



Original Article

Study of Seroprevalence of Human Brucellosis in Rural Population of North Western Rajasthan

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ABSTRACT

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Introduction: Brucellosis is a neglected bacterial zoonotic disease that has been affecting animals and humans for years.

AIM: To study seroprevalence of Human Brucellosis in rural population of North western Rajasthan.

Methodology: The study population in Bikaner district was divided into different geographical strata and then randomly sampled from three Tehsils (Nokha, Kolayat, and Dungargarh). Within these Tehsils, six villages were randomly chosen for the study: Bholasar, Bikampur, Diytara, Kakda, Panchu, and Uttamdesar.

Result: Our study found a seroprevalence of 1.21% for brucellosis, with the highest prevalence in the 41–50 age group (2.12%) and among females (1.62%). A significant association was observed with raw milk consumption (6.67%, *p=0.04*) and dairy farm activities (2.45%, p<0.05). Brucellosis prevalence was highest in individuals exposed to sheep (2.5%) and among farmers (2.5%). Socioeconomic status showed no significant correlation, though the upper lower class had the highest prevalence (1.57%).

Conclusion: This study found a brucellosis seroprevalence of 1.21% in the rural population of Bikaner, with higher rates among females and those aged 41–50 years. Significant associations were observed with raw milk consumption and dairy farm activities. Public awareness, proper milk handling, and animal vaccination are essential to control the disease's spread.

Keywords: brucellosis, milk, seroprevalance.

INTRODUCTION

Brucellosis is a neglected bacterial zoonotic disease that has been affecting animals and humans for years¹. The annual global human brucellosis case reports are about half a million². The poor surveillance systems in developing countries have led to the underestimation of the true burden of the cases of brucellosis³. Several developed countries eradicated brucellosis, but it remains endemic in northern and eastern Africa, India, Central Asia, Mexico, and central and southern America⁴. In Sub-Saharan Africa, animal brucellosis ranges from 10.2 to 25.7%⁵. This high distribution in animals makes human beings to be exposed to acquire the infection and have a potential threat of re-emergence in several countries with an increased incidence of infection in cattle⁵. In recent times, an increasing trend of human brucellosis has been reported from several studies across the globe. Brucellosis global incidence varies widely from <0.01 to >200 per 1,00,000. In India, the disease is prevalent in almost all the states with wide variation. In India, the occurrence of human brucellosis has been reported from some states with a general prevalence of 17–34%⁶ and seroprevalence of around 0.9–8.5%. In India Brucellosis has been regarded to be endemic in rural areas due to high agrarian practices and a lack of awareness about the disease in the rural population. Despite the high risk, lack of good epidemiological data in humans exists from several other states with reported high incidences of brucellosis in livestock. The northeast region of India, particularly Meghalaya, heavily depends on agriculture and livestock farming for the livelihood and economy of the state⁷. Meghalaya has a cattle population of 0.9 million which is reared mainly for milk, meat, and meat products⁸. East Khasi Hills and Ri-Bhoi districts in Meghalaya are regions where livestock farming is the most common and frequent occupation. The expansion of animal industries and the lack of hygienic measures in animal husbandry contribute to brucellosis' persistence as a public health problem in this

region. Studies in livestock from various northeastern states including Meghalaya show a high prevalence of bovine brucellosis of around 9–10%^{9,10}. Despite high livestock prevalence and associated risk factors, till date no studies have been reported on the incidence of human brucellosis in Meghalaya. Among all, Punjab reports the highest (26.6%) cases of human brucellosis. A prevalence of 0.8% in Kashmir, 0.9% in Delhi, 6.8% in Varanasi, 8.5% in Gujarat and Belgaum, 11.51% in Andhra Pradesh, 19.83% in Maharashtra¹¹. Almost 69% of the Indian population lives in rural areas (Census 2011)¹². Most of them have a close interaction with domestic animals due to their occupation, mostly farming. Hence, they have an amplified hazard of contracting several zoonotic illnesses, including brucellosis. This study focuses on the rural population because Brucellosis is a documented occupational risk infrequently detected in the most health care services. Next, brucellosis is not included as a priority communicable disease under the Integrated Disease Surveillance Program [IDSP], a public health surveillance and response system, in India¹². Very less studies have been done to assess the prevalence of brucellosis in the rural population of India. In wake of an existing pandemic caused by SARS-CoV-2 which has a zoonotic origin, it becomes imperative for clinicians to investigate the epidemiology of zoonotic diseases like Brucella in high risk region / population for appropriate preparedness and response mechanism for future epidemics¹³. Numerous serologic methods are used to diagnose brucellosis, with the serum agglutination test (SAT) being the reference technique, though labor-intensive and time-consuming. The Rose–Bengal slide agglutination test (RBT) offers a rapid and affordable alternative for screening in emergency settings. The Coombs antiglobulin test detects non-agglutinating antibodies, requiring serial dilutions to overcome prozones. Immunocapture ELISA (Brucellacapt) provides comparable results to the Coombs test by detecting IgG, IgM, and IgA antibodies. Seroprevalence studies on brucellosis commonly use SAT, ELISA kits, and the Rose Bengal plate test (RBPT) to screen affected animals.

AIM

To study seroprevalence of Human Brucellosis in rural population of North western Rajasthan.

METHODOLOGY

The study population in Bikaner district was divided into different geographical strata and then randomly sampled from three Tehsils (Nokha, Kolayat, and Dungargarh). Within these Tehsils, six villages were randomly chosen for the study: Bholasar, Bikampur, Diytara, Kakda, Panchu, and Uttamdesar. To minimize bias, each village was divided into smaller groups of houses, and participants were randomly chosen from each group using grid sampling. Out of 660 approached individuals, 462 agreed to participate in the study, and 370 consented to blood sample collection. Of these, 330 samples were sent to the laboratory for analysis, while the remaining samples were unusable due to clotting.

All participants were interviewed with a pre–designed questionnaire including age, sex, occupation, socioeconomic status (by modified Kuppuswamy scale as discussed later), dietary habits like ingestion of animal milk or milk products, ingestion of raw meat, contact with animal, type of animal and animal products, and occupation. The questionnaires were completed with the assistance of a trained person in the local language.

RESULT

Table 1 – Seroprevalence of brucellosis according to age groups

Age Groups (years)	Total Participants				p value
	Brucellosis positive (n=4)		Brucellosis Negative (n=326)		
	No.	%	No.	%	
≤20 (N = 83)	0	–	83	100	–
21 – 30 (N = 73)	1	1.40	72	98.63	0.88
31 – 40 (N= 60)	1	1.67	59	98.33	0.72
41 – 50 (N=47)	1	2.12	46	97.87	0.53
>50 (N=67)	1	1.49	66	98.50	0.81

Brucellosis was detected in participants aged 21–30 (1.40%), 31–40 (1.67%), 41–50 (2.12%), and >50 (1.49%), while no cases were found in those under 20. The highest prevalence was in the 41–50 age group (*p=0.53*), but differences across age groups were not statistically significant.

Table 2– Seroprevalence of brucellosis according to socioeconomic status (Modified Kuppuswamy Scale)

Socioeconomic Status	Total Participants		p value
	Brucellosis positive (n=4)	Brucellosis Negative (n=326)	

	No.	%	No.	%	
Upper Class (N=2)	0	0	2	100	–
Upper Middle Class (N=62)	0	0	62	100	–
Lower Middle Class (N=11)	0	0	11	100	–
Upper Lower Class (N=255)	4	1.57	251	98.43	0.92
Lower Class (N=0)	0	0	.0	0	–

Brucellosis cases were only observed in the upper lower class (1.57%, n=255), while no cases were detected in the upper, upper middle, or lower middle classes. The majority of participants across all socioeconomic groups tested negative (*p=0.92*).

Table 3– Seroprevalence of brucellosis according to type of diet

Type of Diet	Total Participants				p value
	Brucellosis positive (n=4)		Brucellosis Negative (n=326)		
	No.	%	No.	%	
Farm milk consumption (N=244)	4	1.63	240	98.36	0.23
Raw milk consumption (N=15)	1	6.67	14	93.33	0.04*
Packed Milk consumption (N=253)	2	0.8	251	99.21	0.24
Milk and Milk products consumption (N=330)	4	1.21	326	98.78	–
Raw Meat consumption (N=0)	0	0	0	0	–

Brucellosis was more common in those consuming raw milk (6.67%, *p=0.04) compared to farm milk (1.63%) and packed milk (0.8%). Overall, 1.21% of participants consuming milk and milk products tested positive, while no cases were linked to raw meat consumption.

Table 4 – Seroprevalence of brucellosis according to type of animal exposure

Type of Animal Exposure	Total Participants			
	Brucellosis positive (n=4)		Brucellosis Negative (n=326)	
	No.	%	No.	%
Animal Contact (N=325)	4	1.23	321	98.77
Cow (N=291)	4	1.37	287	98.63
Goat (N=80)	0	0	80	100
Sheep (N=80)	2	2.5	78	97.5
Camel (N=10)	0	0	10	100
Buffalo	3	1.09	271	98.91

(N=274)				
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Brucellosis was detected in 1.23% of participants with animal contact (n=325), with cases found among those exposed to cows (1.37%, n=291), sheep (2.5%, n=80), and buffalo (1.09%, n=274), while no cases were linked to goat (n=80) or camel exposure (n=10). The majority (98.77%) tested negative for brucellosis.

Table 5 – Participants distribution according to occupation

Occupation	Total Participants				p value
	Brucellosis positive (n=4)		Brucellosis Negative (n=326)		
	No.	%	No.	%	
Farmer (N=80)	2	2.5	78	97.5	0.22
Dairy Farm (N=163)	4	2.45	159	97.54	0.04
Veterinarians (N=0)	0	0	0	0	–
Others (N=87)	0	0	87	100	–

Brucellosis prevalence was 2.5% among farmers (n=80) and 2.45% in dairy farm workers (n=163, p=0.04), while no cases were detected among veterinarians (n=0) or other occupations (n=87). The majority of participants (n=326) tested negative for brucellosis.

DISCUSSION

India, a developing country, has approximately 69% of its population residing in rural areas (Census 2011), where close interaction with domestic animals increases the risk of zoonotic diseases like brucellosis. Despite the significant role of agriculture and livestock in the rural economy, the true incidence of brucellosis remains unknown. This study aims to assess the burden of brucellosis in Northwestern Rajasthan, where limited research has been conducted on its seroprevalence in asymptomatic individuals. By evaluating the prevalence and associated risk factors, we seek to provide insights into the potential public health impact of brucellosis in the region.

In our study, seroprevalence of human Brucellosis was not detected in participants under 20 years of age (n=83), while cases were observed in all other age groups. The prevalence was 1.40% in the 21–30 age group, 1.67% in the 31–40 group, 2.12% in the 41–50 group, and 1.49% in those above 50 years. The majority of participants across all age groups tested negative, with no significant association between age and brucellosis prevalence (p>0.05). Mangalgi et al¹⁴ found the seroprevalence of brucellosis to be 1.75 % in southern India. This is in accordance with our study.

In our study we found that most participants belonged in the upper lower class, with a prevalence of 1.57% (n=255), while no cases were found in the upper class (n=2), upper middle class (n=62), or lower middle class (n=11). There were no participants from the lower class. The majority of individuals across all socioeconomic groups tested negative, and no significant association was found between socioeconomic status and brucellosis prevalence (p=0.92). This may be due to the dairy farming practices and cattle rearing that are more common in lower socioeconomic class.

Brucellosis was observed in 1.63% of individuals consuming farm milk (n=244) and 0.8% of those consuming packed milk (n=253). Notably, raw milk consumption (n=15) had the highest prevalence at 6.67%, showing a significant association (p=0.04). Among participants consuming milk and milk products (n=330), 1.21% tested positive for brucellosis. No cases were reported among those consuming raw meat. Packed milk showed no significant association with brucellosis. None of the participants had raw meat consumption. This is in line with the finding observed by Ali S et al.¹⁵ where consumption of raw milk was highly associated with disease.

In our study we found that out of total participants with animal contacts, 1.23% were found to be positive for brucellosis. Out of total participants exposed to sheep, seroprevalence of brucellosis was (2.5%), followed by cow (1.3%), followed by buffalo (1.09%). Among male participants, maximum seroprevalence was noted with sheep exposure (1.25%), followed by buffalo (0.36%), followed by cow (0.34%). Among female participants, maximum seroprevalence was noted with sheep exposure (1.25%), followed by cow (1.03%), followed by buffalo (0.73%). All seropositive brucellosis were having contact with the animals, which is in time with studies done by other authors as mentioned before. In our study, those with seropositivity for brucellosis were having contact with multiple animals like cows, sheep, and buffalo. Maximum association was found with sheep (2.5%) None of them exposed to goat and camel were seropositive for brucellosis. This is in contrast to the study done by Rhodes HM et al.¹⁶ who observed brucellosis infection in travellers and immigrants from Africa related to consumption of camel milk.

In our study we found that out of total participants who were farmers by occupation, 2.5% were found to be positive for brucellosis. Significant association was found in participants indulged in dairy farm activities, around 2.45% were found to be positive for brucellosis (p value <0.05). Among male participants who were farmers by occupation, seroprevalence of brucella was 1.25% whereas those indulged in dairy farm activities, seroprevalence of brucella was 0.61%. Among female participants who were farmers by occupation, seroprevalence of brucella was 1.25% whereas those indulged in dairy farming activities, seroprevalence of brucella 1.84%. This is in line with findings of Kumar et al.¹⁷ where seroprevalence of brucellosis among farmers was 2.78%.

CONCLUSION

This study assessed the seroprevalence of brucellosis in the rural population of Bikaner district, Rajasthan, revealing a prevalence of 1.21%. The infection was more common among females (1.62%) and individuals aged 41–50 years (2.12%). Significant associations were found between brucellosis and raw milk consumption, as well as dairy farm activities ($p < 0.05$). To curb the spread of the disease, public awareness campaigns should target animal owners and farmers involved in dairy farming. Preventive measures, including proper milk handling and animal vaccination, should be promoted to control the spread of brucellosis in rural areas.

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