



Prevalence and Risk Factors of Occupational Brucellosis Among Veterinarians in the Kingdom of Saudi Arabia

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Abstract

Occupational brucellosis is one of the most important zoonotic diseases among veterinarians worldwide. Therefore, it is important to monitor the prevalence and risk factors associated with occupational brucellosis among veterinarian in Saudi Arabia.

The current study aimed to determine the prevalence of occupational brucellosis among veterinarians in different regions of KSA who work in MEWA, and identify the risk factors associated with the occurrence of disease in veterinarians.

A questionnaire survey was circulated to investigate prevalence of brucellosis among MEWA veterinarians. The questionnaire was sorted to identify the overall veterinarians who laboratory confirmed positive for brucellosis during their lifetime at work. A statistical univariate and multivariate analysis were used to determine the overall disease prevalence and risk factors associated with the occurrence of the disease among veterinarians using SPSS.

The overall prevalence mean \pm SD of occupational brucellosis among 444 MEWA veterinarians was 14.6% \pm 9.6. Private experience (P=0.028), Participating in vaccination (P=0.015), Protective cloth in C.S (P=0.016) were statistically significant risk factors associated with Brucella occurrence within MEWA veterinarians.

These results indicate the need for awareness to be raised within MEWA veterinarians for risk factors associated with brucellosis at the site of work and before participating in vaccination camping's.

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Introduction

Brucellosis is one of the most important zoonotic diseases worldwide, and it is endemic in some areas including Central Asia, the Middle East, Latin America, and the Mediterranean countries [1]. Brucellosis is a commonly neglected zoonosis with a global geographical distribution, and as such jeopardizes human health and animal production [2].

The prevalence of brucellosis among human populations is largely influenced by the prevalence of the disease among domestic animals and local traditions regarding the proximity of animal housing and human habitations and the consumption and processing of milk products [3-5]. Other factors which may influence the prevalence of disease in human beings include the type of *Brucella* species present in the region, the type of the domestic animals kept near human dwellings, the climatic conditions, and standards of personal and environmental hygiene [3]. Veterinarians and veterinary technicians have a higher risk of becoming infected with brucellosis due to repeated contact with infected animals. Contact with excretions from infected animals, particularly milk and abortive materials and inhalation of droplets in the air are the primary transmission routes for occupational brucellosis. Practices that involve handling sharp objects (needles, knives) and needle-stick injuries are common in veterinary practice [1], and veterinary personnel are at risk of accidental exposure to livestock *Brucella* vaccines [6,7]. The animal vaccine strains are defined among possible pathogens for occupational brucellosis in veterinarians [1]. Literature from Saudi Arabia suggests that *B. melitensis* remains the principal cause of human brucellosis, with less frequent infections by *B. abortus* [8].

The objectives of this study were to determine the prevalence of occupational brucellosis among MEWA veterinarians in KSA, and to investigate the potential risk factors associated with the disease.

Materials and methods

Study area

(13) Regions in the Kingdom of Saudi Arabia were included in this study; Western sector (Mecca, Medina, Al Baha), Middle sector (Riyadh, Al Qassim, Hail), Northern sector (Al Jouf, Tabuk, Northern Border), Southern sector (Jazan, Najran, Aseer) and Eastern province.

Study populations

Veterinarians work in the Ministry of the Environment, Water and Agriculture (MEWA) throughout the Kingdom of Saudi Arabia were targeted in the present study.

Study design

An electronic questionnaire was circulated to investigate the overall prevalence and risk factors associated with the occurrence of occupational brucellosis among the veterinarians work in the Ministry of the Environment, Water and Agriculture (MEWA) include 13 main regions in KSA. The potential risk fac-

tors included were: Participant age, place of residence, work place, private experience, government experience, chronic disease, animal contact, test for *Brucella*, dealing with aborted animal, participating in vaccination, drinking raw milk, protective cloth in general inspection, protective cloth in C.S, protective cloth in case of dystocia.

Only veterinarians who got infected with *Brucella* during their veterinary career time and confirmed at hospital were considered in the study. The overall prevalence was calculated based on the number of positive divided by the total number of responding veterinarians x 100.

Statistical analysis

The Chi-Square test (χ^2) was used for univariate analysis for primary categorical analysis of the risk factors. However, to exclude the confounding risk factors; logistic regression was used for multivariate analysis for the association between risk factor and the occurrence of brucellosis. The significant level of association was set at P value < 0.05 and a confidence level of 95% using a statistical analysis program (SPSS) version 22.

Results

The overall mean (\pm SD) of occupational brucellosis among 444 veterinarians affiliated to the ministry of environment, water and agriculture in thirteen main regions in ksa was 14.6% (\pm 9.6).

Table 1: The prevalence of brucellosis (%) among MEWA veterinarians in the thirteen main regions of KSA.

Region	No. of Responding People	No. of +ve People	Prevalence (%)
Mecca	23	1	4.3
Medina	53	6	11.3
Al Baha	14	1	7.1
Riyadh	56	13	23.2
Al Qassim	59	12	20.3
Hail	5	0	0
Eastern Province	67	9	14.3
Al Jouf	21	3	14.3
Tabuk	4	1	0.25
Northern Border	34	4	12.1
Jazan	19	4	21.1
Najran	12	4	33.3
Aseer	77	7	9.1
Total	444	65	14.6

Table (1) shows the highest prevalence of brucellosis was found in Najran (33.3%) and the lowest were reported in Tabuk (0.25%), while no cases reported in Hail (Table 1).

Table 2: Univariate analysis of association between brucellosis and potential risk factors among veterinarians in KSA, using the Chi-square (χ^2) test.

Risk factors	No. tested	No. +ve (%)	d. f.	χ^2	p-value											
Participant age						2	17.446	0.001	Animal contact		3	7.112	0.068			
Less than 30 years	84	2 (2.4)	None	24	1(4.2%)											
30 to 40 years	235	34 (14.5)	Rarely	54	6(11.1%)											
More than 40	125	29 (23.2)	Sometimes	87	8(9.2)											
Place of residence						12	15.373	0.285	Test for Brucella		2	2.517	0.284			
Riyadh	56	13 (23.2)	No	243	38(15.6%)											
Medina	53	6 (11.3)	Yes	130	14(10.8%)											
Mecca	23	1 (4.3)	Dealing with aborted animal		4				5.900	0.207						
Eastern Province	67	9 (13.4)	Not responsible	265							35(13.2%)					
Jazan	19	4 (21.1)	Burial	100							14(14.0%)					
Al Qassim	59	12 (20.3)	Burning	32							4(12.5%)					
Hail	5	0 (0.0)	Special company	27							8(92.6%)					
Aseer	77	7 (9.1)	Throw out of the farm	20	4(20.0%)											
Al Jouf	21	3 (14.3)	Participating in vaccination		3				18.620	0.000						
Northern Border	34	4 (12)	None	130							8(6.2%)					
Najran	12	4 (33.3)	Rarely	164							21(12.8%)					
Al Baha	14	1 (7.1)	Sometimes	88							22(25.0%)					
Tabuk	4	1 (25.0)	Always	62	14(22.6%)											
Work place						6	13.385	0.037	Drinking raw milk		1	.541	0.462			
Office	81	7 (8.6)	No	350	49(14.0%)											
Field	3	1 (33.3%)	Yes	94	16(17.0%)											
Clinic	304	50 (16.4%)	Protective cloth in general inspection		3				3.900	0.273						
Lab	32	2 (6.3%)	proper	93							13(14.0%)					
Slaughter house	12	1 (8.3%)	improper	319							51(16.0%)					
Quarantine	1	1 (100%)	Doesn't deals	31							1(3.2%)					
Other	11	3 (27%)	Doesn't wear	1	0(0.0%)											
Private experience						3	10.896	0.012	Protective cloth in case of abortion		2	3.360	0.186			
None	183	30 (16.4%)	Proper	187	34(18.2%)											
Less than year	49	4 (8.2%)	Improper	192	24(12.5%)											
1 to 5 years	100	7 (7.0%)	Doesn't deals	65	7(10.8%)											
More than 5 years	112	27 (21.4)	Protective cloth in C.S		2	7.697	0.021									
Government experience								4	46.084	0.000	Protective clothin case of dystocia		2	4.437	0.109	
None	7	0 (0.0%)	Proper	161							30(18.6%)					
Less than year	32	0 (0.0%)	Improper	192	31(16.7%)											
1 to 5 years	96	14 (14.6%)	Doesn't deals	91	5(5.5%)											
More than 5 years	309	51 (16.5%)	Protective clothin case of dystocia		2	4.437	0.109									
Chronic disease								4	46.084	0.000	Proper		2	4.437	0.109	
No	372	38(58.5%)	Improper	230							31(13.5%)					
blood pressure	63	24(38.1%)	Doesn't deals	53	4(7.5%)											
Asthma	2	0(0/0%)														
Diabetes	4	3(75.0%)														
Other	3	0(0.0%)														

The chi-square univariate analysis revealed that 6 variables were statistically significant (P value ≤ 0.05). Those factors were participant age ($P=0.001$), workplace ($P=0.037$), private experience ($P=0.012$), chronic disease ($P=.000$), participating in vaccination ($P=0.000$), Protective cloth in C.S ($P=0.021$) (Table2).

Table 3: Multivariate analysis of association between brucellosis and potential risk factors in 444 veterinarians in KSA, using logistic regression.

Risk factors	No. tested	No. +ve (%)	EXP(B)	95% CI for EXP(B)		p-value
				Lower	Upper	
Private experience						
Less than year	49	4 (8.2%)	Ref			0.028
None	183	30 (16.4%)	0.630	0.181	2.197	0.234
1 to 5 years	100	7 (7.0%)	0.326	0.116	0.913	0.029
More than 5 years	112	27 (21.4)	1.315	0.628	2.754	0.311
Participating in vaccination						
None	130	8 (6.2%)	Ref			0.015
Rarely	164	21 (12.8%)	1.729	0.606	4.933	0.306
Sometimes	88	22 (25.0%)	4.732	1.564	14.319	0.006
Always	62	14 (22.6%)	3.489	1.038	11.729	0.043
Protective cloth in case of abortion						
Doesn't deals	65	7 (10.8%)	Ref			0.087
Proper	187	34 (18.2%)	0.499	0.204	1,219	0.127
Improper	192	24 (12.5%)	2.122	0.455	9.892	0.338
Protective cloth in C.S						
Doesn't deals	91	5 (5.5%)	Ref			0.016
Proper	161	28 (17.4%)	2.092	0.873	5.014	0.098
Improper	192	32 (16.7%)	0.261	0.052	1.320	0.104

Table (3) shows only 3 factors were significant in multivariate analysis ($P < 0.05$) which were private experience ($P=0.028$), participating in vaccination ($P=0.015$), and protective cloth in C.S ($P=0.016$).

Discussion

Brucellosis is one of the most important zoonotic diseases in Saudi Arabia, despite efforts of MEWA to control infection in livestock, cases of brucellosis are reported in animals and humans. The total annual human case number decrease from 5169 in 2004 to 3661 in 2012, then rise to 5066 in 2018 [9,10]. To our knowledge this is the first study in Saudi Arabia conducted to estimate the number of cases among veterinarians working in the general directorate of veterinary services, animal resources Agency, ministry of environment, water and agriculture, additionally associated risk factors has been investigated.

The results of this study revealed that occupational brucellosis is spread among veterinarians considerably. The overall mean \pm SD of occupational brucellosis among veterinarians in different regions in KSA was 14.6% \pm 9. This is similar to the prevalence of brucellosis reported among veterinarians in Turkey which was 11.8% [1]. However, Mahmoud and coworkers found the seroprevalence of brucellosis among 53 clinician veterinarians in Jordan was 24.5% [11]. These variations could be attributed to the difference in geographic location alternatively the difference in the investigation approach, difference of tradition and custom between the countries.

The univariate analysis revealed that 6 variables were statistically significant (P value ≤ 0.05). Those factors were participant age, work place, private experience ($P=0.012$), chronic disease, participating in vaccination, protective cloth in C.S (Table2). However, only 3 of those 6 factors were significant

in multivariate analyses ($P < 0.05$) which were private experience, participating in vaccination, and protective cloth in C.S (Table 3).

When assessing age of veterinarians as risk factor, it was shown that veterinarians more than 40 years of age were highly affected, compared with veterinarians 30 to 40 years and Less than 30 years, the difference in infection rate could be attributed mainly to the fact that aged veterinarians have a longer exposure time to brucellosis in field than young one. Age as risk factor was examined by different researchers: A Similar observation was noticed in Al madina al munawara region, Saudi Arabia that brucellosis prevalence is increasing with age [12]. However, the age in our study seemed to be a confounder thus multivariate analysis revealed it not a significant factor.

Univariate analysis revealed that the prevalence of brucellosis by regions has been investigated in this study. The highest prevalence of brucellosis was found in Najran (33.3%) and the lowest were reported in Tabuk (0.25%), while no cases reported in Hail (Table 1). These results are similar to that prevalence of *Brucella* reported in Jazan, KSA (13.4 %) among 400 participants from randomly selected primary healthcare centers [8]. Additionally, the variation between numbers of infected veterinarians in different regions can be explained by geographical location and the difference in the prevalence of animal brucellosis between regions, as well as differences in the degree of direct contact with animals suffering from reproductive problems especially dystocia and abortion.

The highest results found in Najaran in our study might associate with the situation of observed prevalence of brucellosis in animals in the 1st animals survey conducted by MEWA. The data revealed that the highest cases found in animals were also in Najaran 27% while there were no cases in Tabuk (MEWA 1st Survey; non published data). However, the region in this study seemed to be a confounder thus multivariate analysis reveals it not a significant factor.

Univariate analysis revealed that working in different locations of work has a significant effect ($P = 0.037$), there were numbers of veterinarians who have the disease, and this reflects the importance of brucellosis as an occupational hazard. Affected vets work in clinics (51 vets out of 307, 16.6%), slaughterhouse (1 out of 12, 8.3%), quarantine (1 out of 1, 100%). Moreover, the laboratory (2 out of 32, 6.2%), office (7 out of 81, 8.6%), other not specified position (3 out of 11, 27%). If quarantine excluded because just one vet participate, vet work in clinics are consider at high risk to brucellosis compared with different locations characterized by direct contact with animals and their secretions. This could be due to extensive work with animals during abortion or parturition, doing a lot of Caesarean Sections (C.S) and other reproductive problems and at more hazard to be infected by vaccine strain during vaccine campaigns. On the other hand 7 affected vets doing only office job and 3 vets doing other not specified work can be explained by drinking raw milk or having contact with animals in some way like one have own animal herd. However, the workplace has no effect at multivariate analysis.

When investigating chronic disease as a risk factor, it was shown that the veterinarians who have diabetes (75%) were highly affected compared to those who have other chronic diseases or does not have a chronic disease (38%). This is probably because diabetes reduces resistance to infection and thus increasing the susceptibility of them to infection [13]. Univariate analysis revealed that working in private experience has a significant effect on bruceella occurrence ($P = 0.012$). The occurrence of *Brucella* in the privet sector veterinarians significantly associated within the first five years. However, working in government jobs is not significant. The difference might attribute to the awareness campaigns conducted by MEWA to the employees. Another reason that veterinarians in the privet sector has close contact with animals in managing at the herd level than those in a government job. When multivariate analysis conducted the private was still significant ($P = 0.028$).

In our study, the highest infection was observed among veterinarians always and sometimes participating in vaccine campaign (more than four/five times per week), In contrast, those participating a few times in vaccines camping, were relatively at lower risk for contracting the disease. Participating in the *Brucella* vaccine campaign was associated with increased risk to disease. Out of 314 veterinarians participate in vaccination 57 (18.1%) experienced the *Brucella* disease compared with 8 cases out of 130 (6.2%) veterinarians who did not participate in vaccination. Accidental exposures to the live, attenuated vaccine strains of *Brucella* species in veterinarians can occur during preparation of the live vaccines, via needle stick injury, as well as through spray exposure to the conjunctiva and open wounds.

According to these results, the factor protective clothes were not associated with low number of cases and this can be due to inaccurate answers from participants, or the quality of protective clothes was not good enough, or vets did not use them in an appropriate way or there were other confounding

factors for infection like drinking raw milk. In addition, these results could be attributed to limitations in questionnaire design, which did not study the commitment of wearing proper safety clothes before or after getting the disease.

Conclusion and recommendation

Veterinarians work in private clinics, veterinarians participating in vaccination and veterinarians deal with protective cloth in C.S are considered at high risk of brucellosis. These results indicate the need for education, awareness, protective measures implementation and training of those veterinarians in the kingdom as well as vaccine program.

References

1. Kutlu M, Ergonul O, Sayin-Kutlu S, Guven T, Ustun C, et al. Risk factors for occupational brucellosis among veterinary personnel in Turkey. *Preventive Veterinary Medicine*. 2014; 117: 52-58.
2. El-Moselhy EA, Zayet H, El-Khateeb AS, Mohammed AS, El-Tiby DM. Human Brucellosis: Seroprevalence, Risk Factors, and Barriers of Protection among Slaughterhouses' Workers in El-Menia Governorate, Egypt. *Arch Clin Pathol J. J Clin Pathol*. 2018; 1: 2.
3. Omer MK, Assefaw T, Skjerve E, Teklegiorghis T, Woldehiwet Z. Prevalence of antibodies to *Brucella* spp. and risk factors related to high-risk occupational groups in Eritrea. *Epidemiology & Infection*. 2002; 129: 85-91.
4. Cooper CW. Risk factors in transmission of brucellosis from animals to humans in Saudi Arabia. *Transactions of the Royal Society of Tropical Medicine and Hygiene*. 1992; 86: 206-209.
5. Jokhdar HA. Brucellosis in Saudi Arabia: review of literature and an alarming case report in a hospital in Jeddah. *Med J Cairo Univ*. 2009; 77: 47-55.
6. Ashford DA, Di Pietra J, Lingappa J, Woods C, Noll H, et al. Adverse events in humans associated with accidental exposure to the livestock brucellosis vaccine RB51. *Vaccine*. 2004; 22: 3435-3439.
7. Strausbaugh LJ, Berkelman RL. Human illness associated with use of veterinary vaccines. *Clinical infectious diseases*. 2003; 37: 407-414.
8. Ageely H, Bani I, Gaffar A, Eltigani M, Yassin AO, et al. Prevalence and risk factors for brucellosis in Jazan Province, Saudi Arabia. *Tropical Journal of Pharmaceutical Research*. 2016; 15: 189-194.
9. Aloufi AD, Memish ZA, Assiri AM, McNabb SJ. Trends of reported human cases of brucellosis, Kingdom of Saudi Arabia, 2004–2012. *Journal of Epidemiology and Global Health*. 2016; 6: 11-18.
10. Monthly epidemiology report kingdom of saudi Arabia. <http://fets.edu.sa/epi-report/>
11. Abo-Shehada MN, Odeh JS, Abu-Essud M, Abuharfeil N. Seroprevalence of brucellosis among high risk people in northern Jordan. *International journal of epidemiology*. 1996; 25: 450-454.
12. Al-Sekait MA. Epidemiology of brucellosis in Al medina region, Saudi Arabia. *Journal of family & community medicine*. 2000; 7: 47-53.
13. Geerlings SE, Hoepelman AI. Immune dysfunction in patients with Diabetes Mellitus (DM). *FEMS Immunology & Medical Microbiology*. 1999; 26: 259-265.