

Epidemiological Study of Brucellosis in Ilam Province from 2011 to 2018: A Cross-sectional Study

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Abstract

Background: The aim of this study is to investigate the epidemiological indicators of brucellosis in Ilam province, west of Iran, during the years 2011 to 2018.

Methods: This descriptive cross-sectional analytical study was performed on 1,002 patients with brucellosis in Ilam province, west of Iran. People with a Wright test greater than 1.80 or a positive 2ME test who were diagnosed with brucellosis were followed up and treated. Data were analyzed using SPSS software version 21 and Excel 2007.

Results: 1002 patients with brucellosis were diagnosed, 566 of whom were male (56.5%) and 436 were female (43.5%). The mean age at the onset of the disease was 38.11±19.61 in men, 41.73±15.67 in women, and 39.94±17.81 in both sexes. The incidence of brucellosis in 2011 was 20.44 per 100,000 (22.30 per 100,000 in men and 18.53 per 100,000 in women), which dropped to 15.94 per 100,000 in 2018. Regarding the season, most cases of the disease were observed in summer (31%), spring (24.7%), winter (23.6%), and autumn (20.7%), respectively.

Conclusion: The results showed that the age of the onset of the disease was middle age, when individuals are active labor and human capital working in a community. Therefore, improving cross-sectoral and intra-sectoral cooperation and promoting effective education for prevention seem necessary.

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Introduction

Common diseases between humans and animals are one of the most important health problems in human societies. Brucellosis (Malta fever) is one of the most common diseases in humans and animals.¹ It is more commonly classified as an allergic and zoonosis disease, caused by gram-negative bacteria called *Brucella*, which can develop into an acute, subacute, or chronic disease.² About 500,000 human cases are reported each year, and its eradication is a major challenge for most countries.³

Although the transmission of the disease through the consumption of unpasteurized milk and dairy products has been reported as the most important

and common route of transmission, the disease is also transmitted to humans through blood contact and animal birth secretions with injured skin.⁴

The most common symptoms of brucellosis in humans are relatively high fever, anorexia, weight loss, muscle aches and swelling, and big joints pain. In livestock, infertility and recurrent miscarriages may be symptoms of the disease.⁵ Brucellosis is of great importance in most parts of the world, especially in developing countries, in terms of not only public health, but also economic and social status of the society.⁶ Brucellosis can impose a heavy economic burden on the community because of reducing the weight of livestock, causing miscarriage among them,

and reducing the production of dairy products, meat and wool.⁷ The expenses are estimated at more than \$700,000 per year in the United States and Latin America.⁸ Evidence suggests that the disease is more common in countries with poor animal standards and low public health programs and interventions.⁹

The World Health Organization (WHO) reports that from the total number of people with the disease in the world, the share of the eastern Mediterranean, where Iran is located, is about 45,000 people, while the organization states that only one out of every 5 cases of the disease is diagnosed. Accordingly, Iran is in a region with a high rate of incidence of brucellosis; its incidence in Iran is considered as an indigenous disease.^{5, 6, 10} However, its prevalence is not the same in all provinces and is higher in some areas. As the latest statistics of brucellosis in Iran has shown that some provinces such as Golestan, Ilam, Qazvin, Chaharmahal and Bakhtiari, Semnan, Ardabil, Kerman, etc. have had a rate of 11-20 cases;¹¹ even the share of rural areas is higher than urban ones.⁵ In this study, we aimed to determine the epidemiological indicators of brucellosis in Ilam province during the years 2011 to 2018. Due to the direct contact of most rural families of Ilam province with livestock, various complications have been caused by this disease, including miscarriage in livestock and subsequent economic damage to the livestock exports; additionally, there is a significant prevalence of brucellosis in this province, which is one of the most important centers of animal husbandry of the country. The results of this study, in addition to identifying epidemiological indicators of the disease in the province, might be effective to prevent, control, and treat it.

Methods

This is a descriptive-analytical study conducted during 2011 to 2018 in Ilam province. The data of this study were collected based on the national form of Brucellosis report from rural health houses, urban and rural health centers, and some private clinics and offices in the cities of Ilam province. The inclusion criteria were based on the

defined national standards, i.e. all people suspected of having the disease (with clinical symptoms of the disease such as fever and night sweats, weight loss, joint pain, etc.) and based on experiments with a titration above 1.80 Wright and positive Combs' wright titrations. After obtaining the addresses, we followed up these people by the health center follow-up team to check the living conditions and symptoms of other members of the patient's family, provide the necessary training on the disease, and follow up the treatment. At this stage, after carefully examining the patient and her/his family and identifying possible cases of the disease in other members, the information of these patients was entered in the ministry special checklist for brucellosis; in the next stage, this information was entered into the Excel software.

In order to obtain the age-standardized incidence rates of the population of Ilam province, the census of 2011 and 2016 of the Statistics Center of Iran was used, and for the other years, the population was estimated. We used the standard population for low- and middle-income countries in 2013 (Segi) to calculate age-standardized incidence rates.

After the necessary coordination and obtaining the data, we entered them into the SPSS software version 21. To calculate the trend of the disease in different years in men and women, the Chi-Square test was used; A P value of <0.05 was considered significant.

Results

Between 2011 and 2018, 1,002 patients with brucellosis were diagnosed based on clinical symptoms and serological tests in Ilam province. Of them, 566 cases were male (56.5%) and the rest were female. The mean age at the onset of the disease was 38.51±19.61 in men, 41.73±15.67 in women, and 39.94 17.81 in both sexes. 65.7% of the cases were residents of rural area, 25.1% urban dwellers, and the residential areas of the others were unknown (Table 1). There was a statistically significant difference between the incidence of the disease and the place of residence (P<0.001). The incidence of brucellosis in 2011 was 20.44 per 100,000 (22.30 per 100,000 in

Table 1: Frequency distribution of brucellosis cases for age and sex groups in Ilam province (2018-2011)

Age group	Male		Female		Total	
	Number	%	Number	%	Number	%
0-4	11	1.95	3	0.69	14	1.40
5-14	46	8.15	23	5.29	69	6.91
15-24	93	16.48	40	9.21	133	13.32
25-34	116	20.56	74	17.05	190	19.03
35-44	74	13.12	89	20.50	163	16.33
45-54	90	15.95	106	24.42	196	19.63
55-64	73	12.94	77	17.74	150	15.03
65-74	48	8.51	17	3.91	65	6.51
+75	13	2.30	5	1.15	18	1.80
Total	564	100	434	100	998	100

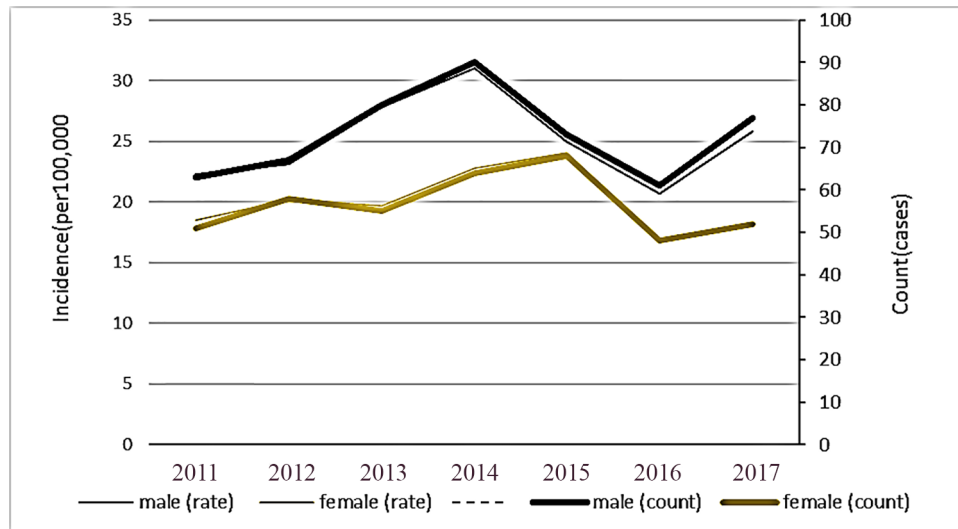


Figure 1: The trend of frequency of cases and the age-specific incidence in 100,000 brucellosis patients in Ilam province for both sexes during the years 2011-2017

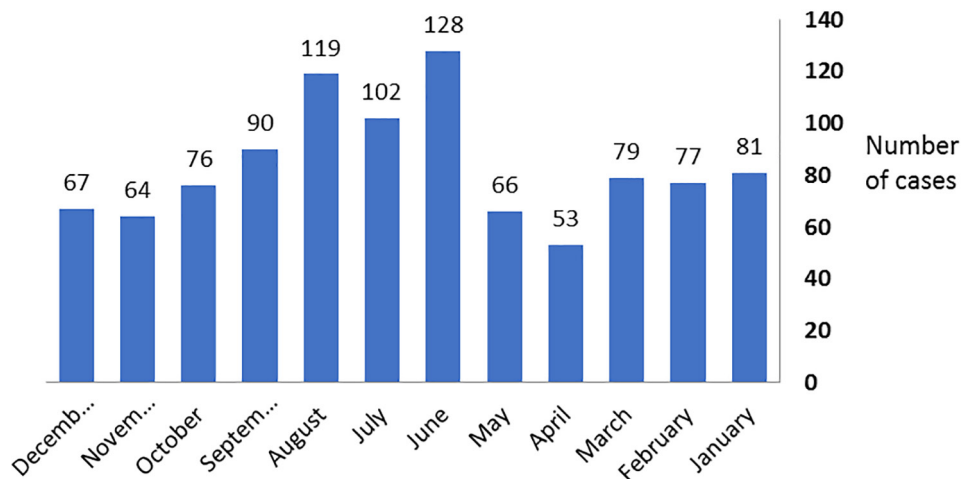


Figure 2: Distribution of brucellosis cases by month in Ilam province during the years 2011-2017

men and 18.53 per 100,000 in women), which dropped to 15.94 per 100,000 in 2018 (P for trend=0.043); 17.98 percent of men and 13.84 percent of women had the disease (P for trend=0.202 for male and $P=0.103$ for female) (Figure 1).

The highest incidence of the disease was observed in June (12.8%) with 127 cases and then in August (11.9%) with 119 case (Figure 2).

According to the season, most cases of the disease were observed in summer (31%), spring (24.7%), winter (23.6%), and autumn (20.7%), respectively. There was a statistically significant difference between the incidence of the disease and the season ($P=0.040$). In the first and second six months of the year, 55.7% and 44.3% of cases were observed, respectively, indicating that the disease was more common in the first six months of the year. The highest and lowest prevalence rates were observed in the age group of 54-45 years (19.63%) and 4-0 years (1.40%), respectively (Table 2), ($P<0.001$). The disease was more

common in the occupational groups of stockbreeders (33.5%), householders (27.9%), and children (13.5%), ($P<0.001$). Consumption of unpasteurized milk and dairy products (80%) played the most important role in the transmission of the disease. According to the 2ME serological test, most patients (54.39%) were not tested, followed by 16.36%, 12.47%, and 8.78% of patients with antibody titers of 1:80, 1:40, and 1:60, respectively. In addition, according to Wright's diagnostic test, most patients (39.42%) had antibody titers of 1:160; 25.64% and 20.65% had antibody titers of 1:320 and 1:80, respectively. 90% of the patients had a history of contact with livestock.

Discussion

Based on the results of this study, the incidence of brucellosis in 2018 was 15.94 per 100,000 people, which is equivalent to an estimated rate of 15-20 per 100,000 people in this province.¹² Of course, this rate is based on the reports of the disease to the health

Table 2: Raw and standardized incidence of brucellosis in 100,000 people in Ilam province (2018-2011)

Age-groups	2011	2012	2013	2014	2015	2016	2017	2018
Male								
0-4	4.35	8.53	8.36	8.20	4.02	7.90	3.87	0
5-14	9.63	19.05	16.48	11.64	16.11	11.38	9.01	13.37
15-24	21.44	24.39	39.87	20.41	19.96	17.28	16.47	12.92
25-34	20.09	19.55	25.39	38.67	15.08	14.72	28.75	15.44
35-44	12.61	12.20	30.73	20.63	28.92	19.45	25.21	10.22
45-54	46.44	44.33	34.69	55.41	31.91	51.15	45.97	12.66
55-64	58.93	55.88	35.41	61.88	69.86	30.85	54.24	52.10
65-74	83.75	53.29	38.23	109.90	82.05	56.35	75.97	94.18
+75	13.79	0	13.34	39.37	38.75	12.71	12.52	37
Total	22.30	23.15	27.82	31.02	24.94	20.66	25.86	17.98
ASR	24.61	25	26.98	31.88	26.50	21.61	25.47	19.13
Female								
0-4	0	4.53	0	4.36	0	0	4.14	0
5-14	0	5.06	14.98	12.32	2.43	4.80	9.48	7.02
15-24	4.71	11.76	16.25	7.81	10.62	6.98	10.31	14.42
25-34	18.28	8.13	11.15	20.28	15.28	14.98	17.63	8.65
35-44	28.14	44.56	23.98	25.57	45.13	19.72	14.91	6.21
45-54	59.48	48.47	53.89	44.11	63.33	40.48	45.35	31.16
55-64	49.32	59.69	46.28	89.81	43.60	58.27	36.06	45.13
65-74	29.47	13.34	12.19	22.46	62.43	9.69	9.07	25.57
+75	39.15	0	0	0	0	0	35.90	17.70
Total	18.53	20.20	19.70	22.77	24.02	16.84	18.12	13.84
ASR	19.48	20.76	20.29	23.26	23.40	16.16	17.35	14.41
Total								
0-4	2.24	6.59	4.31	6.34	2.07	4.07	4.00	0
5-14	4.971	12.27	15.75	11.97	9.46	8.18	9.24	10.27
15-24	13.18	18.18	28.30	14.27	15.43	12.32	13.53	13.63
25-34	19.18	13.84	18.28	29.51	15.18	14.85	23.25	12.09
35-44	20.32	28.26	27.38	23.08	36.97	19.58	20.10	8.23
45-54	52.94	46.40	44.30	49.75	47.68	45.78	45.66	21.98
55-64	53.98	57.82	40.90	75.86	56.82	44.36	45.35	48.71
65-74	57.34	33.33	24.92	64.35	71.66	31.26	39.53	56.38
+75	24.27	0	7.83	23.15	22.80	7.48	22.13	29.08
Total	20.44	21.70	23.82	26.96	24.49	18.78	22.06	15.94
ASR	22.07	22.94	23.71	27.58	25.06	18.86	21.27	16.66

centers of the province, and there are probably cases that have not been reported, as WHO has announced that only one in five patients with brucellosis has been diagnosed.⁶ The average incidence rate in the study of Karimi et al. conducted in Abadeh in 2011 to 2017 was 128.78 per 100,000 people;¹⁰ also, in a study in Arak, 60 cases per 100,000 people were reported.⁵ According to the report of the Ministry of Health in 2009, Ilam was classified as a province with a moderate incidence, while Markazi province was classified as a province with a high incidence of brucellosis.⁵ This difference can be due to different prevalence and occurrence rates in the two provinces, which in itself can be rooted in lifestyle differences. Also, in this study, although the incidence of the disease from 2011 to 2018 (20.44 to 15.94 per 100,000 people) showed a decreasing trend, this trend was statistically significant (P for trend=0.043). However, it is still classified as moderately polluted provinces.¹² This declining trend may be attributed to the improvement of the effectiveness of health system measures and other involved groups such as veterinary; the promotion of

public awareness about the ways of transmission and prevention of this disease has played a significant role in the declining trend.

The results showed that the highest prevalence of the disease was in the age range of 54-45 years. Ebrahimpour et al. in their study reported that the incidence among 56.6% of patients was in the age range of 10-50 years;⁹ also, the study of Akhvediani et al. in Georgia showed that the highest incidence of patients were in the age range of 10-50 years.¹³ In the study of Kasiri et al. in Azna, the highest incidence rate was observed in the age group of 15-24 years.¹¹ However, similar studies^{11,14} have reported the highest incidence of the disease in the lower age range, but, due to the prevalence of the disease in rural areas and the fact that middle-aged people in rural areas are more likely to be engaged in animal husbandry, especially in traditional forms, it seems that in the studied areas, where traditional animal husbandry is prevalent, the reported age is reasonable. In this study,

the mean age of the patients was 39.94 ± 17.81 years. In a study by Karimi et al. in Abadeh, the mean age of the patients was 32 years.¹⁰ Haddadi in Tehran reported this mean age equal to 35.5 years,¹⁵ and Busilovsky et al. reported it equal to 34.5 years.¹⁶ This shows that in our study, the reported patients had a higher mean age than similar studies. Overall, brucellosis often affects people (under the age of 50) who are the breadwinners of families and active working capital in a country.

The results of this study showed that regarding the gender, the rate of infection among men was higher than women, and these cases were reported more in the rural areas than in other areas. The results of a study by Hamzavi et al. in Kermanshah also showed that the rate of infection in men was 52.8%.¹⁷ Ayatollah et al. in their study reported that 53.9% of the patients were men.¹⁸ A study by Dono et al. in 2010 showed that infection in men accounted for 66.2% of cases.¹⁹ Also, Akhvlediani et al. in Georgia reported that the highest incidence of the disease occurred among men.¹³ However, the results of the study carried out by Zeinali et al.,²⁰ as well as that of Alavi et al. on nomads in Khuzestan province showed that women were more affected by this disease than men.²¹ This may be attributed to the living conditions of the nomads; also, the fact that many of these livestock-related activities are the responsibility of women may be the important reason for this difference. In general, it can be concluded from the results of these studies that the rate of infection in men is higher than in women, which may be due to more contact between men and animals and the responsibility of animal husbandry. In general, it should be mentioned that the prevalence of females or males can depend on the culture of the region in keeping livestock because, in some parts of the country, women are often responsible for livestock activities in traditional livestock, but in other places it can be reversed.

Most cases of the disease occur in the summer and in June; generally, the incidence of the disease in the first half of the year was more than the second half of the year. The study of Ayatollah et al. in Yazd showed that most cases of infection were reported in summer (34.3%) and subsequently in spring (29.7%).¹⁸ Ismail Nasab et al. also reported the highest incidence of the disease in May, June and July.²² Also, the results of the study of Hamzavi et al. in Kermanshah showed that most cases of the disease were reported in the first months of the year.¹⁷ In a review study in Pakistan, Gul et al. reported that most cases of the disease occurred during the summer.²³ In general, the results seem reasonable considering the fact that the delivery and abortion in animals occur mostly in the first months of the year and the disease is transmitted through milk or contact with calving secretions.

The results showed that the highest prevalence was

in the occupational groups of stockbreeders (33.5%) followed by householders (27.9%). In the study of Hosseini et al. in Quchan,¹ and Sheikh in Qazvin, the largest occupational group of patients were stockbreeders and then householders.²⁴ Akhvlediani et al. in Georgia reported that most cases of the disease (29%) occurred in Shepherd.¹³ On the other hand, the results showed that 90% of the patients reported no history of contact with livestock. In the study of Karimi et al. in Abadeh, the contact history was 33.4%.¹⁰ It should be noted that the job-based contact of people working in animal husbandry, i.e. contact with birth secretions, etc., may be the reason for the high prevalence in this job category, especially in areas where animal husbandry is performed in the traditional way. Also, in this method of animal husbandry, women householders also accompany and cooperate in cleaning the cage, milking, etc., which may be one of the reasons for the high incidence of these people followed by stockbreeders.

Our study showed that consuming unpasteurized milk and dairy products (80%) was the most important way of transmitting the disease. This finding has been confirmed in the study of Hamzavi et al.,¹⁷ the study of Kasiri et al. in Azna,¹¹ and other similar studies.^{19,25} In a study in Turkey, non-sterile dairy consumption was reported as the main cause of disease transmission in 63.6% of people;²⁶ also, in an overview, Yumuk et al. in Turkey also reported unpasteurized milk as the most important cause of disease transmission.²⁷ However, in the study of Ebrahimi et al.,⁹ non-pasteurized cheese and milk, and in the study of Karimi et al.¹⁰ unpasteurized cheese had the highest frequency in the transmission of the disease. However, in most studies, the most common way of transmitting the disease has been reported to be contaminated milk, which is in consistent with the results of our study.

The results of this study also showed that the highest rate of 2ME serological test reported among patients was 1:80 (16.36%) and then 1:40 (12.47%). In addition, according to the Wright's diagnostic test, most patients (39.42%) had an antibody titration of 1:160.

Strengths

This study examined the course of brucellosis over a period of 6 years to provide useful information for future planning. Also, the cases studied in this research were a significant population living in a province in Iran and can provide a useful information base for future intervention studies.

Limitations

This is a cross-sectional study and cannot determine a known causal relationship between variables. The information of these studies was

collected through the patients' records in health centers, so the researcher did not monitor the quality and quantity of this information.

Suggestion

It is suggested that interventional studies should be designed and implemented in terms of lifestyle, and the best ways to provide information for people involved with livestock and especially the patients' families.

Conclusion

The results of age standardization on the prevalence of brucellosis, although fluctuating, show an increasing trend in the incidence of brucellosis, especially in men. Overall, the epidemiological trend of brucellosis showed that brucellosis still needs to improve health care, health awareness, and cross-sectoral coordination to reduce its incidence and prevalence, especially in areas with traditional animal husbandry.

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Conflicts of interest: None declared.

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