

## Epidemiological Status of Brucellosis in Abadeh County, Fars Province, Iran in 2011-2017

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### ARTICLE INFO

#### Original Article

Received: 4 Jun 2018

Accepted: 18 Aug 2018



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### ABSTRACT

**Introduction:** Brucellosis is one of the most common zoonotic diseases in many parts of the world, which has made problems for the public health and the livestock economics. The aim of this study was to investigate the epidemiological status of brucellosis disease in Abadeh county, Fars province, Iran.

**Methods:** In this cross-sectional study, the demographic and epidemiologic data of 985 patients with brucellosis who referred to the health centers and clinics of Abadeh county from 2011 to 2017 were evaluated. In order to analyze the data, the frequency distribution, statistical model was used through SPSS version 25. A significant level of 0.05 was considered.

**Results:** The incidence of the disease in 2011-2017 was 128.78 per 100,000 populations. Most cases of the disease were reported in the spring and summer. The highest number of people with the brucellosis consisted of housewives (28.7%), ranchers (25.4%), and students and pupil (17.8%). In addition, 56 percent of the patients were the rural inhabitants. This study showed that 62.6 percent of the patients were in contact with the livestock and 50.2 percent of the cases had consumed non-pasteurized cheese, which have been the sources of infection transmission to humans. The mean age of the patients was  $34.3 \pm (19.35)$  years and the age group of 25-34 years had the highest number of patients (20.9), and the prevalence of the disease in men was one and a half times higher than this rate in women.

**Conclusion:** Regarding the high prevalence of brucellosis disease in Abadeh city, training about the ways of disease transmission should be provided to various population groups, especially the individuals who are at risk.

**Keywords:** Brucellosis, Epidemiology, Public Health, Incidence, Abadeh

#### How to cite this paper:

Karimi A, Karimi B. Epidemiological Status of Brucellosis in Abadeh County, Fars Province, Iran in 2011-2017. J Community Health Research. 2018; 7(3): 183-191.

### Introduction

Brucellosis is one of the most common zoonotic diseases in many parts of the world, which has made problems for the public health and the livestock economics<sup>(1, 2)</sup>. So far, six species of *Brucella* have been identified, among which the roles of *Brucella melitensis*, *Brucella abortus*, and *Brucella suis* are more well-known in human pathology<sup>(3, 4)</sup>. This disease is characterized by names such as Mediterranean fever, Malta fever, Undulant fever, and Gibraltar fever<sup>(5)</sup>. Despite the improvements in food health, brucellosis is still common in many parts of the world, especially in the developing countries<sup>(6, 7)</sup>. Human beings are infected by having direct contact with infected animals, consuming non-pasteurized dairy products, breathing dust contaminated by microorganisms, and contacting with animal delivery secretions<sup>(8, 9)</sup>. Symptoms include weakness, lethargy, shivering, sweating, loss of appetite, headache, and psychological symptoms<sup>(3, 10)</sup>. About 500,000 new cases of the disease are reported to the World Health Organization from around the world every year<sup>(11)</sup>. This disease is prevalent in the Mediterranean, the Middle East, North and East Africa, Latin America, the Caribbean, as well as South and West Asia<sup>(12)</sup>. Brucellosis is present in all regions of Iran, but higher incidence of Brucellosis has been reported in the provinces of Khorasan, East Azarbaijan, Hamedan, Lorestan, Fars, West Azarbaijan, Kermanshah, as well as Chaharmahal and Bakhtiari<sup>(13)</sup>. Brucellosis is one of the most important public health problems in endemic country, which has caused significant economic losses in animal related industries including reduced milk production, increased abortion, delayed conception, medical costs and public health problems (cost of treatment and loss of productivity)<sup>(14-16)</sup>. This disease is a work-related illness and is more often observed among shepherds, farmers, veterinarians, livestock producers, and slaughterhouse workers<sup>(5)</sup>. Considering the fact that no study has ever been conducted on the epidemiological status of brucellosis in Abadeh city, this study was carried

out to evaluate the prevalence of the disease, to identify the high-risk groups, and to investigate the level of pollution in different areas of the city.

### Methods

This study used a cross-sectional design. Abadeh is a city and the capital of Abadeh County, in Fars province, Iran which is connected to Isfahan province from the north and west, to Safashahr city from the west, and to Yazd province from the east.

According to the census of 2016, the total population of this city was equal to 100, 831 people. In this cross-sectional study, the needed information of participants was extracted from the care forms of the patients with brucellosis disease in the department of prevention and combating diseases of the city health center. This research studied the data of patients with brucellosis disease registered during seven years from the beginning of 2011 to the end of 2017. The present study collected the demographic (age, gender, occupation, and type of residence; in urban or rural areas) and epidemiologic data of the patients who referred to the health centers, health homes, health homes, and offices located in the county. According to the anti-brucellosis guidelines, Wright test of  $\geq 1/80$  and  $2ME \geq 1/40$  were defined as the criteria to diagnose the positive cases. The population statistics of the city were taken from Iranian Statistics Center on the basis of a population census. The prevalence rate was calculated annually by dividing the number of cases by the total population of the city per 100,000 people. Given the research objectives, data were entered into SPSS Software (Version 25) and analyzed through descriptive analysis, considering  $p < 0.05$  as the significance level.

### Results

The study population included all the patients with brucellosis who referred to the clinics and health centers located in the county for treatment, and their information was recorded at the department of prevention and combating diseases of the city health center. The total number of

patients registered from 2011 to the end of 2017 was 985. The prevalence rate of the disease in this period, based on the population of Abadeh county per 100,000 people, is shown in Table 1.

According to these results, the mean prevalence rate over the mentioned years was 128.78 percent in 100,000 populations.

**Table 1.** Incidence rate of brucellosis in Abadeh county from 2011 to 2017

Years	Frequency (%)	Population	Prevalence/100,000
2011	121 (12.3)	108188	111.84
2012	137 (13.9)	109000	125.68
2013	192 (19.5)	109700	175.02
2014	201 (20.4)	110200	182.39
2015	151 (15.3)	111000	136.03
2016	101 (10.3)	107831	93.66
2017	82 (8.3)	106700	76.85
Total	985 (100)		

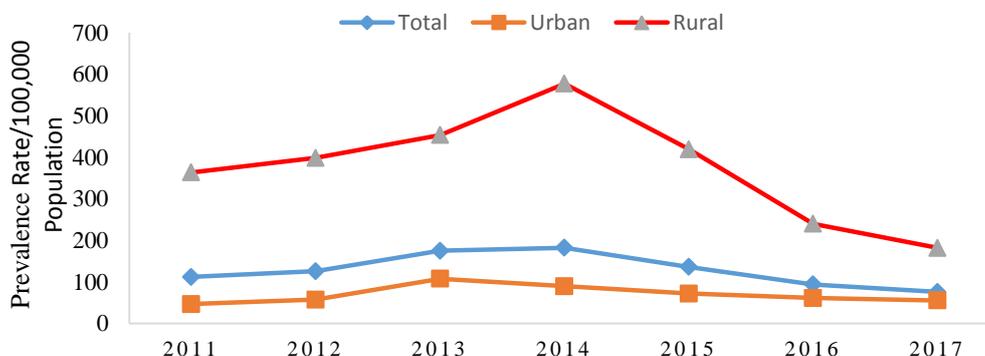
Among the patients infected with brucellosis, 587 cases were males (59.6%) and 398 were females (40.4%). The mean age of the patients was

34.3 ± (19.35) years. The highest number of cases was seen in the age group of 25-34 years old (20.9%), (Table 2).

**Table 2.** The relationship between age groups and gender in patients with brucellosis in Abadeh county from 2011 to 2017

Age Group	sex	Male		Female		Total	
		N	%	N	%	N	%
Less than 5		21	2.1	11	1.1	32	3.2
5-14		75	7.6	43	4.4	118	12.0
15-24		130	13.2	69	7.0	199	20.2
25-34		114	11.6	92	9.3	206	20.9
35-44		84	8.5	56	5.7	140	14.2
45-54		67	6.8	57	5.8	124	12.6
55-64		54	5.5	25	2.5	79	8.0
65≤		42	4.3	45	4.6	87	8.8
Total		587	59.6	398	40.4	985	100

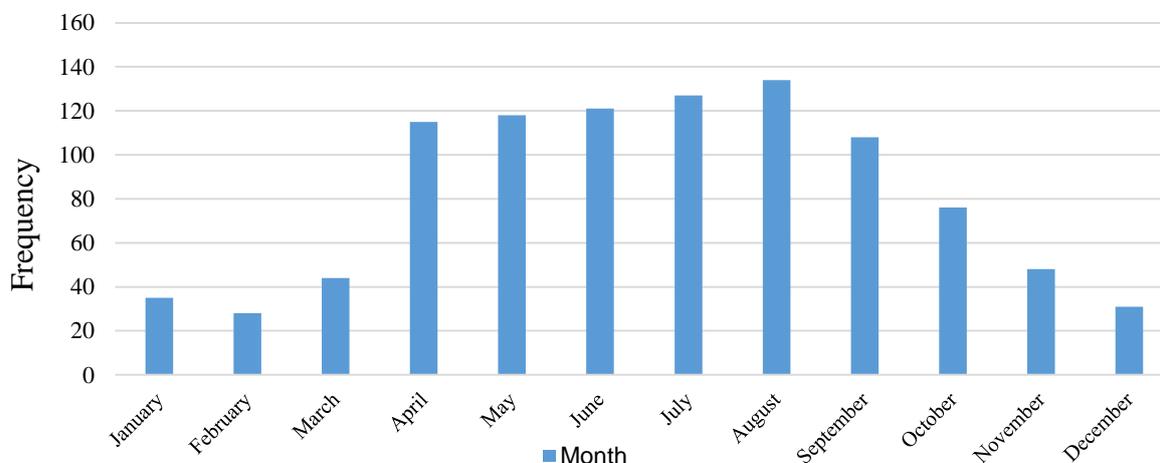
Based on the findings, 552 patients (56%) lived in rural areas and 433 of them (44%) lived in urban regions. Figure 1 represents the trend of infection with brucellosis based on the incidence rate categorized by the type of residence location during the studied years.



**Figure 1.** The trend of infection with brucellosis based on the type of residence location in Abadeh county from 2011 to 2017.

Most cases of brucellosis infection were seen in the months of August (13.6%), July (12.9%), and

June (12.3%), respectively (Figure 2).



**Figure 2.** Frequency of the number of patients with brucellosis according to the month of infection in Abadeh town from 2011 to 2017.

Based on the results, 616 patients (62.6%) were in contact with animals, from whom 415 people (42.1%) were directly in contact with live animals, 190 of them (19.3%) kept livestock near their houses, and 12 patients (1.2%) were in contact with carcasses. We further found that 368 patients (37.4%) were not in contact with livestock.

The findings indicated that 956 cases (97.1%) were infected with brucellosis for the first time. However, in 29 patients (2.9%) recurrence of the disease occurred, or the treatment of the disease failed. The most affected patients were female housewives (28.7%), ranchers (25.4%), and students (17.8%), (Table 3).

**Table 3.** Frequency distribution of patients with brucellosis based on occupation in Abadeh county from 2011 to 2017

Occupation category	Number	Percent
Housewife	283	28.7
Animal husbandry	250	25.4
Student and pupil	175	17.8
Worker	78	7.9
Farmer	74	7.5
Children	56	5.7
Employee	44	4.5
Butcher	9	.9
Others	16	1.6
Total	985	100

In the present study, most people (50.2%) mentioned consumption of the non-pasteurized cheese as the source of infection. The prevalence

of non-pasteurized dairy products among the studied population is presented in Table 4.

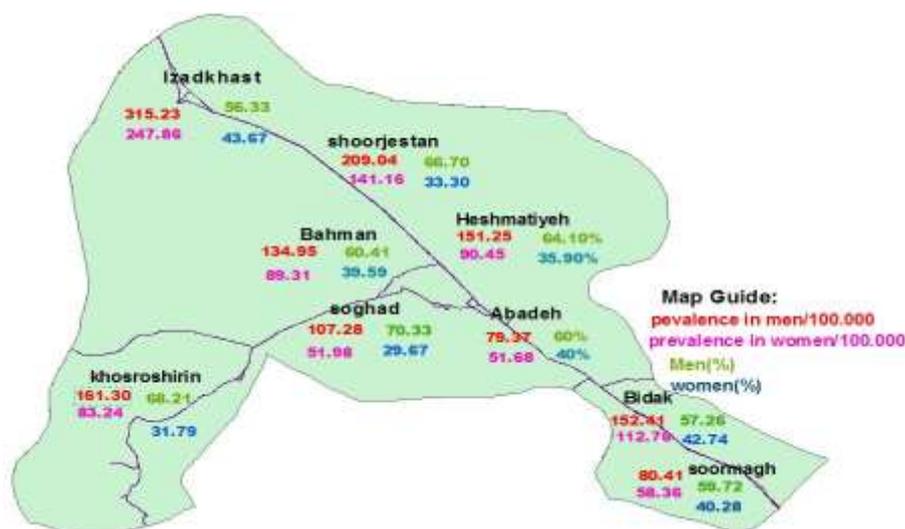
**Table 4.** Frequency distribution of patients with brucellosis according to the type of consumed dairy product in Abadeh county from 2011 to 2017

Name Of The Dairy Product	Male		Female		Total	
	N	%	N	%	N	%
Cheese	297	50.6	197	49.5	494 (50.2)	50.2
Using several dairy products	154	26.2	118	29.7	272 (27.6)	27.6
Milk	123	21	77	19.3	200 (20.3)	20.3
Ice cream	13	2.2	6	1.5	19 (1.9)	1.9
Total	587	100	398	100	985 (100)	100

In this study, the highest number of patients with brucellosis were reported from Abadeh (36%), Izadkhast (26.9%), and Bahman (9.7%) towns, respectively (Table 5 and Figure 3).

**Table 5.** Frequency distribution of brucellosis in Abadeh county based on residence location from 2011 to 2017

Region (City)	Number	Percent
Abadeh	355	36
Izadkhast	265	26.9
Bahman	96	9.7
Soghad	93	9.4
Khosroshirin	78	4.6
Heshmatiyeh	38	3.9
Bidak	30	3
Shoorjستان	27	2.7
Soormagh	19	1.9
Total	985	100



**Figure 3.** The prevalence of brucellosis disease and the percentage of patients modified by gender in different areas of Abadeh city from 2011 to 2017

**Discussion**

The annual incidence average rate of brucellosis in the Mediterranean and the Middle East is about 75 percent per 100,000 population (17). Due to sanitary, socioeconomic reasons and increasing

livestock transportation from infected areas, the prevalence of this disease has increased in the Mediterranean, the Arabian Peninsula, Balkan Peninsula, India and Central and South America (17-19). According to the findings of the current study,

the average incidence rate of brucellosis in Abadeh county, Fars province, Iran from 2011 to 2017 was 128.78 per 100,000 population. According to Farahani et al., the average incidence rate of brucellosis in Arak city was 60 percent in 100,000 people in 2001-2010<sup>(20)</sup>. Health Ministry of Iran declared in 2012 that provinces of East Azarbaijan, Hamedan, Lorestan, Markazi, South Khorasan, West Azarbaijan, and Kermanshah had high levels of pollution (31-41 per 100,000 people)<sup>(13)</sup>.

In the current study, the prevalence of brucellosis in young and middle-aged populations was higher than the elderly group, which can be due to the employment of this age group in economic activities related to livestock and livestock products. Among 985 cases of brucellosis studied in this research, 206 (20.9%) patients belonged to the age group of 25-34 years. In general, the young and middle-aged population (the age group of 14-44 years) with 545 cases of infection (55.3 %) had the highest incidence of the disease. These results confirm the findings reported by Akhvlediani in Georgia State and Ebrahimpour in Mazandaran province<sup>(3, 21)</sup>. In a study conducted by Akhvlediani, approximately 68.7 percent of patients were in the age range of 10-50 years and in another study carried out by Ebrahimpour, the highest prevalence of brucellosis (56.5%) was in the age group of 11-50 years. In a reserach conducted by Kasiri in Azna town in the west of Iran from 2008 to 2009, the highest prevalence of brucellosis was observed in the age group of 15-24, which is consistent with the results of the present study<sup>(22)</sup>.

The mean age of the patients in the current study was  $34.3 \pm (19.35)$  years. Haddadi carried out a similar study in Tehran and reported that the average age of patients with brucellosis was 35.5 years<sup>(23)</sup>. The age median of the participants in the present study was 32 years, but the patients' age median in Bosilkovski's study in Macedonia was 34.5 years<sup>(24)</sup>.

In this study, men were infected with the disease about one and a half time more than women. In a study by Khazaei in west of Iran, 68.9% of the patients were men<sup>(25)</sup>. In Kohei Makita's study,

women were significantly more infected with *Brucella* microbes than men<sup>(26)</sup>. In Ayatollahi's study, 53.9% of the patients were men<sup>(27)</sup>. Furthermore, in a study by Hamzavi in Kermanshah, men accounted for 52.8% of the cases<sup>(28)</sup>. In this study, a significant relationship between gender and age of the patients was observed. In Moradi study conducted in Kurdistan, the relationship between gender and age groups was also significant<sup>(29)</sup>.

In this research, the disease was more prevalent in spring and summer. This could be due to livestock breeding in these seasons as well as the migration of ranchers from the south regions of Iran to this area to sell their non-pasteurized dairy products to the native people, which in turn spread the disease in the region. Meanwhile, the most cases of the disease occurred from May to October, and the lowest cases were in March. Ayatollahi conducted a study in Yazd and mentioned that the highest prevalence rate was observed in summer (34.3%) and spring (29.7%), whereas the lowest incidence was in winter (10.1%)<sup>(27)</sup>. In Dr.Mansour I.Alsoghair study in AlQassim region, the most cases of the disease were from March to June<sup>(30)</sup>.

Approximately 33.4 percent of patients had a history of occupational exposure to animals and 28.7 percent were female housewives. Considering the fact that in rural areas, most livestock activities are done by housewives, the highest number of cases was related to this group. In the present study, 17.8 percent of the patients were students and pupils, which was due to their collaboration with their parents in keeping the livestock. In a study carried out by Ramazani in Khorasan Razavi, most cases of brucellosis occurred among housewives (35.3%), farmers and ranchers (24.2%), students (16.8%), and shepherds (6.6%)<sup>(31)</sup>. Mansour I.Alsoghair reported that in AlQassim region, shepherd (25.9%), farmers (18.6%), students (16.9%), housewives and unemployed individuals (6.5%) were respectively the groups affected by the occupational exposure to livestock<sup>(30)</sup>. In Ammam Abdelkader study in the Southern Zone of Sidi-Bel-Abbes, Shepherds

and farmers were the predominant socio-professional classes infected with Brucellosis<sup>(32)</sup>. Given the high rates of the disease among women and their willingness to learn, implementation of training programs on brucellosis is crucial. In the breeding and lactation seasons of the livestock, appropriate training measures should be taken to address the issues on doing proper milking to have sanitary milk as well as having an appropriate way of producing traditional dairy products.

In the current study, the highest rate of infection occurred among the rural residents (56%). In the research conducted by Kasiriy in Azna town in the west of Iran, 82.9 percent of the patients were rural residents<sup>(22)</sup>. In Khazaei study in west of Iran, 87.8 percent of the cases were residents of the villages<sup>(25)</sup>. In the cities of Arak and North-West Iran, 72 percent and 83 percent of the patients were rural residents, respectively<sup>(20, 33)</sup>. So, inhabitants of the rural areas are at higher risk of developing brucellosis, since their jobs are more related to animal husbandry. Besides, they consume non-pasteurized dairy products more than other people.

In the present study, consumption of cheese was the most common way of disease transmission (50.2%). Kasiri reported that in Azna town, consumption of non-pasteurized milk was the cause of the disease in 62.8 percent of the patients<sup>(22)</sup>. The most important factors causing the high incidence of Brucellosis in endemic areas were keeping livestock near the place of residence, having insufficient knowledge about ways of

transmission and prevention of the disease, having more willingness to use non-pasteurized traditional dairy products, and not having proper access to health services.

According to the results of this study, due to the transfer and entry of the contaminated livestock as well as occupation of the majority of rural population in ranching, the disease is observed in most months of the year.

### Conclusion

Given the high prevalence of brucellosis in Abadeh city, especially in rural areas where livestock farming is concerned, training should be provided on the transmission ways of the disease and the preventive methods. In addition, due to the fact that most cases of this disease were observed among housewives and ranchers in this study, these individuals should be given priority in educational programs.

### Acknowledgements

The study was conducted in accordance with the ethical guidelines of the declaration of Helsinki. Special thanks go to the staff of health centers, clinics, health houses, and physicians who kindly helped in training, preventing, treating, and reporting the disease cases. They cooperated with the unit of fighting with infectious diseases at the city health center.

### Conflict of Interest

The authors declare no competing interests.

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