HERD-LEVEL RISK FACTORS ANALYSIS FOR BOVINE BRUCELLOSIS IN JAMMU, JAMMU AND KASHMIR

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Abstract

Bovine brucellosis is endemic in India and inter-herd transmission of disease may involve multiple factors. In this context, a study was conducted to assess the herd-level risk factors involved in transmission of bovine brucellosis in Jammu, Jammu and Kashmir, India. Pooled milk samples from bovine herds and information on 6 risk factors (sample area, bovine species on farm, history of abortion/retention of placenta on farm, purchase of animals, type of breeding on farm and size of herd) were collected from six villages of Jammu region. Milk samples (n=175) were tested by milk ring test (MRT) to detect brucellosis positive herds. MRT results in association with risk factors were analysed by univariable and multivariable logistic regression analysis. Regression analysis identified sample area, species reared on farm, history of abortion/retention of placenta on farm and herd size as the significant factors associated with herd seropositivity in the study area.

Key words: Bovine brucellosis, Herd prevalence, Risk factors

INTRODUCTION

Bovine brucellosis is endemic in India (Boral *et al.*, 2009). The disease is responsible for huge economic losses in country due to abortions, reduced fertility and loss in milk production (Singh *et al.*, 2015). Recently the Government of India has initiated National Animal Disease Control Programme (NADCP) to eradicate foot and mouth disease (FMD) and brucellosis in country which aims to eradicate brucellosis by 2025 from the country.

The transmission of brucellosis from one herd to another herd may involve multiple factors. Some of the factors for herd prevalence of bovine

brucellosis have been identified and include factors associated with animals such as artificial insemination, purchase of animals, herd size, management system, and history of abortion. In different areas, different factors predominate and it becomes necessary to identify such predominant factors to formulate control strategies in a region (Makita *et al.*, 2011; Chand and Chhabra, 2013; Assenga *et al.*, 2016).

Jammu district of Jammu and Kashmir, India, shares international border with Pakistan. To fulfil their food demands, the people of border region are greatly involved in animal husbandry

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and some of the areas have high bovine population density. Further, the animal rearers of the region frequently buy and sell their animals in local areas as well as the neighbouring states viz., Punjab and Haryana where brucellosis has been reported by many workers (Kaur *et al.*, 2006; Chand and Chhabra, 2013). The animal breeding involves both natural mating and artificial insemination. The risk factors for herd-level prevalence of brucellosis in the region have not been identified. The present study was an attempt to identify the potential risk factors associated with herd prevalence of bovine brucellosis in Jammu district of Jammu and Kashmir.

The study was targeted in six areas viz., Agra Chak, Baspur Bangla, Badyal Brahmana, Bega, Sai Khurd and Purana Pind, and pooled herd milk samples were collected from bovine herds. Samples were collected from 175 herds and analysed. The herds have 1 to 65 animal(s) in milk production. The herds were divided into 3 categories based upon their size in the study (Table 1). None of the herds was vaccinated with *Brucella abortus* S19 vaccine. The sampling was done from November 2017 to March 2018.

The samples were tested by milk ring test (MRT) as per the protocol of OIE (2018). Samples were stored at 4°C for 24 hr prior to MRT. For

MRT, samples and antigen were brought to room temperature. In a small test tube, 30 µL of antigen was added to 1 mL milk sample and incubated at 37°C for 1 hr. The formation of coloured (pink) ring at top was positive for brucellosis. The antigen for MRT was procured from Division of Biological Products, Indian Veterinary Research Institute, Bareilly, Uttar Pradesh (India).

The herd owners in the study area were questioned using a structured questionnaire on various management conditions. Before that, a questionnaire was framed based on the studies published on risk factor analysis of bovine brucellosis (Makita *et al.*, 2011; Sanogo *et al.*, 2012; Boukary *et al.*, 2013; Chand and Chhabra, 2013; Assenga *et al.*, 2016) and pre-tested on a group of animal keepers to identify the risk factors to be considered for study area. Many of the risk factors reported elsewhere such as presence of calving pen in the farm, intensiveness of management, education of respondents and knowledge of brucellosis were removed in pre-testing phase. The 6 risk factors included in selected questionnaire were viz., village, bovine species in farm, history of abortion/retention of placenta in farm, purchase of animals, type of breeding on farm and size of herd.

The MRT results and questionnaire responses were compiled and analysed using SPSS 16.0

Table 1. Attributes of bovine herds (n=175) sampled in the study

Sample area	Herd size (productive animals)			Species on farm			Total	Percent of total
	1-5	6-10	>10	Cattle	Buffalo	Both		
Badyal Brahmana	27	9	1	9	7	21	37	21.1
Agra Chak	21	11	4	15	13	8	36	20.6
Baspur Bangla	43	4	3	18	10	88	50	28.6
Purana Pind	8	0	0	1	0	7	8	4.6
Bega	20	7	1	9	6	13	28	16.0
Sai Khurd	16	0	0	11	1	4	16	9.1
Total	135	31	9	63	37	75	175	

(SPSS Inc., Chicago). Apart from descriptive statistics, the risk factors were analysed by univariable analysis and the factors having $p < 0.25$ were further subjected to multivariable logistic regression with stepwise backward likelihood ratio method. The model fitness was gauged by change in log likelihood method as well as Hosmer and Lemeshow test.

The study was an attempt to identify risk factors in Jammu region of Jammu and Kashmir having large bovine population and is first of its kind for the study area. The study used MRT for identification of brucellosis positive herds as the test has been considered suitable in identifying infected herds (OIE, 2018) and is

used in implementation of national bovine brucellosis control programme in India (Shome *et al.*, 2015). The relative cheapness and quick results than other diagnostic tests are the other added benefits.

The highest prevalence of herd brucellosis was reported in Bega (25.57 %) followed by Sai Khurd (25.00 %) while none of the samples of Purana Pind was positive ($p = 0.07$) (Table 2). It seems brucellosis is endemic in Bega and Sai Khurd localities as purchase of animals was not a significant factor for herd seropositivity in the study (as discussed below). In Purana Pind the absence of disease could be due to low number of samples available for screening. The herds

Table 2. Univariable analysis of risk factors associated with bovine brucellosis at herd level*

Factor	Classes with in factor	Number of samples	Samples positive (%)	P-value	Odds ratio	P-value
Sample area	Badyal Brahmna	37	3 (8.11%)	0.070	0.27	0.111
	Agra Chak	36	3 (8.33%)		0.27	0.120
	Baspur Bangla	50	6 (12.00%)		0.41	0.216
	Purana Pind	8	0		0.00	0.999
	Bega	28	8 (28.57%)		1.20	0.798
	Sai Khurd	16	4 (25.00%)		1.00	
Farm species	Cattle	63	14 (22.22%)	0.037	2.39	0.070
	Buffalo	37	2 (5.40%)		0.48	0.367
	Mixed farm	75	8 (10.67%)		1.00	
History on farm	No history	104	14 (13.46%)	0.116	1.00	
	Abortion in 2 nd half of pregnancy	5	2 (40.00%)		4.29	0.128
		17	0		0.00	0.998
	Retention of placenta	49	8 (17.39%)		1.25	0.638
	Both abortion and retention of placenta					
Purchase of animals	Yes	105	13 (12.38%)	0.530	0.76	0.531
	No	70	11 (15.71%)			
Type of breeding on farm	Natural mating	42	4 (9.52%)	0.281	0.89	0.870
	Artificial insemination	76	14 (18.42%)		1.92	0.213
	Both	57	6 (10.53%)			
Herd size	1-5 animals	135	20 (14.81%)	0.051	0.35	0.158
	6-10 animals	31	1 (3.22%)		0.07	0.029
	>10 animals	9	3 (33.33%)			

*The six risk-factors were analysed by univariable logistic regression. The samples positive (%) and odds ratio were analyzed for statistical significance by chi-square test

Table 3. Multivariable logistic regression analysis of risk factors associated with bovine brucellosis at herd level*

Factor	Classes with in factor	Samples positive %	Odds ratio	P-value
Sample area	Badyal Brahmna	8.11	0.39	0.316
	Agra Chak	8.33	0.48	0.407
	Baspur Bangla	12	0.41	0.268
	Purana Pind	0	0.00	0.999
	Bega	28.57	3.21	0.146
	Sai Khurd	25	1.00	
Farm species	Cattle	22.22	1.72	0.344
	Buffalo	5.4	0.14	0.093
	Mixed farm	10.67	1.00	
History on farm	No history	13.46	1.00	
	Abortion in 2 nd half of pregnancy	40	6.58	0.125
	Retention of placenta	0	0.00	0.998
	Both abortion and retention of placenta	17.39	2.28	0.157
Herd size	1-5 animals	14.81	0.13	0.067
	6-10 animals	3.22	0.02	0.013
	>10 animals	33.33	1.00	

*The four risk-factors were analysed by multivariable logistic regression. The odds ratio were analyzed for statistical significance by chi-square test

rearing cattle alone (22.22 %) had higher prevalence than herds rearing buffalo alone (5.40 %) ($p=0.037$) and could be due to lower susceptibility of buffaloes to *Brucella abortus* infection (Adesiyun *et al.*, 2010). Similar results were reported by Chand and Chhabra (2013) for Punjab and Haryana states.

Herds having history of abortion in 2nd half of pregnancy exhibited higher prevalence (40 %) while herds with no history of abortion were also positive (13.46 %). This could be due to presence of carrier animals in the farm. Herds having history of purchase of animals had lower prevalence than those having no such history ($p = 0.53$). Further, herds practising artificial insemination had higher positive prevalence ($p = 0.281$). The reason for higher prevalence in herds practising artificial insemination is unexplainable as the frozen semen used for artificial insemination comes from semen collection centres certified as

brucellosis-free by veterinary services. It was observed that natural mating was mainly employed in buffaloes in the region and as the brucellosis prevalence in buffaloes was lesser in the study, the prevalence estimates for natural mating were also lower. The herds with size >10 animals had highest positivity (33.33 %) followed by 1-5 animals (14.81 %) ($p = 0.051$). High positivity in large herds had been reported by many workers (Makita *et al.*, 2011; Sanogo *et al.*, 2012; Boukary *et al.*, 2013), but study also reported higher seropositivity in small herds indicating the endemicity nature of disease especially in Bega and Sai Khurd.

In univariate analysis, 2 out of 6 factors i.e. purchase of animals and breeding method had p -value higher than 0.25 and were removed for multivariable logistic regression analysis (Table 2). The remaining 4 factors (sample area, species on farm, and history of abortion/retention of placenta on farm and herd size)

were tested in multivariable regression analysis and were retained in the final model (Table 3). The odds ratios associated with each variable are depicted in Table 2 and Table 3. Thus, the study identified four factors *viz.*, sample area species on farm, history of abortion/retention of placenta on farm and herd size to be significant factors associated with herd-level brucellosis in the region. To the authors' knowledge, this is the first report on herd-level

risk factors analysis for bovine brucellosis in the region.

Conflict of interest: The authors declare no conflict of interest.

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