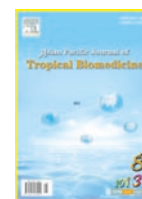




Contents lists available at ScienceDirect

## Asian Pacific Journal of Tropical Biomedicine

journal homepage: [www.elsevier.com/locate/apjtb](http://www.elsevier.com/locate/apjtb)

Document heading doi:10.1016/S2221-1691(13)60121-5 © 2013 by the Asian Pacific Journal of Tropical Biomedicine. All rights reserved.

## Epidemiological, laboratory, diagnostic and public health aspects of human brucellosis in western Iran

Hamid Kassiri<sup>1\*</sup>, Hamid Amani<sup>2</sup>, Massoud Lotfi<sup>3</sup><sup>1</sup>Health School, Ahwaz Jundishapur University of Medical Sciences, Ahwaz, Iran<sup>2</sup>Luristan University of Medical Sciences, Azna Health Services Center, Azna, Iran<sup>3</sup>Health School, Ahwaz Jundishapur University of Medical Sciences, Ahwaz, Iran

## PEER REVIEW

## Peer reviewer

Professor Sharif Maraghi, Full Professor, Head of Department of Medical Parasitology, Medicine School, Ahwaz Jundishapur University of Medical Sciences, Ahwaz, Iran.

Tel: 0098-611-3330074

Fax: 0098-611-3332036

E-mail: [maraghis@gmail.com](mailto:maraghis@gmail.com)

## Comments

It is a good investigation in which the researchers detected some features of epidemiologic, demography, laboratory, treatment and diagnosis of human brucellosis in Azna County. The findings are considerable and propounded to combat this disease in Azna County.

Details on Page 593

## ABSTRACT

**Objective:** To determine brucellosis's epidemiologic, laboratory, diagnostic and public health features considering brucellosis is endemic in Azna County, western Iran.

**Methods:** This descriptive cross-sectional study was investigated on 43 patients with brucellosis in Azna County. The subjects were the patients with symptoms correspondent with brucellosis and positive Wright and 2ME tests. A questionnaire about demographic, epidemiological and laboratory findings was filled in. Afterwards, patients were treated using usual antimicrobial drugs regimen. The collected data were analyzed by SPSS software version 16.

**Results:** Forty-three subjects were found to be positive in laboratory tests. Incidence of Brucellosis was 59.31 per hundred thousand population. About 34.9% of patients were female and 65.1% male. Nearly 95.2 % of human cases were living in rural and 4.8 % in urban areas. Around 20.9% of patients had history of animal contact. The commonest transmission was unpasteurized dairy products (79.1%). The most contagious seasons were summer and spring (60.3%). The most common age group was 15–24 (27.9%), and about 60.5% of the patients were between 15–44 years old. Disease was more common among housewives (30.2%) and farmers (20.9%). The majority of the patients had Wright test titre=1:320 (54.1%) and 2ME test titre=1:160 (56.1%) in serological titration. Doxycycline with Rifampin was used for treatment of the greatest of patients (60.4%).

**Conclusions:** In order to control this zoonotic disease, close cooperation of health and veterinary organizations is necessary.

## KEYWORDS

Human brucellosis, Epidemiology, Laboratory, Diagnosis, Public health, Iran

## 1. Introduction

Brucellosis is one of the common diseases among humans and animals (called zoonoses), and appears in the forms of the acute, sub-acute or chronic. In animals, it often causes damage to the urinary-genital tract, but, in humans, it brings about usually weakness, lethargy,

the weight loss, fever, and sweating<sup>[1]</sup>. The disease is also called abortion of the cow, Mediterranean fever, Malta fever, Undulant fever, Gibraltar fever and Contagious abortion<sup>[2]</sup>. If the disease is eradicated in animals, then, it can be removed from human<sup>[3]</sup>. For the first time, at the end of the nineteenth century, cause of the disease was isolated from a person called David Bruce, from the spleen

\*Corresponding author: Dr. Hamid Kassiri, Assistant Professor, Health School, Ahwaz Jundishapur University of Medical Sciences.

Tel: 00986113738269

Fax: 00986113738287

E-mail: [Hamid.Kassiri@yahoo.com](mailto:Hamid.Kassiri@yahoo.com)

Foundation Project: Supported by Research and Technology Development of Ahwaz Jundishapur University Medical Sciences in collaboration on this project with No. 875.56.

Article history:

Received 28 May 2013

Received in revised form 10 Jun, 2nd revised form 15 Jun, 3rd revised form 10 Jul 2013

Accepted 20 Jul 2013

Available online 28 Aug 2013

of a soldier, who died from the disease<sup>[4]</sup>. In Iran, the first diagnosis of the brucellosis was done by Pasteur Institute of Iran in 1931<sup>[1]</sup>.

The micro, aerobic, without spore and capsule, gram-negative, none mobility bacilli of the genus *Brucella* are the cause for disease. Their growth in the culture medium is slow, and four species of them are pathogenic for the human<sup>[5,6]</sup>. *Brucella melitensis*, *Brucella abortus*, and *Brucella suis* are the classical human pathogens, but *Brucella canis* may also be pathogenic<sup>[5]</sup>. The incubation period usually is 5–60 days, mostly 1–2 months, and rarely several months<sup>[4]</sup>.

This disease is more common in Mediterranean countries (Portugal, Greece, Italy and Spain), Middle East (Saudi Arabia, Israel, Iraq, Kuwait, and Iran) and Latin America (Argentina, Peru and Mexico)<sup>[7]</sup>. Trends of human brucellosis in Iran was investigated between 1991 till 2008. The mean annual incidence of human brucellosis was 43.24/100 000 population. This study showed that there were most of the cases in terms of frequency in the provinces of Khorassan, Eastern Azerbaijan, Hamadan, Luristan, Fars, Western Azerbaijan, Kermanshah, Charmahal-Bakhtiari and Markazi, respectively<sup>[8]</sup>. This disease has been knew as one of the most prevalent zoonoses in the Eastern Mediterranean Region, with more than 45000 cases reported annually. It is an major health challenge in Iran. During 2001–2005, the incidence of human brucellosis was between 120–400 per 100 000 people. Furthermore, a survey displayed that nearly 7.4% of cows in Iran were infected with brucellosis<sup>[9]</sup>. Approximately, 500 000 cases of human brucellosis globally are reported to the World Health Organization annually<sup>[10]</sup>.

Some important ways for transmission of Malta fever to human are eating dairy products, a contact with meat and blood of the infected livestock, skin cuts, breathing dust contaminated with the feces and urine of the animal affected. Transmission of the disease from human to human has rarely been happening, but it has been reported through sexual intercourse (sperm), blood transfusion, bone marrow transplant, shared drug needles among the addicted, intrauterine transfusion through the placenta and breast milk<sup>[11–13]</sup>. Ranchers, farmers and persons which consume unpasteurized livestock materials, include most of the patients in Iran<sup>[14]</sup>.

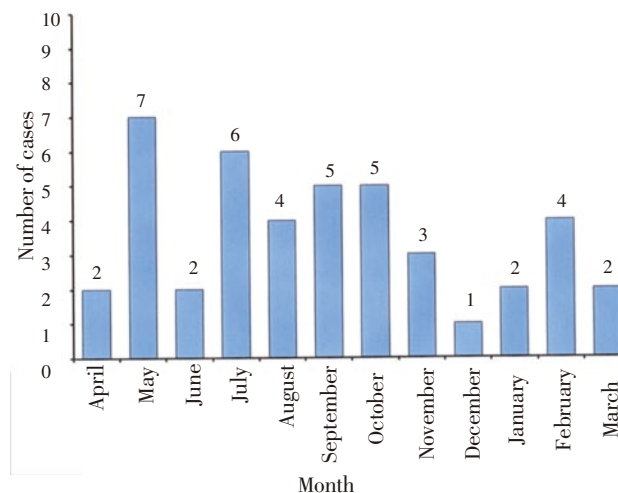
In industrialized countries, brucellosis disease is more frequent in men than in women, but in Iran, due to the close cooperation of women with men in ranching and farming occupations, disease in women has also a high prevalence<sup>[2]</sup>. During the animal delivery seasons (spring and summer), the disease is more extensive<sup>[15]</sup>. This study was conducted to find out the epidemiologic and demographic trends of Malta fever in Azna County in 2008–2009.

## 2. Materials and methods

This research is a descriptive cross-sectional study on 43 patients with brucellosis referred to health-medical centers of the Azna County during the year 2008–2009. Samples were patients who referred with clinical complaints compatible to brucellosis, and their Wright and 2ME tests were positive. The patient's epidemiological, demographic and laboratory data were recorded on the data collection form containing questions about age, sex, residence place, occupation, education, the possible source of the disease, type of laboratory testing, its titer, and finally, prescriptive treatment. The results were analyzed using SPSS software.

## 3. Results

During the year 2008–2009, 43 patients with brucellosis were diagnosed based on clinical symptoms and serological tests in the Azna County. Incidence of brucellosis was 59.31 per hundred thousand population. Most cases were observed in May (16.3%) and July (14%) (Figure 1). Based on the season, most of the cases occurred respectively during the summer (34.8%), spring (25.5%), fall (20.9%) and winter (18.7%). In the first and the second six months of the year, respectively, 60.3%, and 39.7 cases of brucellosis were found, which indicates the disease was more common in the first six months.



**Figure 1.** Distribution of brucellosis cases per month in the Azna County (2008–2009).

During this year, 65.1%, and 34.9% of cases were observed in men and women, respectively. The mean age of patients with brucellosis was 33.34. The highest and lowest prevalence occurred in the age groups of 15–24 years old (27.9%) and 0–4 years old (2.3%) (Table 1). In this study, occupational groups of the patient were determined

respectively housewives (30.2%), farmers (20.9%), non-governmental sector employments (16.3%), ranchers (14%), students (6.7%) and unemployed (4%). The consumption of unhygienic milk and dairy products (79.1%) was determined as the most important route of transmission of brucellosis (Table 2).

**Table 1**

Distribution of cases brucellosis frequency by age group in the Azna County (2008–2009).

Age group	Numbers	Percentage
0–4	1	2.3
5–14	4	9.3
15–24	12	27.9
25–34	6	14
35–44	8	18.6
45–54	4	9.3
55–64	8	18.6
Total	43	100

**Table 2**

Distribution of cases of brucellosis by way of infection in the Azna County (2008–2009).

Transmit way	Numbers	Percentage
Fresh milk	27	62.8
Contact with animals	9	20.9
Fresh cheese	2	4.7
Fresh milk and cheese	5	11.6
Total	43	100

Based on the findings from the study, the mean household size among patients was 6.24 persons, and about families of 49% of patients have had over five people. In this regard, most of the household size in patients was obtained 5 persons (22%), four persons (14.6%), three persons (12.2%) and 6 persons (9.7%), respectively. About 82.9% of patients were resident in the rural areas, and others were residing in the urban areas. In terms of educational level, the majorities of patients (69.8%) were illiterate or had primary education (Table 3).

**Table 3**

Distribution of cases frequency of brucellosis by education level in the Azna County (2008–2009).

Literacy	Numbers	Percentage
Illiterate	15	34.9
Primary	15	34.9
Intermediate	9	20.9
Diploma and above	4	9.3
Total	43	100.0

In this study, based on serologic test 2ME, most patients (56.1%) were with an antibody titer equal to 1:160. Furthermore, 17.1%, and 9.8% of patients have antibody titer 1:80 and 1:320, respectively, and 17.1% were not tested. Moreover, based on diagnostic test of Wright, most patients

(54.1%) had a titer of 1:320. In addition, 35.1% of patients were with titers of 1:160, and the rest were with titers equal to 1:80.

The results showed that the drug regimen of doxycycline and rifampin (60.4%), was the most main regimen prescribed by doctors for patients with brucellosis. The five other therapy regimens were respectively triple drugs regimen of doxycycline with rifampin and streptomycin (16.2%), cotrimoxazole with rifampin (7%), streptomycin with doxycycline (7%), streptomycin with rifampin (7%) and triple drugs regimen of cotrimoxazole with rifampin and doxycycline (2.3%).

In this study, Brucellosis cases in terms of frequency, were found respectively in the villages under the care of health-medical centers of Momen Abad (30.3%), Ashur Abad (23.2%), Khatam Alanbia (18.1%) Shahrak-e-Almahdi (14%), Darband (9.3%), Emamzadeh Ghasem (2.3%) and Dolat Abad (2.3%) (Table 4).

**Table 4**

The frequency distribution of brucellosis by Residence Place in the Azna County (2008–2009).

Health-Medical Services Centers	Residence Place	Frequency	Percentage of Frequency
Khatam Alanbia	Baghmori	1	2.3
	Zarnan	7	16.3
Ashur Abad	Ashur Abad	2	4.7
	Hush	1	2.3
	Aghbolagh	2	4.7
	Charkhestaneh	1	2.3
	Kahriz ah haji	1	2.3
	Kalbar	1	2.3
	Parchestan	1	2.3
Momen Abad	Galeh	1	2.3
	Momen Abad	1	4.7
	Farzian	2	14.0
	Tazaran	6	2.3
	Tribes of Momen Abad	1	4.7
	Shater	2	2.3
Darband	Shurjeh	1	4.7
	Tian	2	2.3
	Ghaleh Rostam	1	2.3
Emamzadeh Ghasem	Tribes of Darband	1	2.3
	Emamzadeh Ghasem	1	2.3
Dolat Abad	Dolat Abad	1	2.3
	Shahrak-e-Almahdi	4	9.3
Shahrak-e-Almahdi	Shahrak-e-Almahdi	2	4.7
	Aliabad	2	4.7
Total		43	100.0

## 4. Discussion

Prevention, control or elimination of brucellosis requires having the right policies, and right epidemiological data. Based on the findings from this study, the incidence rate

of disease in Azna County was 59.31 per 100 000 population during 2008–2009. Accordingly, Azna County is among regions with a high infection (an incidence rate of 54–80 per 100 000 population)[16]. Farahani et al. reported the mean incidence rate of brucellosis was 60 per 100 000 population in the Arak county during 2001–2010[17]. The reported incidence rates vary in different parts of Iran. According to the Iranian Ministry of Health and Medical Education in 2008, the highest incidence rate of the disease in the provinces of Luristan and East Azarbaijan was about 88–110 per 100 000 population, and next, in the provinces of Central, Hamedan and Khorasan–e–Razavi was 66–100 per 100 000 population, and finally in Kerman, Ilam, Kurdistan, Fars, Kermanshah, West Azerbaijan, and Zanjan 22–43 per 100 000 population. In the same year, the incidence rate of brucellosis in the country was reported 25 per 100 000 population.

Brucellosis disease is seen frequently in youth, and with a less frequency in the elderly[18]. In the study, out of 43 cases identified, 12 cases (37.9%) belonged to the age group 15–24 years old. Generally, young and middle-aged groups (15–44 years old) with 26 cases (60.5%) involved most cases, which the results were consistent with studies of Akhvlediani in Georgia, and Ebrahimpour in Mazandaran Province[19,20]. In the study of Akhvlediani, about 68.7% of patients were in the age group 10–50 years old, and in the study of Ebrahimpour, the highest prevalence (56.5%) was in the age group of 11–50 years old. In Ghasemi's study in the Kurdistan Province, the most common age group of the patient was 15–19 years old, and half of them were in the 10–29 age range[15]. The mean age in the present study was 33.34 years old. Haddadi in his study in Tehran, reported the mean age of patients with brucellosis as 35.5 years old[21]. The median age of patients in the study of Bosilkovski in Macedonia was 34.5 years old[22]. The higher prevalence of brucellosis among young and middle-aged people can be due to a more contact with cattle and consumption of unpasteurized dairy products. The incidence rate of this disease can be reduced by implementing health education programs and enhancing knowledge and attitude of persons.

In this study, men compared to the women were about twice more infected with brucellosis. In Donev's study in the Republic of Macedonia, the ratio of the male to female patients was calculated as 1.96:1[23]. In a study in Kampala, (Uganda), significantly more females than males were found to show seropositively for brucellosis[24]. In Ghasemi's study in Kurdistan Province, gender distributions of patients were almost identical[15]. In Hasanjani's study in Babol county, about 56.9% of patients were men[25].

In this study, the disease was more common during the spring and summer seasons, which can be attributed to livestock breeding. Furthermore, the most common months of the disease occurrence were determined May and July;

also, the lowest rate was in December. In Ghasemi's study in Kurdistan Province, the most common months of the disease occurrence were April (12.11%), and May (11.9%), and the lowest prevalence was November (4.8%). Also in the mentioned study, 63% of patients showed signs of brucellosis in the first six months of the year and 27% in the second half of the year[15]. In study of Haddadi in Tehran, most cases of brucellosis were in summer (31.8%), and spring (30.36%)[21].

Approximately, 34.9% of patients had a history of occupational exposure to livestock, which included occupations such as agriculture and ranching. Out of 65.1% patients without occupational exposure to livestock, 30.2% were housewives. Given that women in rural areas carry out an important part of affairs pertaining to the livestock, so housewives were the greatest group affected in terms of employment. Because students help their parents for keeping livestock in the rural areas, they were also involved in the disease. Given the high occurrence of the disease in women, and their tendency for attending the classes, there is the need for educational programs in the field of health care simultaneous with delivery of cattle, a good education for the accurate approach for boiling milk, and manufacturing hygienic dairy products in the season which transmission of disease is common. In Moradi's study in Kurdistan province, most cases of brucellosis were among housewives (39.4%), farmers (20.8%), students (20.6%), shepherds (5.2%), and other jobs (26). In Ghasemi's study in Kurdistan province, housewives (41%), students (19.5%), and farmers (16.5%), were the greatest occupational groups affected[15].

In the present study, a higher proportion of patients (82.9%) were rural people. In the study on 3 880 patients with brucellosis in Kurdistan Province, 81.8% of the cases were rural population[26]. Also, in Arak and Babol counties, respectively 72%, and 60.8% of patients with brucellosis were resident in rural areas[17,25]. Furthermore, rural residents due to their eating habits and consumption of unpasteurized dairy products are at risk for the brucellosis more than urban residents.

In this study, unpasteurized milk and the dairy products were determined as the most common way of transmission of brucellosis (79%). Some of the important causes of outbreaks in endemic areas are factors such as living of people near livestock in the village, a little knowledge about the ways of transmission of disease, the consumption of unsanitary dairy products, low environmental hygiene in the ranches, and being remoteness from health service centers. In Hasanjani's study in Babol County, fresh and unpasteurized dairy products were the main cause of morbidity of brucellosis[25]. Furthermore, In Ghasemi's study in Kurdistan Province, consumption of dairy products and simultaneous contact with infected animals (48%) and consumption of unpasteurized dairy products (36.7%) were diagnosed as the

most common route of transmission of brucellosis<sup>[15]</sup>.

In our study, the therapeutic regimen of doxycycline with rifampin was 60.4% out of all cases prescribed, and other regimens included few percent. In Khadivi's study in Koohrang County, medication regimens used for patients, were mainly rifampin and cotrimoxazole (59.8%) and doxycycline plus rifampin (17.5%), respectively<sup>[27]</sup>. In Haddadi's study, most prescribed regimens were a cotrimoxazole regimen with rifampin, and doxycycline regimen plus cotrimoxazole was associated with the lowest recurrence<sup>[21]</sup>.

In this study, most patients were with Wright's titer of 1:320, which is consistent with the idea that in endemic areas, Wright's titer of patients often is 1:320. This is due to a lot of contact with brucellosis infection in these areas. The 2ME test in most patients was with a titer 1:160. In the study on brucellosis in Arak county, most patients had a titer of 1:320, and a titer of 1.80 in terms of Wright's, and 2ME tests, respectively<sup>[17]</sup>.

According to the results, because Azna County is in the high infection group and a higher prevalence of the disease exists in the rural men, and the disease in different months during the year has incidence. Therefore, prevention and education programs in all seasons during the year are necessary to reduce the economic and social problems resulting from disease. In addition, in order to control this zoonose disease, we recommend an intersectional cooperation between health and veterinary sectors.

### Conflict of interest statement

We declare that we have no conflict of interest.

### Acknowledgements

We thank all employees and officials of Health-Treatment Network of Azna County, Luristan University of Medical Sciences that helped us in carrying out this research project. We acknowledge deputy vice-chancellor for research and technology development of Ahvaz Jundishapur University Medical Sciences in collaboration on this project with No. 87S.56 ; also we would like to express our deep gratitude to the Research Consultation Center for technical support.

---

### Comments

#### Background

Brucellosis is one of the most common zoonotic

diseases, with more than 500 000 new cases reported annually worldwide. Brucellosis is caused by infection with *Brucella* species bacteria. The most commonly affected animals are cows (*Brucella abortus*), sheep and goats (*Brucella melitensis*), pigs (*Brucella suis*), and several other domestic animals. Human infection can occur through consumption of infected, unpasteurized animal products, direct contact with infected animal parts, and through the inhalation of infected particles. It is a significant public health problem and socio-economic challenge in many countries, especially in the Mediterranean region and in Iran, as well. Brucellosis is an endemic disease in Iran. The purpose was to explain the demographic and epidemiologic profile and as well as diagnostic and treatment strategies in patients with brucellosis in Azna County.

#### Research frontiers

The purpose was to explain the demographic and epidemiologic profile and as well as diagnostic and treatment strategies in patients with brucellosis in Azna County. Persistent surveillance and reporting are necessary to monitor of brucellosis and the efficacy of control programmes.

#### Related reports

Most of the cases found during the summer (34.8%). About 65.1% of the patients with brucellosis were men. About 27.9% of the cases, were between 15–24 years old. The possible sources of infection were consumed, unpasteurized dairy products and direct contact with domestic animals. The most important of occupational groups of the patient were determined housewives (30.2%) and farmers (20.9%), The results of this study were consistent with studies of Ebrahimpour *et al.*(2012), Akhvlediani *et al.*(2010) and Karadzovski *et al.*(2010).

#### Innovations and breakthroughs

Identifying the principal risk factors for brucellosis is very considerable for reaching a extensive understanding of the nature of the disease and its transmission methods for control of brucellosis. This research displayed that, the unpasteurized dairy products were as the most common path of transmission of disease

#### Applications

It is serious to recognize the epidemiology of brucellosis in each region. The results of the present study offer that consumption unpasteurized dairy supplies may operate as an great way in disease transmission. So, it is serious to scout the epidemiology of brucellosis in humans and animals.

### Peer review

It is a good investigation in which the researchers detected some features of epidemiologic, demography, laboratory, treatment and diagnosis of human brucellosis in Azna County. The findings are considerable and propounded that this disease is widespread in Azna County.

### References

- [1] Zeinali M, Shirzadi MR, Hajrasolo H. *A guide to combat Brucellosis*. 1st ed. Tehran: Raz Nahan Publications; 2012, p.50.
- [2] Azizi F, Hatami H, Janghorbani M. *Epidemiology and control of common diseases in Iran*. 4th ed. Tehran: Khosravi Publications; 2010, p.915.
- [3] Mohamed NS, Stephen MB, Nammalwar S. Brucellosis: A re-emerging zoonosis. *Vet Microbiol* 2010; **140**: 392–398.
- [4] Institute of Environmental Science and Research Surveillance. Brucellosis, epidemiology in New Zealand. New Zealand: Public Health Surveillance. [Online] Available from: www.surv.esr.cri.nz. [Accessed on 3 April, 2013].
- [5] Atluri VL, Xavier MN, Jong MF, Hartigh AB, Tsohis RM. Interactions of the human pathogenic *Brucella* species with their hosts. *Ann Rev Microbiol* 2011; **65**: 523–541.
- [6] Centers for Disease Control and Prevention (CDC). Bacterial agents. [Online] Available from: www.cdc.gov/biosafety/publications/bmbl5/BMML5\_sect\_VIII. Atlanta, GA, USA: CDC. [Accessed on 3 April 2013].
- [7] Lopes LB, Nicolino R, Haddad JPA. Brucellosis–risk factors and prevalence: a review. *Open Vet Sci J* 2010; **4**: 72–84.
- [8] Mostafavi E, Asmand M. Trend of brucellosis in Iran from 1991 to 2008. *Iran J Epidemiol* 2012; **8**(1): 93–100.
- [9] Dashti AS, Karimi A, Javadi V, Shiva F, Fallah F, Alaei MR, et al. Elisa cut-off point for the diagnosis of human brucellosis: a comparison with serum agglutination test. *Iran J Med Sci* 2012; **37**(1): 9–14.
- [10] Atluri VL, Xavier MN, Jong MF, Hartigh AB, Tsohis RM. Interactions of the human pathogenic *Brucella* species with their hosts. *Annu Rev Microbiol* 2011; **65**: 523–541.
- [11] Xavier MN, Paixão TA, Hartigh AB, Tsohis RM, Santos RL. Pathogenesis of *Brucella* spp. *Open Vet Sci J* 2010; **4**: 109–118.
- [12] Alavi M, Motlagh ME. A review of epidemiology, diagnosis and management of brucellosis for general physicians working in the Iranian health network. *Jundishapur J Microbiol* 2012; **5**(2): 384–387.
- [13] Kassiri H, Amani H, Lotfi M, Hosseini S. Epidemiological aspects of human brucellosis in Aana County, Lorestan Province, West of Iran (2007–2008). *Jentashapir* 2011; **1**(2): 1–9.
- [14] Rezaee MA, Rashidi A, Motaharinia Y, Hossaini W, Rahmani MR. Seroprevalence study of brucellosis among high-risk groups in comparison with other people of the population in Sanandaj (West of Iran). *Afr J Microbiol Res* 2012, **6**(9): 1985–1989.
- [15] Ghasemi B, Mohammadia B, Soofimajidpour M. Epidemiology of human and animal brucellosis in Kurdistan Province in 1997–2001. *Sci J Kurd Univ Med* 2003; **8**(30): 23–32.
- [16] Zeinali M, Shirzadi MR. Effective ingredient in accretion and reduction of brucellosis incidence in human in Iran in 1985–2005. In: Proceedings of 15th Veterinary Congress; 2008; Iran.
- [17] Farahani Sh, Shahmohamadi S, Navidi I, Sofian S. An investigation of the epidemiology of brucellosis in Arak City, Iran, (2001–2010). *Arak Med Univ J* 2012; **14**(7): 49–54.
- [18] Heidari M, Kheirollahi A, Nazar M, Birjandi M, Zareie H. Frequency of epididymo–orchitis in hospitalized patients with acute scrotum at Shohadaye Ashayer Hospital, Khorramabad, Iran. *J Pak Med Assoc* 2012; **62**(8): 44–46.
- [19] Akhvlediani T, Clark DV, Chubabria G, Zenaishvili O, Hepbum M. The changing pattern of human brucellosis clinical manifestations epidemiology, and treatment outcomes over three decades in Georgia. *BMC Infect Dis* 2010; **10**: 346–351.
- [20] Ebrahimpour S, Youssefi MR, Karimi N, Kaighobadi M, Tabaripour R. The prevalence of human brucellosis in Mazandaran Province, Iran. *Afr J Microbiol Res* 2012; **6**(19): 4090–4094.
- [21] Haddadi A, Rasoulinejad M, Afhami SH, Mohrez M. Epidemiological, clinical and para clinical aspects of brucellosis in Imam Khomeini and Sina hospitals of Tehran (1998–2009). *JKUMS* 2006; **10**(3): 242–251.
- [22] Bosilkovski M, Krteva L, Dimzova M, Vidinic I, Spova Z, Spasovska K. Human brucellosis in Macedonia–10 years of clinical experience in endemic region. *Croat Med J* 2010; **51**: 327–336.
- [23] Donev D, Karadzovski Z, Kasapinov B, Lazarevik V. Epidemiological and public health aspects of brucellosis in the Republic of Macedonia. *Sec Biol Med Sci* 2010; **31**(1): 33–54.
- [24] Makita K, Fevre EM, Waiswa C, Kaboyo W, Eisler M, Welbern S. Spatial epidemiology of hospital–diagnosed brucellosis in Kampala–Uganda. *Int J Health Geogr* 2011; **10**(52): 1–9.
- [25] Hasanjani Roushan MR, Mohrez M, Smailnejad Gangi SM, Soleimani Amiri MJ, Hajiahmadi M. Epidemiological features and clinical manifestation in 469 adult patients with brucellosis in Babol, Northern Iran. *Epidermal Infect* 2004; **132**(6): 1109–1114.
- [26] Moradi Gh, Kanani Sh, Majidpour MS, Ghaderi A. Epidemiological status survey of 3880 case of brucellosis in Kurdistan. *Iran J Infect Dis Trop Med* 2006; **11**(33): 27–33.
- [27] Khadivi R, Imani R, Salehi Sh, Dehghan M. The incidence rate of chronic brucellosis following one–year antibiotic therapy in Koohrang district of Chahrmahal Bakhtyari Province. *J Shahrekord Univ Med Sci* 2006; **8**(3): 54–61.