



Original Research Article

Assessment of practices, menaces, and perception of the rural population of Alva Village in Gujarat towards brucellosis: A cross-sectional study to strengthen the "One Health" approach

Himani Bhardwaj Pandya¹, Nidhi Mihirkumar Bhalodia¹, Binda Prakashbhai Pipaliya¹,
Saurabh Chhotalal Norris^{1*}

¹Dept. of Microbiology, Smt. B.K.Shah Medical Institute and Research Centre, Sumandeep Vidyapeeth Deemed to be University, Vadodara, Gujarat, India

Abstract

Background: In Rural communities, A close relationship between People, livestock animals, and farming activities, along with poor medical services, makes them vulnerable to zoonotic infections. The rationale behind the study was to assess the practices, Risks, and attitudes of the rural people towards zoonoses.

Materials and Methods: The community-based study was conducted for 4 months from 10th June 2024 to 15th October 2024 in Alva village, Piparia, Waghodia, Gujarat. A total of 175 residents were surveyed by a one-to-one interview in the local language using a validated structured questionnaire, focusing on demographic details, animal handling practices, consumption practices, Knowledge, and perception towards Brucellosis. Post-intervention was done by explaining the menaces of zoonotic infections through various charts, posters, and Role play.

Results: We found that only 6.3% of the residents were aware of brucellosis, but none of them knew about the transmission of brucellosis via unpasteurized milk or meat. Out of 175 residents surveyed, 148 (84.5%) reported unvarying management of animals and out of them, only 14.9% of them used gloves during the parturition. Around 45(30.4%) participants reported economic loss in cattle such as poor milk production, while a few reported 6 (4%) abortions in cattle. Of the pasteurization techniques, unexpectedly, 110 (62.9%) residents were unaware of the importance of Pasteurization. Regarding milk consumption practices, 58 Residents were using unpasteurized milk, out of them 51(87.9%) were boiling and 7 residents (12.1%) were consuming it directly. Even, Consumption of raw milk products were reported in 37 (21.1%) residents. After the death of the animal, disposal methods were very perilous as 104/148 (70.2%) residents left the remains for scavengers.

Conclusion: Despite being in close contact with animals, residents were unaware of the hazardous effects of following unsafe practices. There was a huge lacuna in knowledge, practices, and awareness of brucellosis in them. Public health interventions, including vaccination, and safe handling practices are a need of the hour.

Keywords: Awareness, Brucellosis, Gujarat, One Health, Rural Health, Zoonotic infections

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1. Introduction

Zoonotic infections are the ones transmitted to humans via either direct or indirect contact with animals or their products¹. These infections are re-emerging in our country due to a collaborative interplay between humans and animals and several factors exacerbate the chances of getting a zoonotic infection are as unsafe animal handling practices, agricultural practices, an increase in the trade of animal products, augmented traveling, poor sanitation, and

consumption of contaminated food and water.¹ Rural communities stay close to domestic animals like Cows, Buffalo, Sheep, Goat, Pigs, and goats which again increases the chances of getting infections like Anthrax, Bovine Tuberculosis, Brucellosis, rabies, etc. The most neglected and worrisome zoonotic illness is Brucellosis caused by *Brucella* species, 3 main species viz. *Brucella melitensis* (Sheep and goat), *Brucella abortus* (cattle), and *Brucella suis* (Pig) principally affect the reproductive systems of livestock, leading to problems such as abortions, infertility, and

*Corresponding author: Saurabh Chhotalal Norris
Email: himanibhardwaj2224@gmail.com

decreased productivity,² which not only has an impact on livestock but also aggravate the morbidity in humans causing symptoms ranging from undulant fever, joint pain, and muscle aches to more fatal complications such as endocarditis and neurological disorders³ The significant mode of vehicle transmission is the consumption of raw milk, other methods include direct or indirect contact with infected animals and their products, inhalation of aerosols, and consumption of unpasteurized dairy products.²

In India, the prevalence of Brucellosis varies widely, with reported rates ranging from 0.8% in Kashmir to a significant 26.66% in Ludhiana.^{4,5} In 1998, Brucellosis prevalence among livestock was reported at 1.8% across 19 out of 23 states, while in 2005, it surged to 24.3% nationwide.⁶ This significant increase underscores the urgent need for heightened awareness, enhanced surveillance, and effective control measures to reduce the disease's impact on both human and animal health. Gujarat is a key Livestock producing state, where research indicates the seroprevalence in animals as 25.64% in only buffaloes.⁷ Due to wide-ranging factors like frequent occupational exposure, poor animal husbandry practices, and very limited veterinary care in rural Gujarat, it seems to hike the prevalence of brucellosis.⁷ Rural populations, particularly farmers, animal handlers, and butchers, are especially vulnerable due to their frequent exposure to animals and a general lack of awareness about these infections⁷. To tackle zoonotic infections effectively, it is essential to understand their epidemiology, clinical manifestations, and socio-demographic risk factors. The Government of India has also promoted collaboration and communication between 3 sectors which include human health, animal health, and environmental health. This strategy will strengthen the holistic framework known as a "One Health" approach.^{8,9} The rural population needs more awareness so that if they identify the initial symptoms of disease, they can immediately approach the nearest health care and veterinary service providers. Educational intervention in the public, vaccination programs, biosecurity measures, and safe consumption practices are vital strategies to reduce the impact of zoonotic diseases in rural areas.¹⁰ This study aims to evaluate the knowledge, attitudes, and practices regarding zoonotic infections, particularly brucellosis among the residents of Alva village, Gujarat. By thoroughly understanding the risk factors and how the community views zoonotic diseases, we can create targeted public health strategies. These interventions will bolster the "One Health" approach, which aims to link human, animal, and environmental health, ultimately reducing the impact of zoonotic diseases in rural areas.¹¹

2. Materials and Methods

This prospective, cross-sectional, community-based study involved 175 residents of Alva village, located in Waghodia Taluka of Vadodara District, Gujarat. According to the 2011 Population Census, Alva is a large village with a population

of 2,066. The study was conducted over four months, from June 10, 2024, to October 15, 2024. Before initiation, ethical approval was obtained from the Institutional Ethical Committee (Approval No: SVIEC/ON/MEDI/SRP/JUNE/24/96, dated June 4, 2024). The study included all residents aged 12 to 70, as well as high-risk populations such as stock breeders, agricultural laborers, and butchers. However, infants and children under the age of 12, migrants who had resided in the village for less than six months, residents unwilling to participate, and pregnant women were excluded.

2.1. Methodology

2.1.1. Data collection

Data were gathered using a validated structured questionnaire designed to capture socio-demographic details, knowledge of zoonotic diseases, and practices related to animal husbandry. To ensure better comprehension, the questionnaire was administered in the local language through one-on-one interactions, where participants were assisted in completing the forms. Apart from asking the questions, interventions like hand hygiene, the use of gloves during handling of the placenta, the importance of Pasteurization of milk, and knowledge on zoonotic infections, vaccination, symptoms caused by brucellosis, its impact in pregnant women, etc. were explained to them with aid of posters in the local language and role play by the MBBS students.

2.2. Structured questionnaire

The data were collected using Google Forms to maintain uniformity and streamline analysis. The tool was divided into the following comprehensive sections

1. Section 1: Demographics: Recorded age, gender, occupation, and educational level of participants. Occupation categories included farmers, cattle herders, housewives, students, and employees
2. Section 2: Animal Contact: Gathered details about livestock ownership, types of animals owned, and the frequency of direct contact with animals. Tasks such as milking, cleaning pens, and assisting during childbirth were included
3. Section 3: Consumption Practices: Assessed consumption habits, including raw/unpasteurized milk and milk products (e.g., cheese and yogurt). Participants were also asked about boiling milk before consumption
4. Section 4: Knowledge of Brucellosis: Assessed participants' awareness of Brucellosis, including transmission methods (e.g., contact with infected animals, unpasteurized dairy consumption, and inhalation of aerosols). Questions also covered symptoms in humans (fever, joint pain, fatigue) and animals (abortion, infertility)
5. Section 5: Attitudes Toward Brucellosis: Evaluated participants' concerns regarding Brucellosis, their

willingness to report suspected cases, and opinions on the importance of vaccination

6. Section 6: Practices Related to Brucellosis and Animal Husbandry: Focused on practices such as assisting animals during delivery, use of gloves, placental tissue disposal, and milk pasteurization. Questions also addressed economic losses related to cattle health and milk consumption from recently calved animals

2.3. Statistical analysis

Data were analyzed using descriptive statistics, and the results were presented as frequencies and percentages. To evaluate the knowledge statement, a two-point system was used where a “yes” response was given a score of “1” and a “no” response was given a score of “0”. For practice responses, a score of “1” was given for “practiced” and “0” for “not practiced.” The attitude was measured using a five-point Likert scale with options ranging from “strongly agree” to “strongly disagree.”

3. Results

The study included 175 participants, with a variety of demographic profiles. The breakdown of participants is as follows: 40 (22.8%) were farmers, 25 (14.2%) were cattle herders, 58 (33.1%) were housewives, 35 (20%) were students, and 17 (9.7%) were employees.

3.1. Knowledge about zoonotic infections (Table 1)

Awareness of zoonotic diseases, particularly brucellosis, was notably low among the participants. Only 11 (6.3%) participants were familiar with brucellosis, while the remaining 164 (93.7%) did not know this disease. Additionally, only 10 (5.7%) participants knew that brucellosis could be prevented in animals through vaccination, with 165 (94.3%) unaware of this preventive option. None of the participants were aware that brucellosis could be transmitted by consuming unpasteurized dairy products or undercooked meat. In terms of the animals most affected by brucellosis, cows and buffaloes were identified as the primary animals by 6 and 5 participants, respectively.

3.2. Animal handling practices: (Table 2)

Out of the 175 participants, 148 (84.5%) reported regular animal handling. Among them, 79 (53.3%) had daily contact

with animals for 2 to 3 hours, 59 (39.8%) had more than 3 hours of daily contact, and 10 (6.7%) had less than 1 hour of contact. The types of livestock handled included buffaloes by 90 (60.8%), cows by 33 (22.2%), both cows and calves by 6 (4%), and both cows and buffaloes by 19 (12.8%). The livestock were held outside the home by most of the participants (88.5%) while 11.5% housed them inside. When it came to vaccination, the practices were quite concerning, as 82/148 (55.4%) residents reported vaccinating all their livestock, 28 (18.9%) vaccinating only some animals, and 38 (25.6%) did not vaccinate their livestock at all.

3.3. Milk and meat consumption practices: (Table 3)

The milk consumption practices were unexpectedly very poor, as only 117 (66.9%) residents consumed pasteurized milk, while 58 (33.1%) used unpasteurized milk. Even awareness regarding the process of pasteurization was reported by 65 (37.1%) participants, with 110 (62.9%) being unaware. 58 residents were using raw milk 51 (87.9%) boiled it before drinking, while 7 (12.1%) did not. Of those 117 residents who consumed pasteurized milk, 103 (88%) boiled it, while 14 (12%) did not. Consumption of raw milk products such as cheese and yogurt were reported in 37 (21.1%) residents, while 138 (78.9%) did not. None of the participants reported consumption of raw meat, and none worked in slaughterhouses or meat processing facilities.

3.4. Animal husbandry practices: (Table 4)

Out of 148 residents handling animals, 89 (60.1%) residents assisted the animals with deliveries, while 59 (39.9%) did not. Unexpectedly, of those who assisted in parturition or disposal of placental tissue, only 22 (14.9%) used gloves, while 126 (85.1%) residents touched it barehanded. The residents also reported economic loss, such as poor milk production in 45 (30.4%) participants, while 4 (2.7%) noted morbidity, and 6 (4%) reported recent abortions in cattle. Regarding the disposal of placental tissue or dead livestock, 24 (16.2%) participants used deep burial, 20 (13.5%) used burning, and 104 (70.2%) left the remains for scavengers. Hand hygiene protocols during the handling of animal manure were followed by 118 (79.7%) residents. They use soap and water for hand washing, while 30 (20.3%) used only plain water.

Table 1: Knowledge about zoonotic infections (Brucellosis and Bovine TB)

Knowledge about Zoonotic Infections	Yes (%)	No (%)
Aware of Brucellosis or Bovine TB	11 (6.3%)	164 (93.7%)
Aware that Brucellosis can be prevented in animals by vaccination	10 (5.7%)	165 (94.3%)
Aware of the transmission methods of Brucellosis (e.g., direct contact, consumption of unpasteurized dairy, undercooked meat)	0 (0%)	175 (100%)
Aware that Bovine TB can be transmitted from animals to humans and humans to animals	11 (6.3%)	164 (93.7%)
Animals most affected by Brucellosis: Cow and Buffalo (each)	Cow:6(3.4%)	Buffalo:5(2.9%)

Table 2: Animal handling practices (n=148/175, 84.5%)

Variable	Number (%)
Daily contact with animals	
< 1 hour	10 (6.7%)
2-3 hours	79 (53.3%)
> 3 hours	59 (39.8%)
Type of livestock handled	
Buffalo	90 (60.8%)
Cow	33 (22.2%)
Cow-Calf and Buffalo	6 (4%)
Cow and Buffalo	19 (12.8%)
Location of Herd	
Outside the house	131 (88.5%)
Inside the house	17 (11.5%)
Vaccination status in livestock	
All are vaccinated	82 (55.4%)
Partially vaccinated	28 (18.9%)
Not vaccinated	38 (25.6%)

Table 3: Practices related to milk and meat consumption

Variable	Yes (%)	No (%)
Pasteurized Milk	117 (66.9%)	-
Raw/Unpasteurized Milk	58 (33.1%)	-
Aware about Pasteurization	65 (37.1%)	110 (62.9%)
Boil the Milk Before Drinking (Raw Milk)	51 (87.9%)	7 (12.1%)
Boil the Milk Before Drinking (Pasteurized Milk)	103 (88%)	14 (12%)
Consumption of Raw Milk Products (Cheese/Yogurt)	37 (21.1%)	138 (78.9%)
Consumption of Raw Meat	0 (0%)	175 (100%)
Working in the Slaughter House or Meat Processing	0 (0%)	175 (100%)

Table 4: Practices Related to Animal Husbandry (n=148/175)

Variable	Yes (%)	No (%)
Assist animals during delivery/parturition	89 (60.1%)	59 (39.9%)
Wear gloves while assisting during childbirth	22 (14.9%)	126 (85.1%)
Economic loss in cattle		
Poor milk production	45 (30.4%)	-
Morbidity	4 (2.7%)	-
Recent abortions in cattle	6 (4%)	-
Disposal of placenta or dead livestock		
Deep Burial	24 (16.2%)	-
Burning	20 (13.5%)	-
Leave for Scavengers	104 (17.2%)	-
Wear gloves during disposal process	22 (14.8%)	126 (85.2%)
Contact with animal manure	99 (66.9%)	49 (33.1%)
Wash hands with soap and water after manure contact	118 (79.7%)	30 (20.3%)

Legend

1. Yes (%): Represents the number and percentage of participants who answered affirmatively to the corresponding question or practice.
2. No (%): Represents the number and percentage of participants who answered negatively to the corresponding question or practice.

4. Discussion

In a country like India, the interaction between humans and animals is age-old and intimate. Hence, the awareness, knowledge, and perception of the local community at high risk of zoonotic diseases become crucial. The results of this study reveal a significant knowledge gap and suboptimal practices of the rural communities towards zoonotic infections, specifically Brucellosis in Alva village, Gujarat, India.

4.1. Knowledge gaps

The study reveals significant gaps in knowledge regarding zoonotic diseases among participants. Only 6.3% of participants were aware of Brucellosis, and none knew that Brucellosis could be transmitted through unpasteurized dairy products or undercooked meat. This lack of awareness highlights a critical need for education on zoonotic diseases to protect both individual and public health. Additionally, the low knowledge of preventive measures, such as vaccination, exacerbates the situation. While awareness of rabies has been noted in previous studies, zoonotic diseases like Brucellosis, which are less frequently discussed, are inadequately covered in rural health education programs. The finding that only 6.3% of participants had heard about brucellosis aligns with a study conducted by Satish Ghughey et al.,¹² where only 4.71% of participants were aware of the disease. Similar studies in rural Maharashtra reported even lower awareness rates, such as 1.83%.¹³ In India, several systematic reviews on zoonotic diseases have emphasized the widespread lack of awareness and knowledge among the general population.¹⁴⁻¹⁶ This evidently indicates the dearth of knowledge and perception about zoonoses in different regions of our country.

4.2. Animal handling and husbandry practices

The study revealed that most residents were regularly in contact with livestock, with a whopping 93.1% handling animals frequently. However, only 14.9% of them used gloves when helping animals give birth, pointing to a glaring lack of safe handling practices. In another study by Satish Ghughey et al.,¹² the situation was even worse, with just 3.9% wearing gloves and a mere 1.9% using masks during animal deliveries. Additionally, many residents did not dispose of placental tissue and carcasses properly. Instead, 17.2% left remains for scavengers to deal with. In contrast, Satish Ghughey et al.,¹² study found that 21.2% buried animal products, 10.9% burned them, and 13.6% tossed them into dustbins. These risky practices can spread diseases from animals to humans (zoonotic pathogens). Economic losses among livestock were also noted, with issues like low milk production (30.4%), illness (2.7%), and recent abortions (4%). Undoubtedly, there are weaknesses in how animal health is managed, and improvements are needed to prevent further economic and health problems.

4.3. Milk and meat consumption practices

The study also highlighted that 33.1% of participants drank unpasteurized milk, and 37.1% did not even know what pasteurization was, which poses significant health risks. While 87.9% of those who drank raw milk boiled it first, the rest still consumed it unsafely. Additionally, 21.1% of participants consumed raw milk products such as cheese and yogurt, further exposing themselves to potential zoonotic pathogens. Interestingly, none of the participants consumed raw meat or worked in slaughterhouses, which reduced the risk of zoonotic transmission through these specific channels. A study done by Krupali Patel *et al*¹⁷ in Urban Ahmedabad also found that the most common high-risk practice followed by 72% of residents was consumption of raw milk, meat, and milk products. It was observed that 83.3% of respondents washed their hands every time before milking. While 81.7% of respondents actively assisted cattle during reproduction, a significant majority (90%) did not wear protective gloves. Additionally, most respondents (95%) did not apply any medication to the udder after milking had stopped, although 96.7% of respondents washed the udder before milking.

This lack of awareness about zoonotic diseases, coupled with insufficient training on animal handling and low literacy rates, may contribute to these risky practices. Similar findings were reported in other studies, indicating that these issues are widespread. This highlights the importance of being aware of the potential risks associated with consuming these dairy products and underscores why the incidence of human brucellosis is increasing in India. Public Health Implications should be strengthened as these findings emphasize the urgent need for targeted public health interventions to bridge knowledge gaps and tackle unsafe practices. A "One Health" approach—integrating human, animal, and environmental health—will be key to creating effective educational and preventive strategies. Essential measures include launching community-level campaigns to increase awareness about zoonotic infections, how they spread, and ways to prevent them, such as through pasteurization and vaccination; providing training on using protective equipment, like gloves, during animal delivery, and promoting safe disposal practices for animal waste and carcasses; encouraging regular vaccination programs and enhancing access to veterinary services to reduce economic losses and prevent the spread of zoonotic diseases; and advocating for safer milk consumption practices, such as boiling raw milk and avoiding raw dairy products.

5. Limitations

This study is limited by its focus on a single rural community, which may not fully represent the practices and knowledge of other rural populations. Further research encompassing multiple regions would help to generalize the findings and strengthen public health strategies.

6. Conclusion

In a nutshell, this study reveals some worrying gaps in awareness and practices around zoonotic diseases among the participants. Hardly anyone knew about brucellosis or how it could be transmitted through things like unpasteurized dairy products. On top of that, safe animal handling practices, such as wearing gloves during deliveries, were rarely followed. The fact that many participants were consuming unpasteurized milk and raw milk products just adds to the health risks. More needs to be done in terms of educating people about these diseases and promoting safer practices. By focusing on targeted educational campaigns, better vaccination practices, and easier access to veterinary care, we can make a big difference. Bridging these knowledge gaps and encouraging safer practices will go a long way in reducing the risk of zoonotic disease transmission and improving overall community health.

7. Source of Funding

None.

8. Conflict of Interest

None.

References

1. Rahman MT, Sobur MA, Islam MS, Levy S, Hossain MJ, El-Zowalaty ME, et al., Zoonotic diseases: etiology, impact, and control. *Microorganisms*. 2020;8(9):1405.
2. Ramanujam H, Palaniyandi K. Bovine tuberculosis in India: The need for One Health approach and the way forward. *One Health*. 2023;16:100495.
3. Alharbi MGT, Alanazi AS, Alanazi NF, Alanazi SJ, Alanazi SM, Alshaibani FS, et al., Overview of Brucellosis: simple Review Article. *Pharmacophore*. 2022;13(2):101–6.
4. Kadri SM, Rukhsana A, Laharwal MA, Tanvir M. Seroprevalence of brucellosis in Kashmir (India) among patients with pyrexia of unknown origin. *J Indian Med Assoc*. 2000;98(4):170–1.
5. Yohannes Gemechu M, Paul Singh Gill J. Seroepidemiological survey of human brucellosis in and around Ludhiana, India. *Emerg Health Threats J*. 2011;4(1):7361.
6. Pandit DP, Pandit PT. Human Brucellosis: Are we neglecting an enemy at the backyard?. *Med J Dr. DY Patil Univ*. 2013;6(4):350–8.
7. Yasobant S, Saxena D, Tadvi R, Syed ZQ. One health surveillance system in Gujarat, India: A health policy and systems research protocol for exploring the cross-sectoral collaborations to detect emerging threats at the human-animal-environment interface. *Trop Med Infect Dis*. 2023;8(9):428.
8. Ahmed MJ, Bhuiyan MI, Chalise R, Mamun M, Bhandari P, Islam K et al. One health assessment of farmers' knowledge, attitudes, and practices (KAPs) on zoonoses in Bangladesh. *Sci Rep*. 2025;15(1):1258.
9. Sharan M, Vijay D, Yadav JP, Bedi JS, Dhaka P. Surveillance, and response strategies for zoonotic diseases: a comprehensive review. *Sci One Health*. 2023;2:100050.
10. Carpenter A, Waltenburg MA, Hall A, Kile J, Killerby M, Knust B et al. Vaccine-preventable zoonotic diseases: challenges and opportunities for public health progress. *Vaccines*. 2022;10(7):993.
11. Abraham A, Bekele B, Tahir M, Ahmed S, Ahmedin L. Associations of community knowledge, perceptions, and practices related to zoonotic disease with sociodemographic factors in and around Chiro Town, Eastern Ethiopia: a cross-sectional study. *One Health Outlook*. 2024;6(1):10.
12. Ghugey SL, Setia MS, Deshmukh JS. Human brucellosis: Seroprevalence and associated exposure factors among the rural population in Nagpur, Maharashtra, India. *J Family Med Prim Care*. 2021;10(2):1028–33.
13. Kadri SM, Rukhsana A, Laharwal MA, Tanvir M. Seroprevalence of brucellosis in Kashmir (India) among patients with pyrexia of unknown origin. *J Indian Med Assoc*. 2000;98(4):170–1.
14. Deka RP, Magnusson U, Grace D, Shome R, Lindahl JF. Knowledge and practices of dairy farmers relating to brucellosis in urban, peri-urban, and rural areas of Assam and Bihar, India. *Infect Ecol Epidemiol*. 2020;10(1):1769531.
15. Kothalawala KA, Makita K, Kothalawala H, Jiffry AM, Kubota S, Kono H. Knowledge, attitudes, and practices (KAP) related to brucellosis and factors affecting knowledge sharing on animal diseases: a cross-sectional survey in the dry zone of Sri Lanka. *Trop Anim Health Prod*. 2018;50(5):983–9.
16. Ghugey SL, Setia MS, Deshmukh JS. Knowledge, attitude, and practice for brucellosis amongst migratory animal handlers: A cross-sectional study in Maharashtra, India. *J Clin Diagn Res*. 2021;15(4):LC01–4.
17. Patel K, Saxena D. Self-reported selected zoonotic diseases among animal handlers in Urban Ahmedabad, India. *Vet World*. 2019;12(1):176–82.

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