21 The incidence of brucellosis in human is corresponds to lambing season. 22 A slight increase in the number of cases was noted in September. In summer a large number of urban Saudis return to their families in rural areas, and when they return to cities in September, they bring a large amount of unpasteurized milk to give to neighbors and friends, this leads to an increase in the consumption of unpasteurized milk, resulting in a rise in the number of cases in September. 15

A male predominance was noted for brucellosis, with a male to female ratio of 3:1, which is similar to the finding reported in a study from Greece.<sup>23</sup> A male to female ratio of 2:1 was reported in some previous studies.<sup>14,16</sup> While in contrast, no significant sex difference was observed in other studies.<sup>13,24</sup> Furthermore, a female predominance was reported in a small study from Saudi Arabia.<sup>17</sup> These variations are most likely related to the differences in occupation, practice, and habits of individuals among the various study populations.<sup>14</sup>

The male predominance can be attributed to the occupation. It has been reported that men are mainly involved in animal husbandry.<sup>23</sup> In our study, 44.5% of the patients with brucellosis were shepherds and farmers, and 99.8% of these shepherds and farmers were men. Among Saudis, the difference between men and women was minimal (54.2% men and 45.8% women), while among non-Saudis, the majority of patients (98.5%) were men, as the vast majority of expatriates who work in shepherding and farming are men.

Saudis represented 51.1% of the cases and non-Saudis represented 48.9%. Among non-Saudis two-thirds (66.7%) of the patients were Indian and Sudanese. In the present study these two nationalities represent 69.2% of shepherds and farmers.

In the present study, the most affected age group was 30–39 years, followed by 20–29 years in the present study, which is consistent with the finding reported in other studies. <sup>14,15,17</sup> Brucellosis is an occupational disease <sup>25</sup> so it was expected to be the most affected age groups this age groups because they are exposed to risk factors related to their occupation.

In the present study, the most common symptom was fever in the present study, which is compatible with the finding in other studies from Saudi Arabia (Table 4). However, the frequencies of signs and symptoms vary among the studies owing to differences in the methods used to select brucellosis cases and the brucella species.

Table 4: Comparison of sign and symptoms of brucellosis in studies conducted in Saudi Arabia.

| Symptoms and signs | Elbeltagy | Malik | Alsekait | Present study |
|--------------------|-----------|-------|----------|---------------|
| Fever              | 90        | 96.2  | 70.6     | 79.7          |
| Arthralgia         | 84.7*     | 76.9  | 31.4     | 72.7          |
| Myalgia            |           |       | 11.8     | 70.9          |
| Headache           | 77.4      | 76.9  | 27.5     | 56.4          |
| Backache           | 84.7*     | 73.1  | 20.6     | 55.6          |
| Fatigue            | 81        |       | 10.8     | 53.8          |
| Sweating           | 78.8      | 96.2  | 28.4     | 46.2          |
| Loss of appetite   |           |       |          | 30.1          |
| Chills             | 38.7      |       | 25.5     | 28.8          |
| Weight<br>loss     | 43.1      |       | 9.8      | 10.5          |

Values given are the percentage of the total in the study. \*Elbetagy combined arthralgia and backache in one label.

A history of animal contact (80.7%) was the most common risk factor for brucellosis, followed by consumption of unpasteurized milk (55.6%) in the present study, which is consistent with the finding of a study from Greece.<sup>23</sup> However, previous studies from Saudi Arabia have reported that consumption of unpasteurized milk was the most common risk factor, with frequencies of (Elbeltagy 88.3%, <sup>15</sup> Malik 84.6% <sup>17</sup> and Altawfiq 71.6% <sup>14</sup> This variation may be related to differences in the customs of the populations in the studies.

The limitations of the study are:

- The epidemiological surveillance done for only 27.9% of cases. Which depends on the activity of health inspectors in each health sector? So, those 27.9% of cases were not representative for all cases in Al-Qassim region.
- The epidemiological characteristics done for the notified cases only, the underreported and not diagnosed cases were not included in this study.

# **CONCLUSION**

There is lack of awareness and inadequate knowledge related to dog bite and its management: 77% were aware that Dog bite causes disease; whereas out of these 46.8% were aware that Rabies is caused by dog bite. 44.4% participants were aware that dog bite wound should be cleaned with soap and water, 95.8% were aware about the

vaccine availability for the dog bite. Eighty eight percent of dog bite victims received treatment.

#### Recommendations

There are misbeliefs and lack of knowledge related to management of dog bite cases. As rabies is 100% preventable disease health education activity for the rural population to be taken for creating awareness about management of dog bite to prevent deaths occurring due to rabies.

### **CONCLUSON**

This study showed that there was a marked decrease in the incidence of human brucellosis during the period between 2010 and 2014 in Al-Qassim region. The number of cases was highest from March to June. The male to female ratio was 3:1. Saudis represented 51.1% of all cases. The mean age patients were  $34 \pm 15$  years, and the most common age groups affected was middle age. 46.5% of cases worked as shepherds and farmers. The most common risk factor was animal contact (80.7%) followed by consumption of raw milk (55.6%).

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