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Epidemiological study of brucellosis (Malta fever) in the city of Torbat Jam from 2017 to 2022

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Abstract

Introduction: Brucellosis, a globally prevalent disease, affects both humans and animals, with notable significance in Iran. While the severity and mortality of this disease are rare, it poses a substantial economic burden due to reduced productivity and livestock abortion. Torbat Jam city has a high prevalence of brucellosis in the region, necessitating an investigation into its epidemiological aspects.
Objectives: The present study aimed to investigate the epidemiology of brucellosis in Torbat Jam city.
Materials and Methods: This study examined 5366 cases of brucellosis in the city of Torbat Jam from 2017 to 2022. A comprehensive checklist encompassing variables, such as age, gender, place of residence, occupation, season, history of contact with infected animals, consumption of unpasteurized dairy products, and vaccination history was used for data collection. The t-test was used to compare the means of two groups, while the chi-square test was employed to assess the relationship between categorical variables and grouped numerical variables. A significance level of 0.05 was considered in this study.
Results: A total of 5366 cases of Malta fever were analyzed in this study, with male patients comprising 50.40% and female patients accounting for 49.60% of the cases. The mean age of the patients during the study period was 33.18±18.81 years. Brucellosis onset occurred at an average age of 35.39±18.03 years in males and 30.96±19.01 years in females, with a statistically significant difference (*P* value <0.01). The youngest reported case of brucellosis was 1 year old, while the oldest was 101 years old. The highest disease occurrence (60.8%) was observed in the age group of 15-50 years, with a higher prevalence observed in both genders within this age group.
Conclusion: The city of Torbat Jam is considered a high-risk area in terms of brucellosis prevalence. Factors such as rural living, contact with animals and consumption of unpasteurized dairy products significantly contribute to the disease's spread in these regions. The results underscore the insufficient public awareness regarding brucellosis transmission and prevention, highlighting the urgent need for educational programs to enhance knowledge and awareness among individuals in these areas.

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Introduction

Brucellosis, commonly known as Malta fever, is a common zoonotic disease affecting both humans and animals. Malta fever is recognized as one of the most significant and well-known zoonoses worldwide, particularly in Iran (1). Clinical manifestations of brucellosis are nonspecific and resemble other febrile illnesses (1). Symptoms include fever, chills, sweating, body and muscle aches, joint pain, back pain, as well as gastrointestinal, respiratory, urinary-reproductive, cardiovascular, and nervous system involvement, along with depression (2). According to the World Health Organization, approximately 500 000 cases of human brucellosis are reported annually, with an incidence rate ranging from 4% to 10% even in developed countries (3).

Key point

The study found that the city of Torbat Jam has a high prevalence of brucellosis, with rural living, contact with animals, and consumption of unpasteurized dairy products contributing to the disease's spread. The results highlight the need for educational programs to enhance public awareness and knowledge about brucellosis transmission and prevention in high-risk areas.

However, the prevalence of brucellosis varies globally. For instance, some regions such as North America, Canada, and Australia exhibit a low incidence of less than 2 cases per 100 000 population, whereas areas in the Mediterranean and the Middle East report a prevalence between 1 and 78 cases per 100 000 population (4). Despite having an extensive healthcare system, Iran remains an endemic region for brucellosis,

ranking fourth in terms of incidence. The distribution of brucellosis across different regions in Iran is not uniform, as evidenced by research conducted between 1991 and 2008, which reported an average annual incidence rate of 43 cases per 100 000 population (5). Khorasan Razavi province, due to its favorable climatic conditions for livestock rearing and the use of traditional breeding methods, experiences a high prevalence of brucellosis within Iran (6). Studies in Khorasan Razavi conducted from 2009 to 2013 indicated an average incidence rate of 26 cases per 100 000 population(7).

Although fatalities caused by brucellosis are rare, the disease poses a considerable economic burden on affected countries. It leads to decreased productivity, livestock abortion, and significant economic and public health implications worldwide. Human transmission primarily occurs through the consumption of contaminated raw dairy products, meat, and related products, direct contact with infected animal tissues and blood, and skin abrasions (8). Given that a significant proportion of the Iranian population engages in agriculture, livestock farming, and related occupations involving close contact with animals, brucellosis has a high prevalence (9). Effective measures for preventing human brucellosis include animal vaccination, improving animal housing conditions, providing veterinary care, and educating high-risk individuals. Additional strategies encompass minimizing contact with infected animals, avoiding consumption of unpasteurized dairy products, early diagnosis, and timely treatment (10).

Before implementing any control programs, it is crucial to gather information on the prevalence of brucellosis both in animals and, if possible, in the human population. One approach involves investigating the potential correlation between age, gender, and occupation, place of residence, season, and consumption of dairy products, history of animal contact, and the occurrence of brucellosis. It is important to note that while occupational exposure to infected animals is considered a risk factor, non-occupational acquisition of the disease is associated with the consumption of unpasteurized dairy products. Considering the economic burden of the disease, lack of public awareness (especially in rural areas), and other related factors, priority must be given to tackling brucellosis in different regions (11). The prevalence of brucellosis varies across different regions due to climatic conditions, livestock species, animal hygiene, access to pasteurized products, and diagnostic tests employed. In diagnosing brucellosis, a comprehensive evaluation of epidemiological, clinical, and laboratory information is crucial. Exchange of information between the health and veterinary sectors can facilitate a better understanding of the disease's incidence, epidemiological characteristics, and successful prevention and control strategies (12).

Iran, in general, experiences a high incidence of brucellosis within the Eastern Mediterranean region. Given the elevated prevalence in Northern provinces, including Khorasan Razavi province and specifically Torbat Jam city, these areas are of particular importance in disease control and prevention efforts (7).

Objectives

The present study aimed to investigate the epidemiology of brucellosis in Torbat Jam city.

Materials and Methods

Study design

In this descriptive-analytical study, information related to patients with brucellosis in health centers and private clinics in the city of Torbat Jam during the years 2017-2022 was investigated. Data collection was conducted using a 7-item checklist, including age, gender, place of residence, occupation, season, history of contact with infected animals, consumption of unpasteurized dairy products, and vaccination history. The inclusion criteria for patient enrollment were individuals who presented with symptoms of the disease, had positive serological tests (Wright test >1:80 and 2-Mercaptoethanol test >1:40), and were diagnosed and treated for Malta fever by a physician.

Statistical analysis

The date pertaining to 5366 cases of brucellosis in this city was analyzed using the R software over a period of 6 years. The study used the Kolmogorov-Smirnov test to assess the normality of the data, conducted t-tests to compare the means of two groups, and utilized the chi-square test to examine the association between categorical variables and grouped quantitative variables. A significance level of 0.05 was considered in this study.

Results

A total of 5366 cases of brucellosis were included in this study, with 2705 (50.40%) cases among males and 2661 (49.60%) cases among females. The average age of the patients during the study years was 33.18 ± 18.81 years. The average age of onset of brucellosis was 35.39 ± 18.03 years in males and 30.96 ± 19.01 years in females, and this difference was statistically significant ($P < 0.01$). The youngest reported age of onset among all patients studied was 1 year, and the oldest was 101 years. The highest incidence of brucellosis cases, 60.80% (3,265), was observed in the age group of 15-50 years, with higher prevalence in both genders in this age group (Table 1).

Amongst the study years, the lowest occurrence of brucellosis cases was reported in the year 2022 (8%), while the highest occurrence was reported in the year 2021 (27%). The number of cases showed an increasing trend from 2017 to 2022, with a decrease in cases in 2022 (Figure 1). Based on the results of this study, 88% of brucellosis cases were reported in rural areas, and 12% in urban areas (Figure 2). The average annual incidence of the disease in the county is 328 per 100 000 individuals, with the highest

Table 1. The frequency of brucellosis disease by age and gender groups in Torbat Jam city during the years 2017-2022

Age (y)	Male		Female		Total		Gender ratio
	No.	%	No.	%	No.	%	
<15	647	23.9	442	16.6	1089	20.3	1.47
15-50	1597	59	1668	62.7	3265	60.8	0.96
>50	461	17.1	551	20.7	1012	18.9	0.84
Total	2705	100	2661	100	5366	100.0	1.02

incidence of 527 per 100 000 individuals in the year 2021 and the lowest incidence of 170 per 100 000 individuals in the year 2022.

Regarding the occurrence of brucellosis cases in different occupations, the highest incidence occurred in the following order: housewives (32%), livestock farmers (21%), students (12%), farmers (11%), and the lowest incidence was reported in military personnel. The trend of disease occurrence by different months of the year shows that the highest number of brucellosis cases was reported in the early months of April, May, June, and July, while the lowest number of cases was reported from March to February (Figure 3). According to the results of this study, 75% of the cases had a history of consuming unpasteurized dairy products, indicating a lack of sufficient awareness and attention to hygiene standards in relation to disease transmission routes in this region. The results also show that 20% (1086) of the patients surveyed had a history of vaccination, 44% (2336) had no vaccination history, and 36% (1946) had unknown vaccination history. In terms of treatment, 90% (4822) of the patients surveyed had successful treatment, while 10% (544) experienced treatment failure. No deaths related to brucellosis were reported among the patients studied.

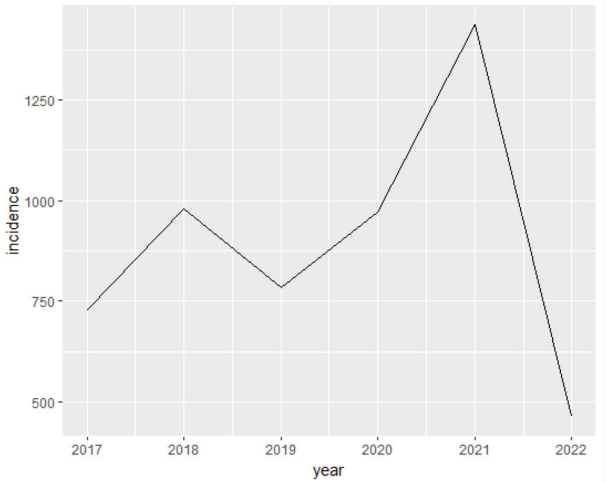

Figure 1. The trend of brucellosis occurrence in Torbat Jam county during the years 2017-2022.

Discussion

Based on the published statistics, the annual incidence of Brucellosis in the city was 328 cases per hundred thousand people, which is significantly higher compared to the national incidence of 43.24 cases per hundred thousand people (13). However, efforts have been made to identify and report the cases accurately through the surveillance system established in the city, providing a more precise understanding of the disease burden in the population. In the current study, the highest incidence rate was in 2021 with 572 per hundred thousand people and the lowest incidence rate was in 2022 with 328 per hundred thousand people (14).

From 2017 to 2021, there was an increasing trend in the number of reported cases, followed by a decrease in 2022. However, the overall number of cases in the population

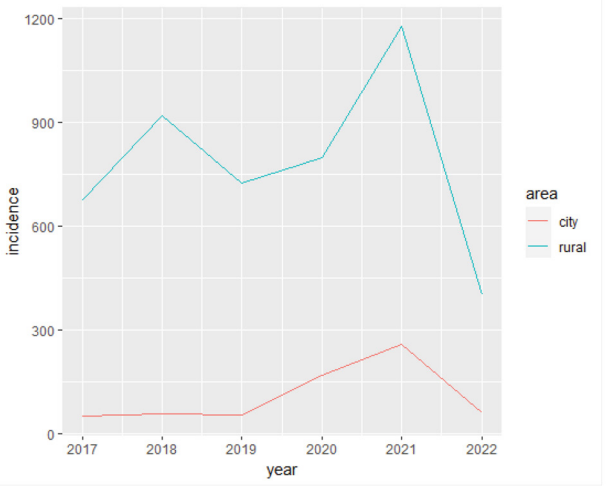

Figure 2. Comparison of brucellosis occurrence trend in urban and rural areas of Torbat Jam County during the years 2017-2022.

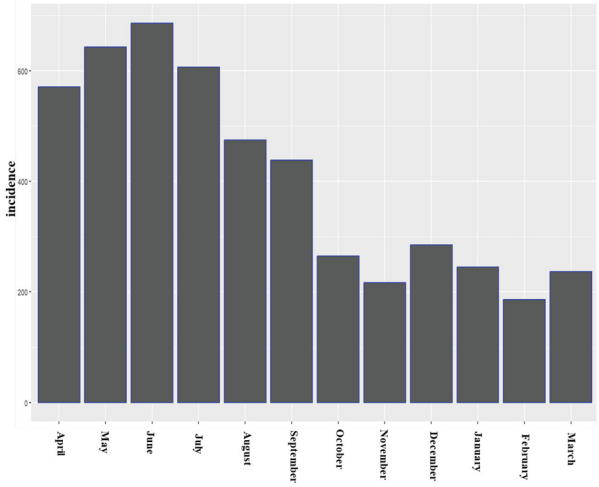

Figure 3. Frequency of brucellosis in Torbat Jam county, disaggregated by month, during the years 2017-2022.

of Torbat Jam city remains high. In studies conducted in Khorasan Razavi province, the highest incidence rate was reported in 2013 with 42.26 cases per hundred thousand people, and the lowest incidence rate was recorded in 2009 with 20.72 cases per hundred thousand people. The highest incidence rates in 2009 were reported in Kalat city, in the years 2010-2011 in Bajestan city, in the years 2012-2014 in Khoshab city, and in the years 2015-2016 in Zaveh city (7). According to a study by Bagheri et al, Kurdistan (71.39 per 100 000), Lorestan (68.09 per 100 000), and Hamadan (56.24 per 100 000) provinces had the highest incidence rates of the disease in the country (15).

The provinces with the highest incidence rates were Hamadan, Lorestan, Kurdistan, and Kermanshah. Seasonally, the highest number of cases occurred in spring, while the lowest occurred in winter (7). A systematic review conducted in 2016 showed that the highest incidence rates of brucellosis were in spring and summer, while the lowest were in winter and autumn (16). These results suggest that increased activities in the livestock sector during these seasons contribute to the occurrence of the disease. Contrary to the findings of the present study and some other sources that reported a higher incidence of brucellosis in males compared to females, the incidence of the disease was reported to be higher in women in Iran, including nomadic areas of Khuzestan province (95.6%) and the residents of Gonabad city (17,18).

The incidence of brucellosis in Iran over the past two decades was 58% in males and 45% in females. Another study in Isfahan showed that 69.9% of patients were male and 87.7% were rural residents (18). In a meta-analysis conducted in 2021 in Iran, the prevalence of brucellosis was significantly higher in women than in men (19). Occupation-wise, studies conducted in Khorasan Razavi reported the highest incidence of the disease in housewives and livestock farmers, which is consistent with the findings of the present study (15). Another study indicated that housewives-livestock farmers had the highest incidence, while children had the lowest incidence, aligning with our results (14). This suggests that brucellosis is considered a seasonal disease. According to another study in 2021, the prevalence of brucellosis based on gender was reported as 57.9% in males and 42.1% in females. Housewives-livestock farmers had the highest incidence rate of 33.2%, which is consistent with the findings of the present study (20).

It appears that in Iran, housewives-livestock farmers, farmers, and individuals in contact with animals are considered to be the primary vulnerable groups to brucellosis. So educational programs should be planned and focused on intervention and prevention in these high-risk groups. Our study showed that the highest number of cases occurred in rural areas, with over 88% of cases reported in rural areas, which is consistent with studies conducted in Khorasan Razavi province(7). Norouzinezhad and colleagues' study reported that the cumulative percentage of brucellosis cases in rural residents was 86.4 % (11). This is not surprising considering that people in rural areas have more contact with animals due to livestock farming.

In our study, over 75% of the examined patients had a history of consuming unpasteurized dairy products, which is also supported by other studies. Moreover, Hashtarkhani and colleagues reported a history of consuming unpasteurized dairy products in more than 77.2% of cases (7). Other studies have shown that contact with contaminated animals and consumption of raw milk and unpasteurized dairy products are major risk factors for brucellosis. They also reported significantly higher rates of fetal abortion and intrauterine fetal death among pregnant women with brucellosis compared to pregnant women without brucellosis (21).

According to the results of this survey, the vaccination history of livestock in Torbat Jam county is very low (36%), indicating a lack of sustainable safety in animals. Although vaccination is likely the most cost-effective control measure, the current vaccines alone are not sufficient to eliminate brucellosis in any host species. However, livestock vaccination can play an effective role in preventing this disease. The development of safer and more effective vaccines alone, or in conjunction with advances or increased emphasis on other components of control programs, can have a significant impact on reducing the incidence and prevalence of brucellosis worldwide, and on common infections between humans and animals (22).

In treated individuals, 10% of patients experienced disease relapse, which is higher than the Shalom study in 2019 (6%) (23). Despite the fact that brucellosis is one of the oldest zoonotic diseases, it is still prevalent in many parts of the world, especially in the Middle East, including Iran. In total, the results of these studies indicate that Torbat Jam county is considered a high-risk area for brucellosis (24). Factors such as living in rural areas, contact with animals and unpasteurized dairy products, and consumption of unpasteurized dairy products are major contributing factors to the spread of the disease in these areas.

Traditional livestock production, unsafe animal slaughter, unauthorized sale and distribution of dairy products, culture of consuming unpasteurized dairy products, incomplete animal vaccination, lack of awareness about transmission routes and prevention strategies for brucellosis, and neighboring countries with a high prevalence of brucellosis are among the challenges in combating brucellosis in Torbat Jam county. Therefore, public awareness regarding transmission routes and prevention of brucellosis is insufficient, and there is an urgent need for educational programs to enhance the knowledge of individuals in these areas.

Conclusion

Educational interventions and focused prevention measures can effectively increase awareness in at-risk individuals.

Mechanization of livestock farming, in conjunction with ongoing education and serious measures to improve environmental sanitation, are useful strategies for controlling brucellosis. Precautionary measures, provided by health authorities, general education on preventing diseases when in contact with animals, education on the importance and proper hand washing techniques, wearing gloves when handling infected animals, wearing masks when cleaning the premises of infected animals, and therapeutic interventions and screening during seasons of increased disease transmission, are among the effective steps to reduce the burden of brucellosis. Epidemiological studies on brucellosis in Iranian livestock contribute to strengthening surveillance, control, and prevention approaches to combat the spread of this shared disease between humans and animals.

Limitations of the study

The study findings may have limited generalizability to broader populations or geographic regions, particularly if the unique characteristics of the Torbat Jam population do not accurately reflect those of other areas.

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Authors' contribution

Conceptualization: Noureddin Niknam.
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Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

The research conducted in this study adhered to the principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Torbat Jam University of Medical Sciences (Ethical code #IR.TRJUMS.REC.1401.002). No intervention was conducted in this study. Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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