Incidence and Risk Factors of Brucellosis in Kermanshah Province, Iran During 2010-2014

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Abstract: Introduction: Incidence of brucellosis was growing up in Iran during the past years. Kermanshah province-west of Iran is one of the endemic regions of the disease. The aim of this study was to evaluate the incidence and risk factors of brucellosis in Kermanshah province during a recent five-year period.

Material and Methods: This study was an observational cross-sectional study performed on registries of the patients with brucellosis at the center for the zoonotic disease of Kermanshah University of medical sciences during 2010-2014. The data was collected using a questionnaire containing demographic data and the risk factor of brucellosis. Collected data were analyzed by SPSS-22 software using descriptive statistic, Chi-square, and student t-test.

Results: The five-years mean incidence of brucellosis in our study was 46.5 in one hundred thousand, and male to female ratio was 1.37/1. The most common risk factors of brucellosis in our patients were unpasteurized dairy products’ consumption (47%) and occupational contact with livestock (14.4%). 84% of the patients were rural. The most common diagnostic method was the standard agglutination test within 1/160 and 1/320 titer.

Conclusion: Risk factors of brucellosis in our study were like other studies, but in more than one-third of the patients, no risk factor was identified. Lack of livestock vaccination history and incomplete registered data about other possible transmission routes of transmission were the limitations of the study.

Keywords: Brucellosis, Risk factor, Incidence, Iran.

1. INTRODUCTION

The trend of brucellosis in Iran has been increasing since 2010, after a decline in the past two decades, and reached 25 in one hundred thousand. According to the Iranian ministry of health report, the incidence of brucellosis is increasing following a decline from 1997 to 2009, possibly due to an increase in local dairy products’ consumption, inadequate animal vaccination, the presence of non-industrial slaughterhouses and the frequent movement of livestock between neighboring cities [1, 2]. A recent meta-analysis reported that the annual incidence of brucellosis in Iran is 0.001%, which is one of the highly prevalent countries around the world and Kermanshah is one of the highest endemic province in Iran [3]. In another study, the incidence of disease in some western provinces is estimated to be 31-41 per hundred thousand, and the most common risk factors were non-pasteurized dairy products’ consumption, occupational exposure to livestock, laboratory contact and the presence of a patient within the family [4]. Animal contamination has also contributed to an increase in the incidence of disease in humans. In one study, seropositivity of Brucella melitensis was 1.7% in lactating goats [5]. Another study in western Iran showed that 11% of the sheep were infected with brucellosis [6].

Many studies showed that the most important risk factors for acquisition of brucellosis were non-pasteurized dairy products’ consumption, high-risk occupational contact, and male sex [7-10]. The most commonly affected age group was 15-20 years in a large study in central Iran [7]. Other high-risk occupations may also be risk factors. In a study of 250 high-risk individuals in western Iran, 12% of the butchers had IgG titers against Brucella spp, followed by hunters and healthcare personnel [9]. In another study on 141 high-risk people, including veterinary students, slaughterhouse workers, and butchers, 8% were seropositive against Brucella spp [11].
Although the IgG titer shows a history of brucellosis, Wright agglutination test has remained the main test for diagnosis, used with or without other diagnostic methods. In endemic areas such as Iran, the minimum diagnostic titer is equally or above 1/160 [12]. Other diagnostic tests, including blood culture and Polymerase Chain Reaction (PCR), have also been used for diagnosis [13]. The purpose of this study was to evaluate the incidence and risk factors of human brucellosis in Kermanshah, an endemic area of brucellosis in Iran during a 5-year period.

2. METHODS

The present study was a descriptive research conducted on a cross-sectional basis from March 2010 (concurrent with the beginning of the solar year) until March 2015 in Kermanshah, West Iran. In this study, annual registries of the patients with brucellosis during the study period were collected from the center for the zoonotic disease of Kermanshah University of Medical Sciences and reviewed. Data collecting tool was the questionnaires containing demographic characteristics of patients, occupational exposure to livestock such as ranching, place of living, unpasteurized dairy products’ consumption, and the diagnostic titer of the Wright agglutination test. Data were analyzed by SPSS-22 software- IBM Corporation, using descriptive statistics, Chi-square and student t-tests with 95% significance.

3. RESULTS

A total of 4559 brucellosis cases were identified during 2010-2014, including 2635 male (57.8%) and 1924 (42.2%) female. The highest incidence rate was 63.2 per 100,000 in 2014 and the mean five-year incidence of brucellosis in

### Table 1. Frequency of brucellosis in Kermanshah from 2010-2014.

<table>
<thead>
<tr>
<th>Sex</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>Total</th>
<th>P_value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>407</td>
<td>416</td>
<td>440</td>
<td>639</td>
<td>733</td>
<td>2635</td>
<td>0.0017</td>
</tr>
<tr>
<td>Female</td>
<td>305</td>
<td>361</td>
<td>323</td>
<td>416</td>
<td>519</td>
<td>1924</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>712</td>
<td>777</td>
<td>763</td>
<td>1055</td>
<td>1252</td>
<td>4559</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. Yearly-incidence of brucellosis in the cities of Kermanshah province, Iran.

<table>
<thead>
<tr>
<th>City</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
</tr>
<tr>
<td>West Islamabad</td>
<td>63.418</td>
<td>68.45.1</td>
<td>89.60.2</td>
<td>109.73.7</td>
<td>147.96.5</td>
</tr>
<tr>
<td>Paveh</td>
<td>19.33.9</td>
<td>10.17.9</td>
<td>4.6.9</td>
<td>8.13</td>
<td>22.36.3</td>
</tr>
<tr>
<td>Salaas</td>
<td>45.127.8</td>
<td>48.136.3</td>
<td>18.47.7</td>
<td>16.42</td>
<td>24.49.4</td>
</tr>
<tr>
<td>Javanroud</td>
<td>4.6.2</td>
<td>9.13.9</td>
<td>3</td>
<td>4.3</td>
<td>4.5.6</td>
</tr>
<tr>
<td>Dalahou</td>
<td>62.139.7</td>
<td>85.191.5</td>
<td>81.189.5</td>
<td>103.240.9</td>
<td>122.308.6</td>
</tr>
<tr>
<td>Ravansar</td>
<td>8.14.8</td>
<td>13.24</td>
<td>27.54.9</td>
<td>26.52.8</td>
<td>12.23.6</td>
</tr>
<tr>
<td>Sarepol Zahaab</td>
<td>76.89.8</td>
<td>84.99.2</td>
<td>73</td>
<td>81.6</td>
<td>44.49</td>
</tr>
<tr>
<td>Songhor</td>
<td>78.75.2</td>
<td>79.76.2</td>
<td>70.72.4</td>
<td>102.105</td>
<td>143.157.6</td>
</tr>
<tr>
<td>Sahneh</td>
<td>32.37.7</td>
<td>42.49.4</td>
<td>48</td>
<td>64.74</td>
<td>98.6</td>
</tr>
<tr>
<td>Ghasre Shirin</td>
<td>18.82</td>
<td>32.147</td>
<td>15</td>
<td>67.2</td>
<td>10.44</td>
</tr>
<tr>
<td>Kermanshah</td>
<td>108.10.9</td>
<td>175.17.7</td>
<td>165</td>
<td>16</td>
<td>348.33.6</td>
</tr>
<tr>
<td>Kangavar</td>
<td>61.75</td>
<td>28</td>
<td>34.4</td>
<td>45</td>
<td>56.5</td>
</tr>
<tr>
<td>Guilan e Gharb</td>
<td>94.148.5</td>
<td>62</td>
<td>98</td>
<td>62</td>
<td>100</td>
</tr>
<tr>
<td>Harsin</td>
<td>44.43.9</td>
<td>42</td>
<td>41.9</td>
<td>63</td>
<td>61.8</td>
</tr>
<tr>
<td>Kermanshah Province</td>
<td>712</td>
<td>36.8</td>
<td>777</td>
<td>40.2</td>
<td>763</td>
</tr>
<tr>
<td>Country</td>
<td>12248</td>
<td>16.5</td>
<td>14208</td>
<td>18.9</td>
<td>16019</td>
</tr>
</tbody>
</table>
Kermanshah province was 46.5 per 100,000 during the study period. The highest incidence rate was 308.6 per 100,000 in Dalaho city during 2014. 84% of the patients were rural and 16% were urban. Using the Chi-square test, the incidence of brucellosis was significantly higher in men (P=0.01) and in rural areas (P=0.045). The five-year incidence of brucellosis in Kermanshah province was higher than the country (P=0.001) (Table 1 and 2 and Fig. 1).

The mean age of the patients was 31.2 years, which included 30 years in male and 32.9 years in the female. The male patients were significantly younger than women by t-student (P=0.021). Non-pasteurized dairy products’ consumptions were found in 2146 patients (47.1%), and occupational exposure to livestock such as ranching in 656 (14.4%). In 1757 patients (38.5%), no risk factors were identified. 4427 patients (97.1%) were diagnosed with Wright agglutination test, 2,207 patients (46%) with two-Mercapto ethanol tests (2ME) and 821 patients (18%) with the Coombs-Wright test. The most commonly used diagnostic headline was 1/160 and 1/320 with the Wright agglutination test (Fig. 2).

4. DISCUSSION

In our study, the incidence of brucellosis from 2010 to 2014 increased from 36.8 to 63.2 per 100,000. A review of other studies in Iran (14, 15, and 20) showed an increase in some other provinces during the same period Table 3.

Considering the endemicity of brucellosis in Kermanshah province, the diagnostic head of the Wright agglutination test was 1/160 and more than 82% of our patients had a diagnostic header of 1/160 and above. In the endemic areas, titers below 1/160 of the Wright test should be interpreted with caution. However, in other studies in Iran, lower titers of the Wright test have been used for diagnosis, such as two studies in Mashhad and Kermanshah, the titers of which being 1/40 and 1/80 had a sensitivity of 95% and 93%, respectively [21, 22]. In our study, the sensitivity for Wright agglutination test with a header of 1/40 reached up to 99.9%.

Except for one study in Tehran [16], in other previous studies in Iran [8-20], the majority of patients were male in the fourth decade of life, living in rural areas. Unfortunately, there was no information about the family history of brucellosis in our registries. The importance of having a positive family history of the disease may be due to a common source of diseases, such as non-pasteurized dairy products’ consumption, or sexual transmission. In a study of 117 people closed to the patients with brucellosis, one-third of them had a high titer of serum antibodies against Brucella spp [23]. Other studies also showed that family history must be considered as a risk factor [14, 16]. However, the major risk factors for the disease are still the non-pasteurized dairy products’ consumption and occupational exposure to livestock.

The main method of prevention is pasteurization of dairy products. Other preventive programs are livestock vaccination and general education. In one study, the effect of animal vaccination during 1983-2008 has reduced the number of human brucellosis in Iran [24] and a similar study in Hamadan province, another endemic region in west Iran, showed that animal vaccination accompanied by a reduction in the incidence of disease in humans [25]. Furthermore, two studies showed a reduin the incidence of disease by education [26 and 27].

Noteworthy, more than one-third of our patients did not have any common risk factor of brucellosis. It may be considered that unregistered risk factors such as family history of brucellosis, sexual transmission, or healthcare related transmission are increasing. The most important limitation of

Fig. (2). Number of Brucellosis Cases Diagnosed by Three Tests.
Table 3. Incidence of brucellosis in the different location in Iran.

<table>
<thead>
<tr>
<th>Study</th>
<th>Location province</th>
<th>Time</th>
<th>Number of the Patients</th>
<th>M/F ratio</th>
<th>Mean age (years)</th>
<th>Incidence of 100,000</th>
<th>Rural Living</th>
<th>Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hashtarkhani (14)</td>
<td>Khorasan</td>
<td>2009-2013</td>
<td>5743</td>
<td>1.32/1</td>
<td>33</td>
<td>26</td>
<td>85%</td>
<td>Non-pasteurized dairy products (77%), family history</td>
</tr>
<tr>
<td>Shahryari (15)</td>
<td>Kohkilooyeh</td>
<td>2009-2013</td>
<td>374</td>
<td>0.98/1</td>
<td>39</td>
<td>-</td>
<td>68%</td>
<td>Livestock contact (84%)</td>
</tr>
<tr>
<td>Eini (8)</td>
<td>Hamadan</td>
<td>2005-2009</td>
<td>230</td>
<td>1.31/1</td>
<td>40.8</td>
<td>-</td>
<td>72%</td>
<td>Non-pasteurized dairy products (60%), Livestock contact (39%)</td>
</tr>
<tr>
<td>Haddadi (16)</td>
<td>Tehran</td>
<td>1998-2004</td>
<td>415</td>
<td>0.9/1</td>
<td>35.5</td>
<td>16%</td>
<td>7%</td>
<td>Non-pasteurized dairy products (76%), family history (19), Livestock contact (17%)</td>
</tr>
<tr>
<td>Esmailnasab (17)</td>
<td>Kordestan</td>
<td>2006</td>
<td>1059</td>
<td>1.03/1</td>
<td>34</td>
<td>73.5</td>
<td>90%</td>
<td>Livestock contact (79%)</td>
</tr>
<tr>
<td>Moradi (18)</td>
<td>Kordestan</td>
<td>1997-2003</td>
<td>3880</td>
<td>1.08/1</td>
<td>30</td>
<td>17-89</td>
<td>81%</td>
<td>Livestock contact (62%)</td>
</tr>
<tr>
<td>Farahani (19)</td>
<td>Markazi</td>
<td>2001-2010</td>
<td>3880</td>
<td>1.5/1</td>
<td></td>
<td>60</td>
<td>72%</td>
<td></td>
</tr>
<tr>
<td>Hamzavi (20)</td>
<td>Kermanshah</td>
<td>2011</td>
<td>774</td>
<td>1.13/1</td>
<td>39.9</td>
<td>87%</td>
<td></td>
<td>Non-pasteurized dairy products (81%), Livestock contact (75%)</td>
</tr>
<tr>
<td>Rajabi (Current study)</td>
<td>Kermanshah</td>
<td>2010-2014</td>
<td>4559</td>
<td>1.37/1</td>
<td>31.2</td>
<td>46.5</td>
<td>84%</td>
<td>Non-pasteurized dairy products (47%), Livestock contact (14%), Male (57.8%), Rural (84%)</td>
</tr>
</tbody>
</table>

our study was incomplete records of these risk factors in existing cases.

CONCLUSION

Most of our patients were rural, and the main important risk factors in our study were non-pasteurized dairy products’ consumption and occupational exposure to livestock, which can be largely managed through education. Other local health system policies such as livestock vaccination, especially in the endemic regions are recommended. Furthermore, we recommend that the patient registries should be revised according to the general and regional risk factors of the disease and carefully cetered by the health care providers.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No Animals/Humans were used for studies that are the basis of this research.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

Incidence of Brucellosis in Kermanshah

Infectious Disorders - Drug Targets, 2019, Vol. 19, No. 00  5


