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## Serological Detection of Brucellosis in Human in Akre District

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### Abstract

*Brucellosis* is a potentially fatal pathogen that contributes to significant health problems in developing countries with inadequate standardized health control. This study investigated brucellosis in patients attending Gullan hospital in Akre district, Duhok province, Kurdistan region of Iraq during the period of March-November, 2021. Blood samples from (347) patients, (99) males, and (248) females were collected and analyzed using the Rose Bengal test. The overall percentage of *Brucellosis* infection was (16.13%) with the highest rate (37.8%) recorded for the age group 34-39 years and the lowest rates (11.25% and 11.22%) for the age groups 16-21 and 28-33 years respectively. Statistically, the distribution of *Brucellosis* among age groups was found to be insignificant ( $P=0.08$ ). Generally, more males (20.2%) than females (14.51%) were diagnosed with *Brucellosis*, however, the statistical distribution of the disease between males and females was also insignificant ( $P=0.33$ ). *Brucella* infection was more common in the spring and summer. The *Brucellosis* incidence ranged from 0.5% (September) to 27.9% (June) with ( $P=0.035$ ) which is statistically significant.

**Key words:** Brucellosis, Epidemiology, Rose Bengal test, Serological, Akre.

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### Introduction

*Brucellosis* is one of the most common zoonotic bacterial infections in the world, with relatively high mortality rates. In recent years, the annual infection rate has risen to more than 500,000. Such a large infection has a significant negative impact on human health and livestock production, and its eradication has become a major public health issue in many countries with ineffective health-care systems (Seleem et al., 2010). The first case of *Brucellosis* infection was discovered among the British army in Malta in 1887, hence the name Malta fever (Akpinar, 2016).

*Brucella* is a pathogenic bacterium that lives and multiplies within phagocytes. *Brucella* spp., particularly *B. melitensis*, *B. abortus*, and *B. suis*, have been identified as pathogenic *Brucellosis* species in humans and are major public health concerns (Christopher et al., 2010). The disease spreads to humans through direct contact with infected animals, as well as indirectly through polluted environments or the consumption of raw animal products. All domestic animals, with the exception of cats, can become infected with the bacteria, increasing the likelihood of transmission to humans. However, it is most common among veterinarians, farmers, and slaughterhouse workers as an occupational disease (Palmer et al., 2011).

The clinical signs of the disease vary from patient to patient and can range from asymptomatic illness to severe conditions. The most common symptoms of *Brucellosis* in humans are persistent fever, headache, insomnia, general malaise, arthritis, constipation, and sexual impotence, as well as nervousness and depression ([Khan and Zahoor, 2018](#); [Megid et al., 2010](#)).

In animals, the most common sign is abortion, followed by low milk yield and high temperature ([Khan and Zahoor, 2018](#)). Other common signs in female animals include low fertility, vaginal secretions, and neonatal death. Males are more likely to experience epididymitis, orchitis, unilateral or bilateral testicular atrophy, sperm abnormalities, and infertility. Splenomegaly, lymphadenopathy, and hepatopathy ([Megid et al., 2010](#)).

The disease has nearly been eradicated in developed countries such as the United States, Europe, and Australia. In the United States, for example, the number of infections has been reduced to less than 100-200 cases per year ([Pappas et al., 2006](#)). The recorded rate in EU countries was 0.9 per 100,000 populations ([Facciola et al., 2018](#)). In Australia, the overall incidence rate ranges from 0.2 to 1.6 cases per 100,000 population, or approximately 20 infections per year ([Ip et al., 2019](#)).

Bacterial infection rates are highest in developing countries, with rates as high as 100 cases per 100,000 people in Middle Eastern countries such as Iraq, Jordan, and Saudi Arabia. In Central Asian countries such as Kyrgyzstan and Azerbaijan nearly identical figures have been presented ([Rubach et al., 2013](#)).

Human *Brucellosis* incidence in the Kurdistan area of Iraq ranges from moderate to high, with Sulaimaniya having the highest rate (976 cases per 100,000 population), followed by Erbil (71 cases per 100,000 population), and Duhok (40 per 100,000 population) having the lowest recorded prevalence ([Mohammed, 2015](#)).

The Akre District, Duhok Province, has one of the largest ruminant livestock populations, including cattle, sheep, and goats (182,000 sheep, 134,000 goats, and 23,000 cattle). This sector is critical for sustaining the district's food security and providing a significant income for residents. Ruminant livestock, which has a population of 212,000, is a valuable source of milk, meat, and fur production, as well as a relatively high income and job security for farmers. However, because the region lacks veterinary infrastructure, intracellular pathogens such as *Brucella* continue to threaten animal productivity and public health. ([Directorate of Duhok Veterinary, 2020](#)).

In a study conducted in 2017, 54.1 % of the animals (goats and sheep in Akre) were found to be *Brucellosis* seropositive ([Alhamada et al., 2017](#)). Such a high number of infections among animals in the region is concerning, and further research into infection rates among humans is necessary. We conducted our research from March to November 2021, during the region's birthing and milking season, when farmers have close contact with their animals. To our knowledge, no such studies have been carried out in the region.

## Materials and Methods

This study was conducted to find out the *Brucellosis* rates among patients who visited Gullan Teaching Hospitals, in Akre district, Duhok, Kurdistan region of Iraq. The study was done during the period March – November 2021, in the animal birthing and milking season in the region as the farmers have close contact with their animals and residents consume the local animal products such as milk, yogurt, and cheese.

Blood samples from 347 patients having signs and symptoms of *Brucellosis* were collected. Then the samples were categorized based on the age, gender and visiting date of the patients. Five milliliters of venous blood were withdrawn from each patient using a sterile disposable syringe, and then samples were transferred to the Gullan Teaching Hospitals laboratory for the Rose-Bengal test using plate test kits from Biolabo Company.

Differences between the seroprevalence of *Brucellosis* according to age, gender, and monthly incidence rates was calculated using R-statistics software version 4.2. In all analyses, the confidence level was set at 95% and a P-value < 0.05 was considered significant.

## Results and Discussion

Blood samples were collected from 347 patients who attended Gulan hospital in Arke District, Duhok Province, and were suspected of having Brucellosis infection over the course of nine months (March-November). The Rose Bengal test results showed that the overall seropositivity of human brucellosis in patients was (16.3%) as shown in table 1. Regarding the neighboring regions, this infection rate is slightly higher than that recorded for patients who attended Rizgary Teaching Hospital in Erbil (10.7%) ([Rasul and Mansoor, 2012](#)), this might be due to the fact that people who are living in the countryside are mostly farmers and have close contact with the infected animals. Our findings are very close to the ones recorded for the patients from Azadi general hospital (17.8%), in Duhok center, where people from the city center and the countryside attend the mentioned hospital ([Assafi et al., 2019](#)). While our results are significantly lower than those recorded for Mosul city (29.9%) during the same period of the study. This could be due to the city's difficult post-war conditions and the lack of health measures for controlling the transmission of the disease from infected animals to the humans ([Daood et al., 2020](#)).

Table 1: Seropositivity of human brucellosis according to age group.

Age groups (Years)	No. of samples	No. of Positive (%)
16-21	80	9 (11.25)
22-27	87	14 (16.1)
28-33	98	11 (11.22)
34-39	45	17 (37.8)
40-45	37	5 (13.5)
Total	347	56 (16.13)

In other parts of Iraq, other than the Kurdistan region, For example, a very high rate of *Brucellosis* infection was recorded in Baghdad in 2015, in a study conducted by ([Al-Bayaa et al., 2017](#)), 71% of Baghdad's population was found to be *Brucellosis* positive in 2015. While in other parts of the country substantially lower rates were seen during the same period of study. Compared to neighboring countries, comparable *Brucellosis* rates were found in Saudi Arabia at 12.5% ([Aloufi et al., 2016](#)), considerably lower rates at 6% in Turkey ([Gül et al., 2014](#)), and much higher rates of 53% in Syria ([Alsayed and Monem, 2012](#)) and Iran 34.39% ([Pakzad R, Barati M, Moludi J, Barati H, Pakzad, 2016](#)).

The age has been considered as one of the major risk factors for distribution among humans. The *Brucellosis* prevalence among age groups (Table 1) ranged from 11.22% for the age group 28-33 years old to 37.8% for the age group 34-39 years old. Those findings agree with the ones obtained for Mosul city ([Daood et al., 2020](#)). In the Duhok center, patients between the ages of 21 and 30 had a higher incidence rate ([Assafi et al., 2019](#)). Also, in Erbil, the age group 21-30 years was found to be the most highly infected at 31.25% ([Rasul and Mansoor, 2012](#)). This may be because young people in urban areas become infected through the consumption of animal products, whereas in rural areas like Akre District, the infection is primarily brought on by farmers' close contact with their animals and the fact that people in the age range of 34 to 39 spend the majority of their time on farms. The distribution of *Brucellosis* was determined to be insignificant statistically ( $P=0.08$ ) despite the diversity in infection throughout the age groups.

Table 2: Seropositivity of human brucellosis according to gender.

Age Group	Male		Female	
	No. of samples	No. of positive (%)	No. of samples	No. of positive (%)
16-21	19	4 (21)	61	5 (8.96)
22-27	23	2 (8.7)	64	12 (18.75)

Age Group	Male		Female	
	No. of samples	No. of positive (%)	No. of samples	No. of positive (%)
28-33	36	6 (16.66)	62	11 (17.74)
34-39	8	5 (62.5)	37	6 (16.21)
40-45	13	3 (23)	24	2 (8.33)
Total	99	20 (20.2)	248	36 (14.51)

*Brucellosis* can infect both sexes; however, in our study, more males (20.2 %) than females (14.51 %) were diagnosed with the disease (See Table 2). These findings contradict those of [\(Assafi et al., 2019\)](#) in the Duhok center and [\(Daood et al., 2020\)](#) in Mosul city but agree with those of [\(Rasul and Mansoor, 2012\)](#) in Erbil. The fact that rural men in Kurdistan have a higher infection rate than rural women is easily explained by the fact that most farmers and butchers there are men who tend the farm and their animals while women are mostly responsible for domestic duties.

Male infection rates were highest in the 34-39 year age group (62.5 %), and lowest (8.7 %) in the 22-27 year age group. Females aged 22-27 years had the highest infection rate (18.75 %), while females aged 40-45 years had the lowest rate (8.33 %).

Despite the fact that more men than women were discovered to have the disease, the difference in disease prevalence between men and women was statistically insignificant ( $P=0.33$ ).

Table 3: Monthly distribution of brucellosis.

Month	No. of Samples	Positive Cases %
March	43	11(25.5)
April	34	6(17.64)
May	55	11(20)
June	43	12(27.9)
July	31	2(6)
August	23	2(8.7)
September	18	1(0.5)
October	60	4(0.6)
November	40	7(1.7)

Table 3 shows the monthly distribution of *Brucellosis* incidence, with the highest percentage of infection occurring in June at 27.9 % and the lowest percentage occurring in September at 0.5 %. Infection with *Brucella* was more common in the spring and summer. The high prevalence of the disease during these two seasons is easily explained: spring is animal birthing season, and summer is milking season, when farmers have close contact with their animals, increasing the likelihood of disease transmission from infected animals to humans. Furthermore, during these two seasons, the market is flooded with local milk and milk derivatives such as cheese, yogurt, and so on, raising the risk of infection among consumers. Our findings are consistent with those from other parts of Iraq, including Duhok [\(Assafi et al., 2019\)](#), Baghdad, Qadissiya, and Diyala [\(Al-Bayaa et al., 2017\)](#). The disease's monthly variation was statistically significant ( $P$ -value =0.035).

## Conclusion

This study looked into the frequency of human brucellosis in the rural parts of the Arke District. The rate of Brucellosis was found to be significantly lower than that of Mosul and relatively similar to that of the neighboring areas, including the towns of Dohuk and Erbil. As men spend more time in the field tending to their animals and have more access to the bacteria from the infected

animals, the district males are reported to have a higher rate of Brucellosis than the females. The disease is observed to be more prevalent in the spring and summer months since these are the times of year when animals are born and milked in the area, and because the local market stocks more milk and milk derivatives.

Despite higher infection rates in certain age groups and a higher proportion of infected males than females, the disease's age and gender distributions were statistically insignificant. While the monthly distribution was statistically significant.

We believe that the disease is still a public health issue, and that much more collaboration between veterinary and public health authorities is needed to raise public awareness and educate animal owners on how to deal with infected animals in order to reduce infection rates.

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### Conflict of Interest

The author declares that she has no conflicts of interest to report regarding the present study.

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