Research Article

An epidemiological study of brucellosis in rural area of North Karnataka

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Abstract

Background: Brucellosis is a significant important reemerging endemic zoonotic transmissible disease in India but often neglected. It still poses a noteworthy threat to human health in India, in particular, to the rural population who are principally engaged in agriculture, including animal husbandry, thus are in close contact with domestic animals.

Objective: To study the seroprevalence of brucellosis among contacts of the cases in rural area of North Karnataka.

Materials and Methods: A case contact-based epidemiological study was undertaken followed by identification of 190 close contacts at Kadoli village of Belagavi taluk and district. Serological screening test of provisionally diagnosed cases were done by Rose Bengal plate test (RBPT) and standard agglutination test (SAT); repeat SAT was done using 2-mercaptoethanal (2-ME) blocking agent. Data were expressed as percentages, and statistical analysis was done using χ^2test.

Result: Of the total 190 contacts of the cases, 90 (47.4%) of them showed signs and symptoms suggestive of brucellosis and were screened by RBPT, which showed positivity in 42.2% of them. Seroprevalence of brucellosis using SAT with titer of 160 IU/mL or above was found to be 28.8% among clinical suspects.

Conclusion: Our study demonstrated a high seroprevalence of brucellosis in the rural area, among the contacts who are often neglected or misdiagnosed. The risk of developing brucellosis was attributed to unsafe animal handling and consumption of unpasteurized milk. Apparently low incidence is an illusion, as many cases go unreported. A high level of suspicion is needed for early detection and the right treatment.

KEY WORDS: Brucellosis, rural area, epidemiological study, standard agglutination test

Introduction

Brucellosis (undulant fever, Malta fever, or Mediterranean fever) is an important but neglected, reemerging, endemic, zoonotic, communicable disease. Although brucellosis has been eradicated in many developed countries, it still poses a serious public health issue in many developing nations, and in high endemic regions such as Africa, the Mediterranean, the Middle East, parts of Asia, and Latin America.[1] It remains a grave concern to human health in India, in particular, to the rural population who are principally engaged in agriculture, including animal husbandry, thus are in close contact with domestic animals. Alarming increase in the transmission of brucellosis in rural areas owing to the high requirement for dairy products, together with modified and exaggerated farming practices and lack of awareness among the rural population, raises concern.[2,3]

Epidemiological evidence reveals that, in India, brucellosis is recorded in almost all states but the scenario differs between states and is present in different species of mammalian farm animals including cattle, goats, buffalo,

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yaks, camels, horses, and pigs.[1] Consumption of unpasteurized dairy products, contaminated food, and occupational contact are the major risks of infection to man.[4] Reports in a few countries show that contact with infected materials such as aborted fetuses, placentas, urine, manure, carcass, and salvaged animals cause human brucellosis in 60%–70% of cases.[5] In general, infection by contact is found among veterinarians, abattoir workers, farmers, animal handlers, and others who work with animals and their products.[6] The cases reported are only the "tip of an iceberg" even in endemic areas. It has been estimated that the incidence of brucellosis may be 25 times higher than the reported incidence because of misdiagnosis and underreporting.[2,7] Misdiagnosis and underreporting can happen mainly because, in many cases, patients have pyrexia of unknown origin and imitates variety of clinical entities, which makes the diagnosis tedious for an unaware physician.[5] With all such practical unresolved issues and frequent reports of suspected cases of brucellosis, we formulated an epidemiological study with a purpose to know the seroprevalence and risk factors of human brucellosis among close contacts in rural area.

Materials and Methods

This descriptive cross-sectional study was conducted between September 2013 and April 2014 at Kadoli village of Belagavi taluk and district, Karnataka, India, where predominantly the residents are involved in animal rearing and farming. Three cases of human brucellosis were reported to the Pediatric Department of the teaching hospital in August 2013. All the cases were aged younger than 15 years. Serological studies revealed a significant high titer (20480 IU/mL) by a standard agglutination test (SAT), which was diagnostic of brucellosis and further confirmed by blood culture. Therefore, occupationally exposed individuals with or without pyrexia of unknown origin (PUO) and suspected contacts of the cases were identified in the surrounding areas and included in the study using purposive sampling.

The purpose of the study was explained to the study subjects who were the permanent residents of Kadoli village, and informed consent was obtained from the participants. Data were collected by using a predesigned and structured questionnaire, which included the sociodemographic details and behavioral risk factors. This was followed by a physical examination of all the contacts by the investigators. Among the subjects who were presumptively diagnosed as brucellosis contacts, serum samples were collected after obtaining a written informed consent.

Serum samples were first screened by Rose Bengal plate test (RBPT) and further subjected to SAT for titers at Microbiology Department of teaching hospital. Cases were defined by the presence of a Brucella agglutination titer of at least 160 IU/mL or more, if the personnel had signs or symptoms compatible with brucellosis according to the recommended case definition criteria suggested by the World Health Organization (WHO).[5,8] The serum samples were further tested with 2-mercaptoethanol (2-ME) to confirm acute brucellosis infection.[9,10]

Table 1: Distribution of the study participants according to their gender and occupation ($N = 190$)

Predominant occupation	Men (%)	Women (%)	Total
Farmers	38 (36.5)	14 (16.3)	52 (27.4)
Livestock handlers (shepherds)	49 (47.2)	29 (33.7)	78 (41.0)
Household contacts	7 (6.7)	31 (36.0)	38 (20.0)
Students	10 (9.6)	12 (14.0)	22 (11.6)
Total	104 (100)	86 (100)	190 (100)

$\chi^2 = 30.109$; $df = 3$ $P < 0.00001$.

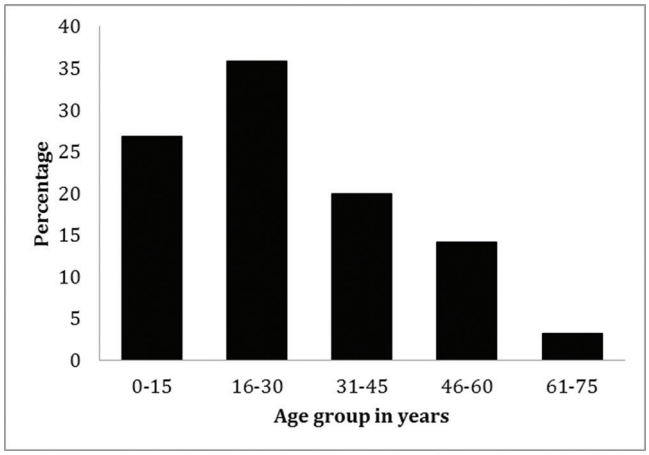

Figure 1: Distribution of study participants according to age.

Data were expressed as percentages, and statistical analysis was done using χ^2 test using Statistical Package for Social Sciences (SPSS, Inc., version 17.0). *P*-value <0.05 was considered as statistically significant.

All seropositive subjects were provided with a course of doxycycline treatment (100 mg twice daily) for 6 weeks. Serum samples of 48 goats, from all the houses of the contacts with possible exposure, were also subjected to RBPT. Health education lectures were organized to create awareness among the high-risk groups (farmers, shepherds, and animal handlers) regarding brucellosis involving the Community Medicine Department, Gram Panchayat, veterinary hospital, and Primary Health Center, Kadoli, Karnataka, India.

Result

Of the total 190 contacts of the cases, 104 (54.7%) were men and 86 (45.3%) women. The predominant occupation of the male participants was livestock handling (47.2%) and of female participants was household work (36.0%). This difference was found to be statistically significant ($P < 0.0001$) [Table 1]. The mean age of the participants was 24.57 ± 15.41 years. Majority were in the age group of 16 to 30 years (35.8%) [Figure 1]. Among the study participants, 47.4% of

Table 2: Percentage of subjects who were positive for symptoms suggestive of brucellosis (*N* = 190)

Age group (years)	Total No. of persons examined (%)	No. of persons with symptoms S/O brucellosis (%)
0–15	51 (26.8)	34 (66.6)
16–30	68 (35.8)	28 (41.2)
31–45	38 (20.0)	18 (47.3)
46–60	27 (14.2)	8 (29.6)
61–75	6 (3.2)	2 (33.3)
Total	190 (100)	90 (47.4)

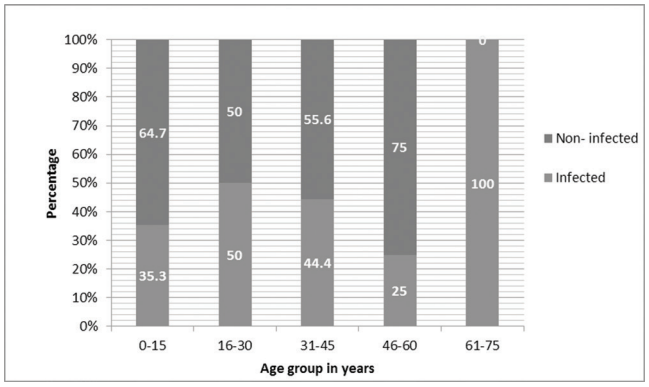

Figure 2: Percentage of people with different age group and percentage who were infected (positive for SAT ≥ 160 IU/mL).

them showed signs and symptoms suggestive of brucellosis and were presumptively diagnosed as brucellosis, of which predominantly were in the age group of 1–15 years (66.6%) [Table 2].

The serum samples of all the persons who were clinically suspected was collected and screened by RBPT, which showed positivity in 42.2% of them. The seroprevalence of brucellosis was found to be 28.8% among clinical suspects using SAT. About 15.4% of them showed positive result with 2-ME blocking agent, indicating acute infection [Table 3 and Figure 2]. The behavioral risk factors of the study participants were assessed; majority were animal handlers (42.6%), and 31.1% of them gave history of consuming unpasteurized raw milk [Table 4].

Substantial evidences revealed possibility of high prevalence of infection among the goats reared by the family and whose milk was regularly consumed by them and others in the village without any pasteurization. Among the 48 goats tested, 29.2%of goats showed the evidence of Brucella infection, which was confirmed by the Institute of Animal Health and Veterinary Biologicals, Belagavi, Karnataka, India.

Table 4: Behavioral risk factors of brucellosis among the study participants (*N* = 190)

Behavioral risk factors	No. of participants	Percentage
History of consuming raw milk	59	31.1
Unsafe animal handling practice	81	42.6
History of food contamination	38	20.0
Consumption of undercooked meat	12	6.3
Total	190	100

Discussion

In our study, a serious threat of an outbreak was identified soon after serial reporting of cases of brucellosis from Kadoli village. All the three index cases were in the age group of younger than 15 years, suggesting lower immunity toward the infection. Children can be particularly at risk as they may adopt new born or sick animals as pet.[5]

Brucellosis is endemic in the Indian subcontinent as it is reported in almost all states. The rearing of domestic cattle and unsafe animal handling practices has been suggested as an important factor in the maintenance and spread of infection.[1,11] The prevalence of human brucellosis reported in the previous studies in Andhra Pradesh and Orissa was found to be 11.5% and 6.5%, respectively.[12,13] In a similar seroprevalence study done at Ludhiana, Punjab, revealed that 24.5% of the participants were positive by RBPT, and diagnosis was established in 26.6% using SAT with a titer range between 80 and 1,280 IU/mL. This result was comparable with our study; however, this study had a lower cut off value of 80 IU/mL for establishing diagnosis. Lack of knowledge about zoonosis, contact with parturient animal, and raising animals were recorded as the major causative factors.[14] The findings were

Table 3: Percentage of contacts who were positive for serological tests for Brucella antigen (*N* = 90)

Age group (years)	No. of persons with symptoms	No. of positive for screening RBPT (%)	SAT titer ≥ 160 IU/mL (%)	No. of Positive for STAT + 2-ME (%)
0–15	34	12 (35.3)	6 (17.6)	4 (11.8)
16–30	28	14 (50.0)	12 (42.8)	2 (7.1)
31–45	18	8 (44.4)	4 (22.2)	4 (22.2)
46–60	8	2 (25.0)	2 (25.0)	2 (25.0)
61 and older	2	2 (100.0)	2 (100.0)	2 (100.0)
Total	90	38 (42.2)	26 (28.8)	14 (15.4)

found to be consistent with our study, except for the fact that the knowledge regarding the disease was not included in our study.

In a study done by Mathur et al.,[15] the seroprevalence of brucellosis among dairy personnel in contact with infected animal was 8.5%. In another study by Thakur and Thapliyal,[16] a prevalence of 4.97% in animal contacts and 17.39% among veterinarians was reported.[16] A study done in Gujarat showed SAT positivity 8.5%.[17] On the contrary, the seroprevalence noted in our study was considerably higher when compared, indicating a higher infection rate.

A study by Mantur et al. reported that, of the 5,726 study subjects, 93 children with brucellosis were identified by testing samples with seroprevalence of 1.6% by SAT (>160 IU/mL), and the diagnosis was confirmed in 43 of these pediatric patients by the isolation of *Brucella melitensis*. Majority of the pediatric patients and their family members were shepherds (41.9%), and the most probable risk factors responsible for infection were practice of consuming fresh goat milk and the close contacts with animals. The most important fact was that brucellosis was alleged on first analysis only in 15 cases; however, in the rest 78 cases, initial identifications were as enteric fever, malaria, PUO, and rheumatic arthritis.[18] Although the prevalence was very low, the positivity among pediatric cases were comparable with our study. Thus, the children are at most risk of developing Brucella infection.

Majority of the patients in our study were shepherds from rural area, and because of regular close contact with animals when taking them to the fields and unsafe handling of infected products of gestation during parturition, high seroprevalence has been reported. In the study done by Kochar et al.[19] from Northwest India reported a similar finding, with an additional information on the clinical presentation of the cases and their diet pattern, which included consumption of raw milk of cattle and goats, which is heavily infected with the organism.[19]

Similarly, Almuneef et al.[20] emphasized in their study the significance of screening household members and contacts of acute brucellosis cases in endemic areas. This is an important epidemiological step that must be taken into account by the family physicians, so that timely diagnosis and provision of therapy can result in lower morbidity. Brucellosis must be more importantly reported to health authorities, and awareness of the infection occurrence can be used to prioritize disease control policy for brucellosis and to alert health staff.[21]

Limitations

Sample size could not be calculated as there was a risk of impending outbreak; hence, the contacts were selected by purposive sampling. The serological examination of asymptomatic contacts and culture for isolation of species of Brucella for the symptomatic contacts could not be done because of operational and resource constraints.

Conclusion

Our study demonstrated a significant seroprevalence of brucellosis in the rural area of North Karnataka, among the contacts who are often neglected or misdiagnosed. The risk of developing brucellosis was attributed to poor animal handling practices and consumption of unpasteurized milk. Apparently low incidence is an illusion, as many cases go unreported. Hence, it is recommended that brucellosis must be included in public health education, particularly in the rural areas, as it imposes a dual burden on human and animal health. High index of suspicion is needed for early diagnosis and prompt treatment. Regular examination is essential to monitor the presence or absence of human/animal brucellosis and formulate strategies for intervention.

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