Seroprevalence Rate of Brucellosis in Sheep at Aljouf Region, Saudi Arabia

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Abstract: In this work, the prevalence of *Brucella* spp. antibodies among sheep in Aljouf region, Saudi Arabia was investigated. Five hundred and fifty sera were collected randomly during March to April 2021 from sheep of both sexes, age and breed in the region. Samples were tested for circulating antibodies against *Brucella* spp. by Rose Bengal Plate Test (RBPT), Rapid test (RT) and ELISA. Pearson's Chi-square was adopted to estimate possible correlation between RBPT, Rapid test, ELISA and risk factors involved. Kappa test was used to measure agreement of the results and the tests adopted. Out of the tested sera forty (7.3%) were positive for *Brucella* spp. antibodies by RBPT, 23 (18.4%) in Dumataljundal, 16 (16.7%) among male, compare to 24 (5.3%) among female, 28 (70%) were positive among the groups of 12-30 month age. On the other hand, eighty-eight (16%) sera were positive in *Brucella* ssp. Antibodies by rapid test, 39 (31.2%) in Dumataljundal, 23 (24.0%) among male, compared to 65 (14.3%) in female, higher percentage (20.7%) of antibodies was found in 36-48 months old. ELISA revealed that eighty-five samples (15.5%) were positive by ELISA, 39 (31.2%) in Dumataljundal, 23 (24%) among male, compared to 62 (13.7%) in female, higher percentage (19.8%) of *Burucella* spp. antibodies was found in 36-48 month age. Significant correlation between seroprevalence screened by RBPT and city (-0.168), sex (-0.166) and age (0.121) were recorded. Likewise, significant relationship between seropositivity detected by rapid test and city (-0.311), sex (-0.100) and age (0.088) were estimated. ELISA results were correlated with city (-0.297), sex (-0.108) and age (0.085). Analysis revealed strong correlation between ELISA and rapid test (0.980), moderate correlation (0.636) between ELISA and RBPT was noticed. Kappa test indicated moderate agreement between RBPT and ELISA (value=.583), while perfect agreement between rapid test and ELISA was estimated (value=.979). Large-scale epidemiological investigation is needed to better understand possible risk factors involved and to implement effective control measures.

Keywords: Seroprevalence, Brucellosis, Sheep, Aljouf region. Saudi Arabia

INTRODUCTION

Brucellosis remains a worldwide zoonotic disease. While many countries have eradicated *Brucella abortus* from cattle, *B. melitensis* infects mainly sheep and goats and its zoonotic importance, plays a significant role in the national economy and the public health of many developing countries (Alemneh and Dawit, 2018). Ovine brucellosis caused by gram-negative, coccobacillae, facultative intracellular bacteria which belong to the genus *Brucella*, containing at least 10 species which includes *Brucella melitensis* one of three biovars (biovars 1, 2 and 3) and *B. ovis* as well as many other. The natural reservoirs of the species *B. melitensis* are basically goats and sheep but also infects cattle and swine. However, *B. ovis* is primarily afflicting sheep (Lopes *et al.,* 2010; Olsen and Palmer, 2014). Ovine brucellosis has been shown to occur worldwide. It is mostly present in Mediterranean countries, the Middle East, Asia, India, China, Mexico and parts of Latin America. *Brucella ovis* has been recorded in parts of Eastern Europe, Africa, Western State of the United States of America (USA), New Zealand and Australia, it does not occur in the United Kingdom (UK) (Foster *et al.,* 2018). It was described in different parts of the country (Radwan *et al.,* 1983; El-rahim, 2014; Abdellatif *et al.,* 2020). The disease is responsible for massive economic losses around the world especially in countries where accurate data are not available to truly assess the loss. Losses are generally due to culling of animals, abortion, infertility, reduced milk production, treatments costs of animals, vaccines, market losses, losses due to missed reproductive cycles, hospitalizations for human cases and administrative costs by governments in an attempt to control or eradicate the infection (Bamaiyi *et al.,* 2014).

Antibiotic treatment has been used successfully in some valuable rams, but it is usually not economically achievable. Fertility may remain low even if the organism is eliminated from treated rams (Samadi *et al.,* 2011). The control and eradication of brucellosis in small ruminants depends mainly on the vaccination, identification and culling of infected animals. Therefore, sensitive and specific tests to estimate the prevalence rate of ovine brucellosis is important to implement public health control measures and to prevent spreading of the disease to non-infected herds. The present investigation aimed to estimate the prevalence of circulating antibodies against *Brucella* spp among sheep at Aljouf region, Saudi Arabia and to determine possible risk factors involved among animals investigated and to measure possible agreement of the results obtained by RBPT, RT and ELISA.

MATERIALS AND METHODS

Study area

The study was conducted in Aljouf region. Northwest of the Kingdom of the Saudi Arabia, including Sakaka, Dumataljundal, Qurayyat and Tabarjal (Fig. 1).

Experimental animals and collection of samples

Sera (n=550) were collected randomly during March to April 2021 from sheep of both sexes, 6 months to 4 years old and without history of reproductive disorders (Table 1).

Table (1): Categorical risk factors associated with seroprevalence of brucellosis among sheep

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from Aljouf region. Northwest of the Kingdom of the Saudi Arabia

City	Animal No.	Percent %
Skaka	175	31.9
Dumataljundal	125	22.7
Tabarjal	125	22.7
Qurayyat	125	22.7
Total	550	100.0
Sex		
Male	96	17.5
Female	454	82.5
Total	550	100.0
Age/month		
6-11	129	23.5
12-18	213	38.7
24-30	97	17.6
36-48	111	20.2
Total	550	100.0
Health status		
No Clinical Signs	509	92.5
Clinical Signs	41	7.5
Total	550	100.0

Blood samples (n=550) were collected from the jugular vein into plain vacutainer tubes, centrifuged at 3000rpm for 15min. Sera were preserved at -20ºC until analysis.

Sample size

The sample size was calculated according to the method described by Thrusfield (2005) using the formula of 95% confidence and 5% precision as follows:

The expected prevalence (22%) was estimated according to the previous reports (Radwan *et al.,* 1992; Al-Sekait, 2000; El-rahim, 2014; Shabana and Krimly, 2020)

$N = (1.96)^2$ P exp (1- Pexp)/d2

(N = required sample size, P exp = expected prevalence and d =desired absolute precision)

$N= (1.96)^2 \times 0.22 \times 0.22/(0.05)2 = 552$

However, 550 animals will be tested for circulating antibodies against *Brucella* spp.

Rose Bengal Plate Test (RBPT)

Collected sera were screened for antibodies directed against *Brucella* antigen by the RBPT test Kits (*Lillidale Diagnostics Pig Oak Farm, Holt, Wimborne, Dorset, BH21 7DG*). Briefly, serum sample (0.03ml) was mixed with an equal volume of antigen. The mixture was agitated gently for four minutes at ambient temperature, and then observed for agglutination.

Rapid Test

Rapid test was performed according to the manufacturer's instructions (Antigen *Rapid GS. Brucella Ab Test Kit -22 Samsung 1-ro 4-gil, Hwaseong-si, Gyeoggi-do, 18449, Korea*). Briefly, sera (10µl) were added to the test device. Then, 4 drops (approximately 120µl) of assay diluent were added into the sample hole (s). The test was interpreted after 20min.

Indirect ELISA for Serum

The *PrioCHECK® Brucella Ab 2.0 ELISA* (*Veterinary Laboratories Agency, New Haw, Addlestone, Surrey KT 15 3NB United Kingdom, Version 1.1*) was used for in vitro detection of antibodies against *Brucella melitensis* in serum of sheep according to the manufacturer's protocol.

Statistical analysis

Chi-square

Pearson's Chi-square was adopted to estimate possible correlation between RBPT, Rapid test, ELISA and risk factors (city, sex, age, health status) using SPSS-22 (Statistical Package for Social Sciences 22).

Kappa test

Kappa test was used to measure possible agreement of the results recorded by ELISA, RBPT and rapid test using SPSS-22.

RESULTS

RBPT

Forty (7.3%) out of five hundred and fifty sera were positive reactors for *Brucella* spp. antibodies (Table 2, 5, 6, 7, 8; Fig 2).

Rapid test

Eighty-eight (16%) out of five hundred and fifty samples were positive for *Brucella* spp (Table 3, 5, 6, 7, 8; Fig 2).

ELISA

Eighty-five (15.5%) out of five hundred and fifty sera were reactive for *Brucella* spp. antibodies (Table 2, 5, 6, 7, 8; Fig 2).

Statistical analysis

Chi-square

Analysis of data revealed significant correlation between seroprevalence of *Brucella* spp. screened by RBPT according to city (-0.168), sex (-0.166) and age (0.121). Likewise, significant relationship between seropositivity detected by rapid test and city (-0.311), sex (-0.100) and age (0.088) were estimated. Similarly, ELISA results were correlated with city (-0.297), sex (-0.108) and age (0.085). There was no correlation between the prevalence and the health status of the animals tested. Furthermore, strong correlation between ELISA and rapid test (0.980), and moderate correlation (0.636) between ELISA and RBPT was noticed (Table 9).

Kappa test

Kappa test indicated moderate agreement between RBPT and ELISA (value=.583), while perfect agreement between rapid test and ELISA was estimated (value=.979) (Table 10).

Table (2): Potential of animal-level risk factors for brucellosis seropositivity detected by RBPT in sheep herds in Aljouf regions of the Saudi Arabia (March to April 2021)

City		**Skaka**	**Dumataljundal**	**Tabarjal**	**Qurayyat**	**Total**
Total	Count	175	125	125	125	550
	%	31.8%	22.7%	22.7%	22.7%	100.0
Negative	Count	160	102	123	125	510
	%	91.4%	81.6%	98.4%	100.0%	92.7
Positive	Count	15	23	2	0	40
	%	8.6%	18.4%	1.6%	0.0%	7.3%
Sex		**Male**		**Female**		**Total**
Total	Count	96		454		550
	%	17.5%		82.5%		100.0%
Negative	Count	80		430		510
	%	83.3%		94.7%		92.7%
Positive	Count	16		24		40
	%	16.7%		5.3%		7.3%
Age / month		**6-11month**	**12-18month**	**24-30month**	**36-48month**	**Total**
Total	Count	129	213	97	111	550
	%	23.5%	38.7%	17.6%	20.2%	100.0%
Negative	Count	127	199	83	101	510
	%	98.4%	93.4%	85.6%	91.0%	92.7%
Positive	Count	2	14	14	10	40
	%	1.6%	6.6%	14.4%	9.0%	7.3%
Health status		**No clinical signs**		**Clinical signs**		**Total**
Total	Count	509		41		550
	%	95%		7.5%		100%
Negative	Count	472		38		510
	%	92.7%		92.7%		92.7%
Positive	Count	37		3		40
	%	7.3%		7.3%		7.3%

Table (3): Potential of animal-level risk factors for brucellosis seropositivity detected by rapid test in sheep herds in Aljouf regions of the Saudi Arabia (March to April 2021)

City		**Skaka**	**Dumataljundal**	**Tabarjal**	**Qurayyat**	**Total**
Total	Count	175	125	125	125	550
	%	31.8%	22.7%	22.7%	22.7%	100.0%
Negative	Count	130	86	122	124	462
	%	74.3%	68.8%	97.6%	99.2%	84.0%
Positive	Count	45	39	3	1	88
	%	25.7%	31.2%	2.4%	0.8%	16.0%
Sex		**Male**		**Female**		**Total**
Total	Count	96		454		550
	%	17.5%		82.5%		100.0%
Negative	Count	73		389		462
	%	76.0%		85.7%		84.0%
Positive	Count	23		65		88
	%	24.0%		14.3%		16.0%
Age / month		**6-11month**	**12-18month**	**24-30month**	**36-48month**	**Total**
Total	Count	129	213	97	111	550
	%	23.5%	38.7%	17.6%	20.2%	100.0%
Negative	Count	114	181	79	88	462
	%	88.4%	85.0%	81.4%	79.3%	84.0%
Positive	Count	15	32	18	23	88
	%	11.6%	15.0%	18.6%	20.7%	16.0%
Health status		**No clinical signs**		**Clinical signs**		**Total**
Total	Count	509		41		550
	%	92.5%		7.5%		100.0%
Negative	Count	429		33		462
	%	84.3%		80.5%		84.0%
Positive	Count	80		8		88
	%	15.7%		19.5%		16.0%

Table (4): Potential of animal-level risk factors for brucellosis seropositivity detected by ELISA in sheep herds in Aljouf regions of the Saudi Arabia (March to April 2021)

City		**Skaka**	**Dumataljundal**	**Tabarjal**	**Qurayyat**	**Total**
Total	Count	175	125	125	125	550
	%	31.8%	22.7%	22.7%	22.7%	100.0%
Negative	Count	133	86	122	124	465
	%	76.0%	68.8%	97.6%	99.2%	84.5%
Positive	Count	42	39	3	1	85
	%	24.0%	31.2%	2.4%	0.8%	15.5%
Sex		**Male**		**Female**		**Total**
Total	Count	96		454		550
	%	17.5%		82.5%		100.0%
Negative	Count	73		392		465
	%	76.0%		86.3%		84.5%
Positive	Count	23		62		85
	%	24.0%		13.7%		15.5%
Age / month		**6-11month**	**12-18month**	**24-30month**	**36-48month**	**Total**
Total	Count	129	213	97	111	550
	%	23.5%	38.7%	17.6%	20.2%	100.0%
Negative	Count	115	181	80	89	465
	%	89.1%	85.0%	82.5%	80.2%	84.5%
Positive	Count	14	32	17	22	85
	%	10.9%	15.0%	17.5%	19.8%	15.5%
Health status		**No clinical signs**		**Clinical signs**		**Total**
Total	Count	509		41		550
	%	92.5%		7.5%		100.0%
Negative	Count	432		33		465
	%	84.9%		80.5%		84.5%
Positive	Count	77		8		85
	%	15.1%		19.5%		15.5%

Table (5): Percentage of *Brucella* spp. antibodies according to city

City	Percentage Positive with:		
	RBPT (%)	Rapid Test (%)	ELISA (%)
Skaka	37.5	51.1	49.4
Dumataljundal	57.5	44.3	45.9
Tabarjal	5.0	3.4	3.5
Qurayyat	0.0	1.1	1.2
Total	100	100	100

Table (6): Percentage of *Brucella* spp. antibodies according to sex

Sex	Percentage Positive with:		
	RBPT (%)	Rapid Test (%)	ELISA (%)
Male	40.0	26.1	27.1
Female	60.0	73.9	72.9
Total	100	100	100

Table (7): Percentage of *Brucella* spp. antibodies according to age

Age	Percentage Positive with:		
	RBPT (%)	Rapid Test (%)	ELISA (%)
6-11month	5.0	17.0	16.5
12-18month	35.0	36.4	37.6
24-30month	35.0	20.5	20.0
36-48month	25.0	26.1	25.9
Total	100	100	100

Table (8): Percentage of *Brucella* spp. Antibodies according to health status

Health status	Percentage Positive with:		
	RBPT (%)	Rapid Test (%)	ELISA (%)
Clinical signs	7.5	9.1	9.4
No clinical signs	92.5	90.9	90.6
Total	100	100	100

Table (9): Pearson's Chi-square of the seropositivity, city, sex, age, health status and the serological tests (RBPT, Rapid test and ELISA)

		City	Sex	Age	Health status	RBPT	Rapid test	ELISA
RBPT	Pearson Correlation	-.168**	-.166**	.121**	.000	1	.642**	.636**
	Sig. (2-tailed)	.000	.000	.004	.991		.000	.000
	N	550	550	550	550	550	550	550
Rapid test	Pearson Correlation	-.311**	-.100*	.088*	.027	.642**	1	.980**
	Sig. (2-tailed)	.000	.019	.039	.525	.000		.000
	N	550	550	550	550	550	550	550
ELISA	Pearson Correlation	-.297**	-.108*	.085*	.032	.636**	.980**	1
	Sig. (2-tailed)	.000	.011	.047	.456	.000	.000	
	N	550	550	550	550	550	550	550

*. Correlation is significant at the 0.05 level (2-tailed)

**. Correlation is significant at the 0.01 level (2-tailed)

Table (10): Agreement of RBPR and Rapid test with ELISA as determined by Kappa test

		RBPT		**Total**
		Negative	**Positively**	
ELISA	**Negative**	464	1	465
	Positive	46	39	85
Total		510	40	550

	Value	**Asymp. Std. Errora**	**Approx. Tb**	**Approx. Sig.**
Measure of Agreement	.583	.053	14.908	.000
N of Valid Cases		550		

		Rapid test		
		Negative	**Positive**	
ELISA	**Negative**	462	3	465
	Positive	0	85	85
Total		462	88	550

	Value	**Asymp. Std. Error[a]**	**Approx. T[b]**	**Approx. Sig.**
Measure of Agreement	.979	.012	22.974	.000
N of Valid Cases		550		

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Fig (1): Map of Kingdom of Saudi Arabia showing Aljouf region. Northwest of the Kingdom of the Saudi Arabia.

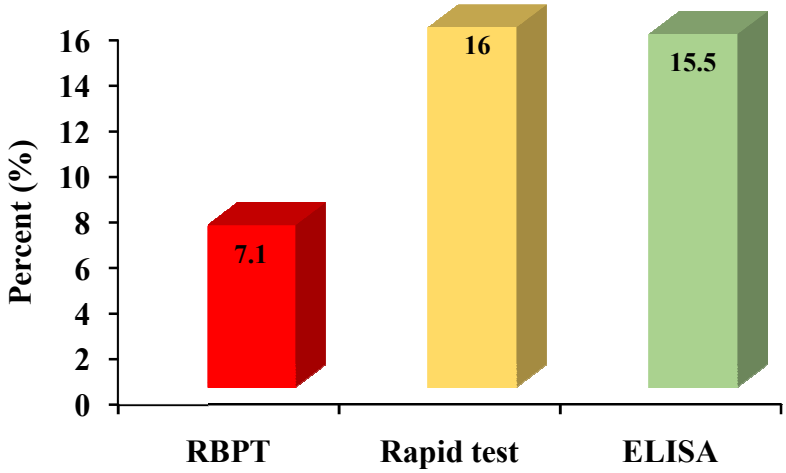

Figure (2): Percentage of seropositivity of ovine brucellosis as tested by RBPT, rapid test and ELISA

DISCUSSION

The seroprevalence was comparable to that recorded in India (Suryawanshi et al., 2016). However, it was inconsistent with the previous studies carried out in other parts of the country including Hail (11.4%), western region (15.6%), Makkah (14.2%) and Asir (12.3%) (Abdellatif *et al.,* 2020; El-rahim, 2014; Bilal *et al.,* 1991; Radwan *et al.,* 1983). Inconsistency in the prevalence of ovine brucellosis in different areas may be attributed to the fact that the prevalence of brucellosis may vary depending upon the breed involved, herd size, management, and seasonality of the disease, which could affect the rate of transmission of *Brucella* infection. City wise prevalence was supported by Acha and Szyfres (2003) who reported that the rate of *Brucella* infection varies greatly from one country to another and between regions even within a country. Difference in seroprevalence according to city might be related to the number of animals related to the grazing area in the regions investigated. The antibodies detected in males were higher than in females. Shafy *et al.* (2016) recorded that the prevalence among females (39.2%) is higher than males (18%), it may be linked to the interaction of other risk factors that might affect the prevalence of the antibodies among sheep and it might need further investigation. Age wise percentage agreed with Shafy *et al.* (2016) who reported that the percentage in adults (57%) was higher than in young animals (8.1%), lowered incidence among young animals may be owed to the immunization acquired by maternal immunoglobulins. Previous literature indicated that with exception of age, no other factors had an effect on the percentage of brucellosis in sheep, neither for RBPT- nor for SAT-seropositive statuses in Sudan (Abdallah *et al.,* 2015). Inapparent infection may be due to the immune status of the animal or the virulence of the circulating strain.

The higher percentage of antibodies detected by rapid test compared to RBPT may be related to the sensitivity and specificity of the test (El-Eragi *et al.,* 2014). The performance of the rapid test is regarded as sensitive, specific, and accurate among the current different diagnostic techniques (Büyüktanır *et al.,* 2012). Immunoenzymatic techniques may present an

advantage over non-enzymatic techniques for the sensitive detection of ovine *Brucella*-specific antibody. City wise results revealed variation according to the regions investigated. According to the best of our knowledge, no previous data were so far available concerning the prevalence of ovine brucellosis in the region. Difference of seroprevalence may be owed to host population density, age, prevailing management practices and the social environment that can influence the contact rates. The prevalence was higher among males compared to females. Radostitis *et al.* (1994) found that males are often resistant compared to female animals to Brucellosis. Hirsh and Zee (1999) have described that male animals are less susceptible to infection, due to the absence of erythritol. Furthermore, Crawford *et al.* (1990) found that the immune response of male animals to *Brucella* infection is limited and testes of infected male animals were usually observed to be non-reactors or exhibited low antibody titers. Difference in our results may be related to small number of males tested as compared to females. The percentage of antibodies is higher in adults than in young. It has been reported that brucellosis is essentially a disease of sexually mature animals (Radostits *et al.,* 2000; Quinn *et al.,* 1999). Higher prevalence rate may be due to sex hormones and erythritol, which may stimulate the colonization of *Brucella*, and tend to increase in concentration with age and sexual maturity (Radostitis *et al.,* 2007). Clinically, 15.7% of the reactive animals were healthy and 19.5% were suspected. Subclinical infection may be due to the immune status of the animal and/or the strain of the bacteria involved in the infection.

The ELISA results were similar to those obtained by Sharma *et al.* (2017). Al-Hankawe and Rhaymah. (2012) described higher rate by ELISA (15.9%) then modified Rose-bengal test (13.4%), Rose Bengal test (11.8%), tube agglutination test (6.9%) and 2-Mercapto-ethanol test (8.2%). In the contrary, few authors have published lower seropositivity by ELISA compared to the RBPT (Sharifi *et al.,* 2015). The percentage estimated by ELISA was higher than that obtained by RBPT. The percentage obtained related to the higher sensitivity of ELISA to detect anti-Brucella antibodies in all species especially small ruminant, several studies indicated that ELISA is more sensitive than conventional tests (ElTahir *et al.,* 2018). Discrepancy in the records may be due to introduction of infected animals into flocks, as well as the absence of quarantine measures, mixing of different species of infected flocks, improper disposal of aborted fetus placenta membranes, contact of healthy animals with contaminated drinking water, grassing yards and feed, and lack of vaccination and control strategies for small ruminants (Sadhu *et al.,* 2015; Unver *et al.,* 2006). Sex wise seroprevalence was similar to the previous reports (Samadi *et al.,* 2010; Al-Majali, 2005; Kabagambe *et al.,* 2001). But it contrasts with that reported by Ebid *et al.* (2020), who described that female were more susceptible than males. So, female might have act as reservoir for brucellosis (Shafy *et al.,* 2016). Contrary may be due to the number of the sex tested in each investigation (Ebid *et al.,* 2020). Age based results was similar to Rajala *et al.* (2016) who stated that sheep population of age greater than 1.5 years had significantly higher odds of *Brucella* seropositivity than the younger ones. It is also supported by many other studies (McDermott and Arimi, 2002; Martin, 1993) that younger animals were more resistant to infection than adult animals. This might be true because older animals remained in the flock for a long time, and they had a longer duration of exposure. Based on the health status, 15.1% of the reactive animals were healthy, while 19.5% were suspected. Inapparent infection may occur due to that animals were in incubation period, immune status of the herds and/or the virulence of the strain of the bacteria.

Analysis of data revealed significant correlation between seroprevalence of *Brucella* spp. and city, sex and age. There was no correlation between the prevalence and the health status of the animals tested. Results of this investigation was in accordance to that observed by Rahman *et al.* (2011a). However, it contradicted with Akhter *et al.* (2014) who found that none of these risk factors was associated with brucellosis in sheep. Contradiction in the previous reports may be attributed to variation in the risk factors in terms of sex, age, district, breed, stillbirth and neonatal losses at both individual animal and flock level (Gebremedhin, 2015; Akhter *et al.,* 2014). Furthermore, strong correlation between ELISA and rapid test, and moderate correlation between ELISA and RBPT was recorded. The results agreed with Büyüktanır *et al.* (2012), which may be related to the high affinity of the antibodies to the antigens used in ELISA and rapid tests. Rapid test was considered as similar to an ELISA because of its enzymatic immunoassay based nature, equivalent performance to ELISA, individual applicability, and ability to determine seropositive animals in less than 5 min (Genc *et al.,* 2011; Buyuktanir *et al.,* 2008; Raj *et al.,* 2008).

CONCLUSION

Seroprevalence of *Brucella* spp. among sheep in Aljouf region Saudi Arabia was 7.3% by RBPT, 16% by rapid test and 15.5% by ELISA. The prevalence significantly correlated with city, sex and age. Nevertheless, no significant association between the prevalence and health status of the animal was found. Kappa test showed perfect agreement between ELISA and rapid test. On the other hand, moderate agreement between ELISA and RBPT was estimated. Large-scale epidemiological studies are needed to better understand possible risk factors involved in the epidemiology and to implement effective control measures.

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معدل الانتشار المصلي للبروسيلا في الأغنام بمنطقة الجوف، المملكة العربية السعودية

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في هذا العمل، تم تحديد انتشار البروسيلا. تم فحص الأجسام المضادة بين الأغنام في منطقة الجوف بالمملكة العربية السعودية. جمعت خمسمائة وخمسون مصلاً عشوائياً خلال الفترة من مارس إلى أبريل ٢٠٢١ من الأغنام من جميع الأجناس والأعمار والسلالات في المنطقة. تم اختبار عينات من الأجسام المضادة المنتشرة ضد البروسيلا. بواسطة الروز بنقال، الاختبار السريع والاليزا. تم اعتماد مربع كاي سكوير لتقدير العلاقة المحتملة بين الروز بنقال والاختبار السريع و الاليزا وعوامل الخطر المعنية. تم استخدام اختبار كابا لقياس مدى توافق النتائج والاختبارات المعتمدة. كانت أربعون مصل (٧.٣٪) موجبة للبروسيلا. أجسام مضادة لـ الروز بنقال، ٢٣ (١٨.٤٪) في دومة الجندل، ١٦ (١٦.٧٪) بين الذكور، مقارنة بـ ٢٤ (٥.٣٪) بين الإناث، ٢٨ (٧٠٪) كانت إيجابية بين المجموعات العمرية ١٢-٣٠ شهرًا. من ناحية أخرى، كانت ثمان وثمانين (١٦٪) موجبة بالفحص السريع، ٣٩ (٣١.٢٪) في دومة الجندل ، ٢٣ (٢٤.٠٪) بين الذكور، مقابل ٦٥ (١٤.٣٪) للإناث، نسبة أعلى (٢٠.٧٪) من الأجسام المضادة في عمر ٣٦-٤٨ شهرًا. كشفت الاليزا أن خمسة وثمانين عينة (١٥.٥٪) كانت موجبة بواسطة الاليزا، ٣٩ (٣١.٢٪) في دومة الجندل، ٢٣ (٢٤٪) بين الذكور، مقابل ٦٢ (١٣.٧٪) للإناث، نسبة أعلى (١٩.٨٪) من الإيجابية. تم العثور عليها في سن ٣٦-٤٨ شهرًا. تم تسجيل ارتباط كبير بين الانتشار المصلي الذي تم فحصه بواسطة الروزبنقال والمدينة (-٠.١٦٨) والجنس (-٠.١٦٦) والعمر (٠.١٢١). وبالمثل، تم تقدير علاقة معنوية بين الإيجابية المصلية المكتشفة عن طريق الاختبار السريع والمدينة (-٠.٣١١) والجنس (-٠.١٠٠) والعمر (٠.٠٨٨). ارتبطت نتائج الاليزا بالمدينة (-٠.٢٩٧) والجنس (-٠.١٠٨) والعمر (٠.٠٨٥). أظهر التحليل وجود علاقة قوية بين الاليزا والاختبار السريع (٠.٩٨٠)، لوحظ ارتباط متوسط (٠.٦٣٦) بين الاليزا والروزبنقال. أشار اختبار كابا إلى اتفاق معتدل بين روزبنقال والاليزا (القيمة = ٠.٥٨٣)، بينما تم تقدير التوافق التام بين الاختبار السريع والاليزا (القيمة = ٠.٩٧٩). هناك حاجة إلى تحقيق وبائي واسع النطاق لفهم عوامل الخطر المحتملة ذات الصلة بشكل أفضل ولتنفيذ تدابير المكافحة الفعالة.

الكلمات المفتاحية: الانتشار المصلي، الحمى المالطية، الضأن، منطقة الجوف، المملكة العربية السعودية