Original Article

# Seroprevalence of Brucellosis and Risk Factors Related to High Risk Occupational Groups in Kazeroon, South of Iran

S Beheshti,[1] GR Rezaian,[1] F Azad,[1] Z Faghiri,[1] F Taheri[2]

[1]Shiraz University of Medical Sciences, Shiraz, Iran

[2]School of Veterinary Medicine, Shiraz University

## Abstract

Background: Brucellosis is a major zoonosis worldwide. Many people for their professions are at higher risk of contracting the disease.

Objective: To determine the seroprevalence of brucellosis and its risk factors in a group of high risk professions.

Methods: In a cross-sectional study, all personnel or students of veterinary schools, slaughters and butchers working in the city were invited to participate (n=141). A comparison group (n=44) randomly selected from patients who were selected at random from people attended our healthcare center for reasons other than the infectious diseases.

Results: 4 veterinarians, 15 veterinary assistants, 42 veterinarian students, 52 butchers, 17 slaughters, 8 slaughterhouse workers and 3 chefs made the first group and 14 storekeepers, 5 students of engineering, 11 clerks, 13 freelance workers, and 1 high school student made the comparison group. While the rate of consumption of most of the studied dairy products was almost similar in both groups, comparison group patients consumed more often milk ($p<0.001$) and cream ($p<0.001$) than the high risk group. 11 (7.8%; 95% CI: 3.4%–12.2%) cases from high risk group and none of the comparison group were found seropositive for *Brucella*.

Conclusion: Profession is the main factor in seropositivity. Consumption of dairy products and raw milk is not associated with a higher risk of seropositivity.

Keywords: Brucellosis; Occupations; Zoonoses; Seroepidemiologic studies; Prevalence

## Introduction

Brucellosis is one of the important zoonotic diseases worldwide.[1,2] In 1861, Martson named the disease "Mediterranean gastric remittent fever."[3] In 1887, Bruce discovered *Brucella melitensis*—a small non-motile Gram negative facultative intracellular cocco-bacilli that remains one of the main causes of infection in humans and domestic animals.[4] The endemic areas for brucellosis are sub-Saharan Africa, the Mediterranean region, the Middle East, Africa, Latin America and parts of Asia.[4,5] This infection is commonly seen in cattle, goats, buffalo, yaks, camel, horses and pigs and causes abortion and decreased milk production and in this way, is an economic burden for societies.[6] In human, brucellosis causes disability that needs long-term treatment

Correspondence to Shohreh Beheshti, MD, Shiraz University of Medical Sciences, Shiraz, Iran
E-mail: beheshts@sums.ac.ir

with multiple antibiotics, and leaves permanent sequelae, loss of work hours and medical expenses.

For human, *B. abortus*, *B. melitensis* and *B. suis* are pathogens. Raw milk and dairy products made from unpasteurized milk such as soft cheese, cream and ice cream may have high numbers of bacteria. Use of these products is believed to be a main cause of brucellosis in man.[7] The disease may be contracted through abrasions of the skin, inhalation of infectious aerosols or direct contact with the conjunctiva. These routes of infection are more important in veterinarians, lab technicians, butchers and farmers who have direct contact with animals and their products such as blood, meat, placenta and fetus. Man to man transmission of the disease is rare.[8-10] However, in case of transmission, the most probable route is sexual contact.

In industrialized countries, brucellosis affects human mainly as an occupational disease.[11] It usually affects middle-aged men who work with milk or domestic animal products. In developing countries, however, the story is a little bit different. In the Middle East countries, such as Iran, where people in rural areas have close contact with domestic animals, use to drink raw milk and soft cheese and where many children, both boys and girls, at different ages work as shepherd, brucellosis is endemic. Furthermore, some people believe that for prevention of infection in newborns, they should be fed with raw colostrum which is rich in micro-organisms, if the sheep is infected. So in rural areas, brucellosis is an endemic zoonotic disease in both sexes among different age groups.

In the Eastern Mediterranean region, the incidence rate of brucellosis varies widely from 8.2 (in Syria) to 132.4 (in Iran) cases per 100 000 indicating that brucellosis is the leading zoonotic disease in the region.[12,13] In all parts of Iran, human brucellosis is endemic and still remains a healthcare problem.[5]

Since there is scarce information on the epidemiology of brucellosis in Iran, particularly in those whose job put them at risk of contracting the disease, this study was conducted to determine the risk of exposure to *Brucella* in people who have direct contact with livestock as a consequence of their job. We also tried to elucidate the correlation between consumption of dairy products and seropositivity for *Brucella*.

## Materials and Methods

In a cross-sectional study, seropositivity for brucellosis was investigated in two groups of high risk individuals (Group 1: n=141) and a comparison group (Group 2: n=44) randomly selected from the city of Kazeroon, South of Iran. All personnel or students of veterinary schools, slaughters and butchers working in the city were invited to participate. The control group comprised of patients who were selected at random from people attended our healthcare center for reasons other than the infectious diseases. All the participants gave informed written consents to participate in this study. The participants were asked to complete a questionnaire consisted of questions about their demographic data, job experience and service time, dairy consumption habit, and clinical manifestations pertinent to brucellosis. A blood sample was also taken from each participant and tested for brucellosis by Rose Bengal plate test (RBT), standard tube agglutination test (SAT), and 2-mercaptoethanol (2ME) test. Seropositivity (exposure to Brucella) was considered if we had either a positive RBT or an antibody titer ≥1:40 in SAT or a titer ≥1:20 in 2ME tests. Data were coded and analyzed by SPSS for Windows. The mean of two normally-distributed variables was compared with *Student's t* test. Categorical variables were

**Table 1:** Frequency of dairy products consumption in the two studied groups.

| Dairy product | Group 1 (n=141) n (%) | Group 2 (n=44) n (%) | p |
|---|---|---|---|
| Milk | 23 (16.3) | 17 (38.6) | 0.001 |
| Cheese | 51 (36.2) | 21 (47.7) | 0.169 |
| Butter | 22 (15.6) | 4 (9.1) | 0.278 |
| Yoghurt | 133 (94.3) | 40 (90.9) | 0.421 |
| Cream | 25 (17.7) | 18 (40.9) | 0.001 |
| Ice cream | 125 (86.5) | 41 (93.2) | 0.233 |

analyzed by $\chi^2$ or *Fisher exact test* when appropriate. A p value <0.05 was considered statistically significant.

## Results

All the participants were men. The study group consisted of four veterinarians, 15

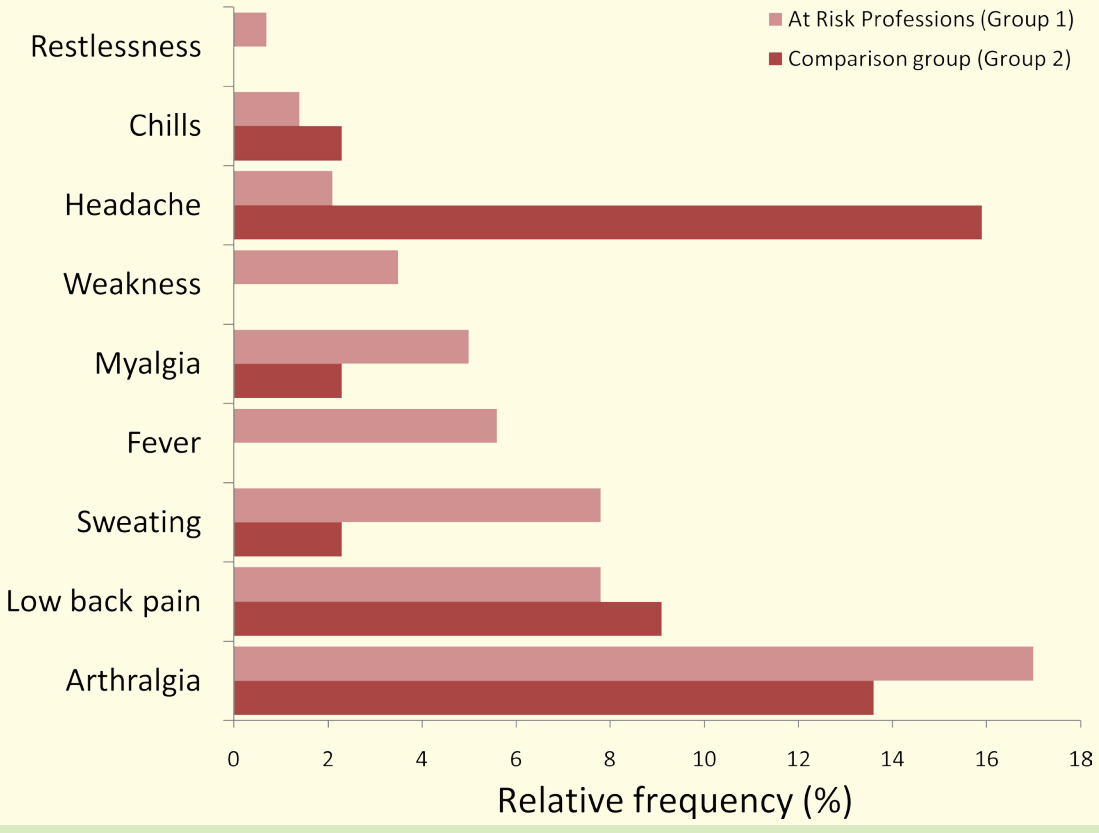


**Figure 1:** Distribution of clinical symptoms of brucellosis in the two studied groups.

veterinary assistants, 42 veterinarian students, 52 butchers, 17 slaughters, eight slaughterhouse workers and three chefs. The comparison group (Group 2) consisted of 14 storekeepers, five students of engineering, 11 clerks, 13 freelance workers (not in close contact with animals or their products; four retired), and one high school student. The mean age was 33 (range: 14–70) years in group 1 and 39 (range: 11–66) years in group 2 (p=0.0081).

The mean service time was 12 years for group 1 and 13 years for group 2. While 98 (70%) of 141 persons in group 1 have worked for 15 years or less, 27 (61%) of 44 in group 2 have done so (p=0.52).

The frequency of dairy products consumption in the two studied groups is presented in Table 1. While the rate of consumption of most of the studied dairy products was almost similar in both groups, group 2 patients consumed more often milk (p<0.001) and cream (p<0.001) than group 1.

The distribution of clinical symptoms in the two studied groups is presented in Figure 1. The prevalence of headache in group 2 was significantly (p<0.001) higher than group 1. The distribution of other

**Table 2:** Test results for the 11 seropositive cases.

| Age (yrs) | Profession | RBT* | SAT† | 2ME‡ |
|---|---|---|---|---|
| 48 | Veterinary assistant | – | 1:40 | 1:20 |
| 42 | Veterinary assistant | + | 1:80 | 1:40 |
| 38 | Veterinary assistant | – | 1:40 | – |
| 49 | Veterinary assistant | + | 1:40 | – |
| 44 | Veterinary assistant | + | 1:40 | 1:20 |
| 35 | Slaughter | + | 1:80 | 1:40 |
| 54 | Chef | + | 1:80 | 1:80 |
| 45 | Slaughter | + | 1:20 | – |
| 30 | Butcher | + | – | – |
| 35 | Veterinary assistant | + | 1:320 | 1:160 |
| 33 | Butcher | + | 1:40 | – |

*RBT: Rose Bengal plate test ; †SAT: Standard tube agglutination test; ‡2ME: 2-mercapto-ethanol test

**TAKE-HOME MESSAGE**

- Profession is the main factor in seropositivity; those jobs which put people in close contact with animals or their products are a risk for contraction of brucellosis.
- Consumption of dairy products and raw milk is not associated with a higher risk of seropositivity.
- Sweating, myalgia, and weakness are symptoms highly predictive for having a positive test result.
- Those with high risk professions should be tested for the disease as soon as they develop even mild symptoms.

symptoms was not significantly different between the two studied groups (Fig 1).

Eleven (7.8%; 95% CI: 3.4%–12.2%) cases from group 1 and no one from group 2 were found seropositive for *Brucella* (Table 2). The mean±SD age of these persons was 41.2±7.6 years which was significantly (p=0.002) higher than that of the seronegative persons in group 1 (32.3±9.1 yrs). Most of those who were found seropositive had a service time more than 15 years (p=0.003). One case had active disease who received the appropriate treatments.

Type of dairy products consumption did not have any associations with seropositivity. Sweating, myalgia, and weakness were symptoms highly predictive for seropositivity (p<0.05).

## Discussion:

We found that those like veterinarians, slaughters, and butchers whose job put them at risk of exposure to animals or animal products are more likely to be seropositive for *Brucella*. This finding is consistent with what we reported earlier.[14] Obviously, the chance of seropositivity increases by advancement of age and service time. Furthermore, we found that history of dairy consumption had no associations with seropositivity and that ironically, those who consumed more often milk and cream but had no close contact with animals, were seronegative. This is in contrast to many previous reports which mentioned that consumption of dairy products, particularly raw milk is a major risk factor and the main route of infection.[15] However, our findings are in keeping with other studies which revealed that the majority of cases with brucellosis were attributed to direct contact with animals or their products.[16,17] A recent study found an overall *Brucella* seroprevalence of 5.52% in high risk occupational groups in Tanga, Tanzania[17] which is consistent with the prevalence of 7.8% observed in our study. All these observations underline the importance of occupational exposure in seroconversion and contraction of the disease. In our study, we included many at risk professions including veterinarians, veterinary assistants, veterinarian students, butchers, slaughters, and slaughterhouse workers. We found that six of 11 seropositive cases were veterinary assistants (Table 2). However, many previous research studies overlooked some of these important at risk occupational groups. As an example, some authors did not include veterinary assistants in their studies.[18-22] Only few studies took into account this important issue.[23]

Clinically, the brucellosis can be presented as a sudden or gradual febrile disease. It may progress to a chronically debilitating illness with grave complications. It presents with nonspecific symptoms in-

cluding fever, sweating, lethargy, malaise, headache, low back pain, arthralgia and musculoskeletal pain.[1,4]

Because of vague clinical manifestations of the disease, lab diagnosis is of paramount importance. The organism is intracellular and thus, its isolation is difficult. Therefore, serological test and rapid molecular test are more appropriate. Molecular tests, however, are sophisticated and expensive, while serological tests are cheap, easy and rapid. We, therefore used a combination of serological tests—RBT, SAT, and 2ME—to find the seroprevalence of the disease.

The distribution of all symptoms but headache was similar in the two studied groups (Fig 1). Ironically, the prevalence of headache was even higher in our comparison group which might be attributed to the fact that this group was selected from patients who attended our center for reasons other than infectious problems and not the normal people. However, presence of sweating, myalgia, and weakness were highly predictive for having a positive test result. In a previous report, the most common symptoms were fever and sweating.[14] Brucellosis is usually presented with mild symptoms in those who are at high risk of exposure and in close contact with animals compared to other patients who are not exposed to the infectious agent.[16]

Although we tried to include various at risk professions in our study, one of our limitations was that the number of studied people in each category was small. Large well-controlled studies are needed to further elucidate the important health issue of at risk professions.

## References:

1. Smits HL, Kadri SM. Brucellosis in India: a deceptive infectious disease. *Indian J Med Res* 2005;**122**(5):375-84.
2. Memish ZA, Balkhy HH. Brucellosis and international travel. *J Travel Med* 2004;**11**(1):49-55.
3. Martson JA. Report on fever (Malta). *Great Britain Army Med Dept Rep* 1861;**3**:486-521.
4. Corbel MJ. Brucellosis: an overview. *Emerg Infect Dis* 1997;**3**(2):213-21.
5. Refai M. Incidence and control of brucellosis in the Near East region. *Vet Microbiol* 2002;**90**(1-4):81-110.
6. Renukaradhya GJ, Isloor S, Rajasekhar M. Epidemiology, zoonotic aspects, vaccination and control/eradication of brucellosis in India. *Vet Microbiol* 2002;**90**(1-4):183-95.
7. Bikas C, Jelastopulu E, Leotsinidis M, Kondakis X. Epidemiology of human brucellosis in a rural area of north-western Peloponnese in Greece. *Eur J Epidemiol* 2003;**18**(3):267-74.
8. Omer MK, Assefaw T, Skjerve E, Tekleghiorghis T, Woldehiwet Z. Prevalence of antibodies to Brucella spp. and risk factors related to high-risk occupational groups in Eritrea. *Epidemiol Infect* 2002;**129**(1):85-91.
9. Osoba AO, Balkhy H, Memish Z, et al. Diagnostic value of Brucella ELISA IgG and IgM in bacteremic and non-bacteremic patients with brucellosis. *J Chemother* 2001;**13 Suppl 1**:54-9.
10. Memish ZA, Mah MW. Brucellosis in laboratory workers at a Saudi Arabian hospital. *Am J Infect Control* 2001;**29**(1):48-52.
11. Kaufman AF, Martone WJ. Brucellosis. In: Last JM, ed. Public Health and Preventive Medicine. New York: Appleton Century Crofts, 1980: 419-22.
12. Abdou AE. Overview on the major bacterial zoonoses situation in the Mediterranean region. *Inf Cir WHO MZCC* 1996;**41:**2-4.
13. Meslin FX. Zoonoses in the world: current and future trend. *Inf Cir WHO MZCC* 1996;**40:**2-4.
14. Beheshti S, Rezaian GR, Aghasadeghi K, Faghiri Z, Aghajan Shakeri M. Brucellosis in Iran: the Fars province experience. *Med J IR Iran* 2001;**15**(2):67-71.
15. Hasanjani Roushan MR, Mohrez M, Smailnejad Gangi SM, Soleimani Amiri MJ, Hajiahmadi M. Epidemiological features and clinical manifestations in 469 adult patients with brucellosis in Babol, Northern Iran. *Epidemiol Infect* 2004;**132**(6):1109-14.
16. Minas M, Minas A, Gourgulianis K, Stournara A. Epidemiological and clinical aspects of human brucellosis in Central Greece. *Jpn J Infect Dis* 2007;**60**(6):362-6.

17. Swai ES, Schoonman L. Human brucellosis: seroprevalence and risk factors related to high risk occupational groups in Tanga Municipality, Tanzania. *Zoonoses Public Health* 2009;**56**(4)**:**183-7.

18. Meky FA, Hassan EA, Abd Elhafez AM, Aboul Fetouhl AM, El-Ghazali SM. Epidemiology and risk factors of brucellosis in Alexandria governorate. *East Mediterr Health J* 2007;**13**(3)**:**677-85.

19. Kassahun J, Yimer E, Geyid A, et al. Sero-prevalence of brucellosis in occupationally exposed people in Addis Ababa, Ethiopia. *Ethiop Med J* 2006;**44**(3)**:**245-52.

20. Mukhtar F, Kokab F. Brucella serology in abattoir workers. *J Ayub Med Coll Abbottabad* 2008;**20**(3)**:**57-61.

21. Yoo SJ, Choi YS, Lim HS, et al. [Seroprevalence and risk factors of brucellosis among slaughterhouse workers in Korea]. *J Prev Med Public Health* 2009;**42**(4)**:**237-42.

22. Karimi A, Alborzi A, Rasooli M, Kadivar MR, Nateghian AR. Prevalence of antibody to Brucella species in butchers, slaughterers and others. *East Mediterr Health J* 2003;**9**(1-2)**:**178-84.

23. Agasthya AS, Isloor S, Prabhudas K. Brucellosis in high risk group individuals. *Indian J Med Microbiol* 2007;**25**(1)**:**28-31.

Unlike the Gregorian calendar in which each year starts at midnight, the Iranian new year, based on Jalali calendar developed mainly by Khayyam, is based on celestial position of the earth and starts simiultaneously in all parts of the earth as it passes through the vernal equinox in March 21. Each year, Iranains celebrate this moment by gathering together, spreading a tablecloth and putting at least seven certain substances whose name in Persian starts with 'S' (above photo). They then pray and wait for the moment after which the new year as well as the Iranian Spring Festival, *Now-Rooz* (means new day) begins.