International Journal of Animal and Veterinary Advances 5(2): 82-86, 2013
ISSN: 2041-2894; e-ISSN: 2041-2908

Submitted: January 21, 2013 Accepted: February 18, 2013 Published: April 20, 2013

Sero-Prevalence and Epidemiology of Brucellosis in Camels, Sheep and Goats in Abu Dhabi Emirate

[1]Maymona A Mohammed, [2]Mohamed T Shigidy and [3]Abdulwahab Y Al juboori
[1]Department of Animal Production, Ministry of Animal Resources and Fisheries-Khartoum-Sudan
[2]University of Khartoum-Department of Microbiology-Faculty of Veterinary Science, Khartoum-Sudan
[3]Veterinary Consultant-Abu Dhabi Food Control Authority (ADFCA), Abu Dhabi-UAE

Abstract: Brucellosis is a disease of animals caused by *Brucella* species and is transmissible to humans. This study was undertaken to determine the sero-prevalence of the disease in livestock including sheep and goats and camels, in different regions of Abu Dhabi emirate and to identify factors associated with the epidemiology of the disease. A serological study using 6126 blood samples from livestock were obtained from 267 farms (Izaba) during the period from January 2009 to December 2010. The Rose Bengal Plate Test and competitive ELISA were used as screening and confirmatory tests, respectively. The overall sero-prevalence of *Brucella* antibodies was 8.00% and 7.00% detected by the RBPT by c-ELISA respectively. *Brucella* prevalence was 8.3, 5.9 and 4.7% in Alain, Abu Dhabi and Western region. The prevalence of the disease was higher (8.4%) in sheep and goats than (4.4%) in camels respectively. The result showed that, the prevalence of brucellosis was significantly higher in females than male ($p<0.04$) Out of the 267 farms sampled in the study, 147 (55.1%) were infected with *Brucella*. There was strong correlation between herd size and prevalence of the disease, very large herds had significantly higher prevalence when compared with small ones. The study revealed light of a size able prevalence among livestock in Abu Dhabi Emirate and the results reflect the necessity of a control program of the disease is needed to be adopted.

Keywords: *Brucellosis*, c-ELISA, epidemiology, sero-prevalence, zoonotic

INTRODUCTION

Brucellosis is an infectious bacterial disease caused by the genus *Brucella* and affecting a number of animal species (Hirsh and Zee, 1999). It is a worldwide zoonotic disease that is recognized as a major cause of heavy economic losses to the livestock industry and poses serious human health hazard (Ocholi *et al*., 2005). In animals, it is a significant cause of reproductive losses usually caused by *B. abortus* in cattle, *B. melitensis* and *B. ovis* in small ruminants, *B. suis* in pigs and *B. canis* in dogs (Khorasgani *et al*., 2008).

The disease is endemic particularly in Mediterranean, Middle East and the Arabian Gulf, parts of Africa, Europe and Latin America. Consumption of contaminated foods and occupational contact remain the main sources of infection (Annapurna *et al*., 2012). The disease is reported in domestic animals and humans in Oman, Qatar, Kuwait and Saudi Arabia which share border with United Arab Emirates (Yasmin and Remya, 2011).

In Abu Dhabi emirate, where a large number of animals are kept closed as mixed flocks, there is a relatively lack of information about the epidemiology of brucellosis in livestock, accompanied with an absence of control measures and programs especially in the non commercial farms. Earlier studies carried out in 1989 revealed that the average *Brucella* prevalence was 6.4% in goats, 5.4% in sheep and 1.5% in camels and then degreased in 1990 to 3.4, 2.0 and 2%, respectively (Refai, 2002).

All the previous studies conducted in Abu Dhabi Emirate were either in a limited area and/or period and did not reflect the exact impact of the prevalence of brucellosis in the emirate. Moreover, up to date, no systemic research on the epidemiology of brucellosis that cover all the regions of Abu Dhabi Emirate was carried out to best of our knowledge, therefore, the objective of this study was to investigate the sero-prevalence of the disease in large number of different animal species including camel, sheep and goats distributed randomly in Abu Dhabi emirate and to elucidate the role of risk factors in the spread of the disease among livestock. This in turn will provide a base for the designation of the suitable control program of the disease.

MATERIALS AND METHODS

Animals and samples: The study was conducted during the period from January 2009 to December 2010 in three main regions of Abu Dhabi emirate, Abu Dhabi

Corresponding Author: Maymona A Mohammed, Department of Animal Production, Ministry of Animal Resources and Fisheries-Khartoum-Sudan, Tel.: +971508145706

region, Alain region and Western region. The number of animals sampled was determined according to Pfeiffer (2002) and Robinson (2003).Sampling was conducted in two stages, randomly selected herds then randomly selected animals within those herds based on the animal populations. The regions were stratified into three regions: Abu Dhabi, Alain and Western region; sex of animals into two groups: males and females; and the herd size into four categories: small herd (<50), medium herds (50<150), large herds (150<500) and very large herds (>500).

A total of 6126 blood samples of both sexes of sheep, goats and camels were randomly collected from 267 mixed farms (*izba*) located in three regions of Abu Dhabi emirate. They were 664 males and 3649 females of sheep and goats from 257 herds; 170 males and 1643 female of camels collected from 188 herds. About 5-10 mL of blood was drawn from a jugular vein of each apparently healthy animal using a plain vacutanier tube (without EDTA).Tubes were incubated over night at 4ºC and serum was then separated by centrifugation. The collected sera were lapelled and stored at-20ºC until used.

Animal experiments were conducted in accordance with the guidelines provided by the Ministry of Environment and Water, United Arab Emirate. All experiments complied with article number 12 of animal welfare federal law number 16 for 2007.

Rose Bengal Plate Test (RBPT): All serum samples were screened by the RBPT for the presence of antibodies against *Brucella* antigens. The test was performed on round-bottom-welled plastic plates according to Alton *et al*. (1988) using the antigens, positive and negative control provided by the Veterinary Laboratory Agency (VLA), Weybridge, UK. Before testing, both sera and the antigen were left at room temperature to reach about 25 ˚C. Equal volumes of test serum and antigen (30µL) were placed on the plate test and mixed thoroughly by stirrer. The plate was then shaken on a rocker for 4 min. Later, all degrees of agglutination reaction were read and recorded as positive if there were visible agglutinations or as a negative result if there were no visible agglutinations at the end of the agitation period (OIE, 2008).

Competitive Enzyme-Linked Immunosorbent Assay (c-ELISA): The positive or doubtful samples with RBPT were further confirmed by the c-ELISA (CVL, New Haw, Weybridge, surrey KT15 3NB UK) according to the manufactory instruction. The cut-off for determining sero-positivity was calculated as ≥60% of the mean of the Optical Density (OD) of the 4 conjugates control wells and antibody titres were calculated as binding ratio using the formula defined by the c-ELISA kit manufacturer as follow:

$$\text{Banding ratio} = \frac{\text{Mean of 6 negative control wells}}{\text{Mean of 6 positive control wells}}$$

Analysis of data: Data was statistically analyzed by Chi-square and t-test for independence comparison test using the statistical software program (SPSS for Windows version 15, USA). Differences were considered significant at $p<0.05$.

RESULTS

Screening of animals for *Brucella* antibodies: RBPT results showed that, out of the 6126 livestock sera tested, 506 (8.30%) were positive by RBPT. Prevalence of brucellosis was higher (9.5%) in sheep and goats than that observed (5.4%) in camels (Table 1). Highest prevalence of *Brucella* antibodies in sheep and goat was observed in Alain region (11.5%) followed by lower prevalence's of (7.5%) and (7.3%) in Abu Dhabi and the western regions respectively. In comparison the highest prevalence of Brucella antibodies in camel was also observed in Alain region (5.6%) followed by lower prevalence's of (5.2%) and (4.9%) in Abu Dhabi and the western regions respectively (Table 2).

Prevalence of brucellosis in animals: To obtain the real sero-positive reactors, the positive or doubtful samples with RBPT were further confirmed by the c-ELISA. Out of the 506 positive sera tested by RBPT, 441 samples which represent 7.00% of the total samples (6126) used in the study were found to be positive by c-ELISA. The overall prevalence of brucellosis detected by c-ELISA remains higher in sheep and goats (8.4%) followed by low prevalence's of (4.4%) observed in camels (Table 3). With regard to regions under study the highest prevalence of brucellosis calculated from c-ELISA results in different species of livestock was 8.3% in Alain followed by 5.9% in Abu Dhabi were as the lowest prevalence was 4.7% observed in the Western region. Similarly in sheep and goats *Brucella* antibodies detected by c-ELISA decreased to (10.7%), (6.52%) and (5. 26%) in Alain, Abu Dhabi and western regions respectively. The decrease in antibody prevalence in camel was (4.66%), (4.42%) and (3.15%) in Alain, Abu Dhabi and western regions respectively (Table 4).

The prevalence of the brucellosis detected by c-ELISA in females of different species was significantly higher (3.5-8.5%) than that found in males (1.3-5%) (Fig. 1), chi-square ($p<0.05$).

Out of the 267 farms (*izba*) sampled 147 (55.1%) were found to be infected with *Brucella* by c-ELISA. These were 81 (61.8%), 39 (50.6%) and 27 (47.8%) out

Table 1: Positive reactors for brucellosis with RBPT in different species of animals

Animals species	No. of samples	No. of positive	(%)
Sheep and goat	4313	409	9.5
camel	1813	97	5.4
Total	6126	506	8.3

Table 2: Positive reactors for brucellosis with RBPT in three regions of Abu Dhabi emirate

	Animals species				
	Sheep and goat		Camel		
Region	No. of samples	No. of positive (%)	No. of samples	No. of positive (%)	Total
Abu Dhabi	1150	86 (7.5%)	520	27 (5.2%)	(113) 6.8%
Al Ain	2213	254 (11.5%)	1008	56 (5.6%)	(310) 9.6%
Western region	950	69 (7.3%)	285	14 (4.9%)	(83) 6.7%

Table 3: Positive reactors for brucellosis with c-ELISA in different species of animals

Animals species	No. of samples	No. of positive	(%)
Sheep and goat	4313	362	8.4
Camel	1813	79	4.4
Total	6126	441	7.2

Table 4: Positive reactors for brucellosis with c-ELISA in three regions of Abu Dhabi emirate

	Animals species				
	Sheep and goat		Camel		
Region	No. of Samples	No. of positive(%)	No. of Samples	No. of Positive(%)	Total (%)
AbuDhabi	1150	75 (6.52%)	520	23 (4.42%)	(98)5.9
Al Ain	2213	237 (10.70%)	1008	47 (4.66%)	(284)8.8
Westernregio	950	50 (5.26%)	285	9 (3.15%)	(59) 4.8

Table 5: Sero-prevalence of brucellosis in the farms in the different regions

Region	Total no. of farms	NO. of infected farms	(%)
Abu Dhabi	77	39	50.7
Al Ain	131	81	61.8
Western region	59	27	45.8
Total	267	147	55.1

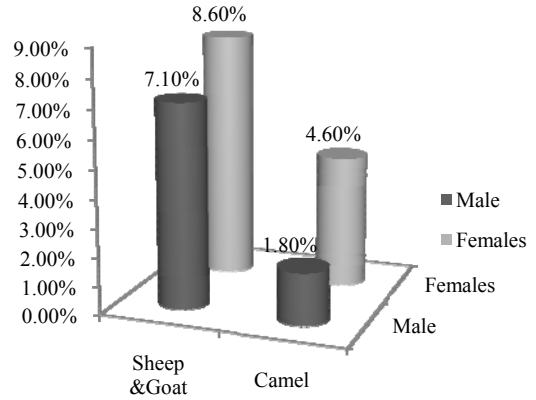

Fig. 1: Sero-prevalence of brucellosis in the different animal species according to sex

of 131,77 and 59 farms located in Alain, Abu Dhabi and western region, respectively (Table 5).

The sero-prevalence of the disease in a total of 230 herds of different animal species was 37.7% and 29.7% out of 77 and 55 sheep and goats and camel herds respectively. Regarding to the herd size, the prevalence of brucellosis detected by c-ELISA in herds of the different livestock species (camels, sheep and goats) was high (12%) in very large herds (very large herds (>500) in contrast with mall (<50), medium (50<150) and large herds (150<500) ($p<0.05$) (Fig. 2).

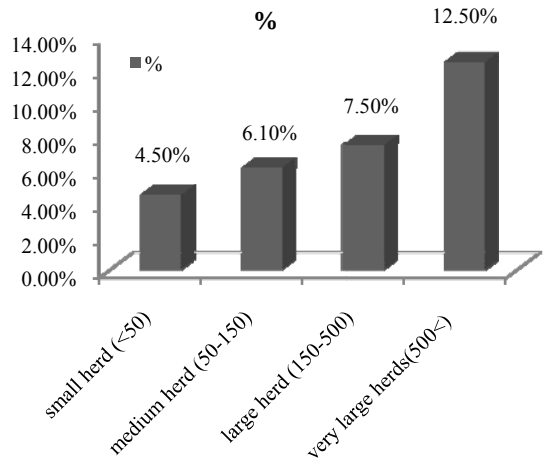

Fig. 2: The prevalence of the disease in the different species of livestock based on the herd size

DISCUSSION

Pastoral communities of Abu Dhabi Emirate raise livestock primarily as social traditional activity and economic income from meat and milk production. The major risk factors of human brucellosis infection that include contact with animals and the ingestion of raw camel milks are a common and consistent traditions in the Bedouin society. In United Arab Emirates in general and in Abu Dhabi Emirate in special regardless of the previous documented high occurrence of brucellosis in animals, neither control program is currently adopted nor an epidemiological study was carried out. Therefore, this study was designed to systemically investigate the sero-prevalence and risk factors associated with brucellosis in different livestock species in Abu Dhabi Emirate. Information obtained from this study will outline measures for brucellosis control.

In this study the overall prevalence of brucellosis obtained by RBPT screening of sheep and goats and camels (6126) samples targeted in the three regions of Abu Dhabi emirate was 8.30%, however this prevalence was reduced to 7.20% when the c-ELISA was used as a confirmatory test for the RBPT positive samples. This variation in prevalence by RBPT and c-ELISA tests could be attributed to false positive obtained by the former test which has been described as a highly sensitive but not specific test, while the latter is both a specific and sensitivity test and can eliminate

cross-reaction due to heterogeneous bacteria and can minimize false positive as previously described (Farouk *et al*., 2011).

According to livestock species, the study pointed that, prevalence of brucellosis confirmed by c-ELISA was higher in sheep and goats (8.4%) than that of camels (4.4%). The same phenomenon of higher prevalence of *Brucella* in sheep and goats was observed in all regions of Abu Dhabi Emirate. Sheep and goats represent the large number of animal's population in the emirate. These animals are kept overcrowded and reared in open system in which animals in different ages ; aborted and pregnant ones; males and females are housed together in high stocking density. In the traditional sector, infected animals with *Brucella* are usually kept for breeding despite the fact that congenital infection is a major epidemiological means of spread of the disease and it is well known that as high as 20% of calves born by to infected heifer's could be found persistently infected with brucellae (Nielsen and Duncan, 1990).

In contrast the prevalence of brucellosis in sheep and goats in this study was higher than those reported by a survey done in 1989 and 1990 in Abu Dhabi emirate (Refai, 2002). Also the sero-prevalence of brucellosis in camels in observed here was found to be higher than that reported by Afzal and Sakkir (1994), Moustafa *et al*. (1998) and Refai (2002). These differences in sero-prevalnces may be due to the difference in number of samples collected and the difference of diagnostic techniques used each study.

In this study the sero-prevalence of brucellosis was significantly higher in females than male ($p<0.04$). This is in accordance with Hussein *et al.* (2005) and Solmaz *et al.* (2004). In all herds sampled, females were higher in number than males. In addition, females are comparatively under greater physiological stress during pregnancy and lactation which make them more susceptible to infection (Walker, 1999). Radostits *et al*. (2007) have shown that erythritol, a polyhydric acid found in higher concentration in the placenta and fetal fluids of females than in seminal vesicles and testis of males can be responsible for females being more susceptible than males.

Variability in prevalence of brucellosis between animal farms was observed in the three regions under this study. Highest (61.8%) prevalence of disease in livestock farms was recorded in Alain region. This might be attributed to the fact that more than 50% of the Abu Dhabi emirate's total livestock is in Alain region. Moreover, the absence of disease control measures especially in the traditional section, methods of husbandry including farming systems and practices, livestock movements, mixing and trading of animal and sharing of grazing grounds might have played a role in the increased prevalence in the region (Kabagambe *et al*., 2001). In contrast, the comparatively lower (47.8%) prevalence of the disease in the Western region farms could be due to the systems of animal husbandry practices, where animals range in low accumulation density in vast areas and the fact that chances of close contact between animals is low, with a resultant of decreased exposure. Also the climate of the area is arid with absolute temperature above 40 °C from March to November and yearly average of 9.6 h sunlight a day. Dryness and sunlight during long summer seasons are expected to decrease the survival chances of the organisms because of the sensitivity of brucellae to ultraviolet radiation and heat (Deutcher, 2006).

The results obtained here revealed that, herd size appears to be a major risk factor for brucellosis compared with other factors ($p = 0.000$). As herd size increases, the chance of contact between animal increases too, which leads to more chances of infection (Abbas and Agab, 2002) especially during calving or abortion when most of brucellosis contamination occurs (Gameel *et al*., 1993) and together with poor management are directly related to infection rate (Abou-Eisha, 2000; Wernery and Kaaden, 2002).

In conclusion, the prevalence of brucellosis in Abu Dhabi emirate was found to be high in both sheep and goats and camel. Higher prevalence of the disease was in females and large herd sizes and than males and small herds sized respectively. The prevalence was higher in Alain region followed by Abu Dhabi and western region. Results reflect the necessity of a control program of the disease is needed to be adopted.

ACKNOWLEDGMENT

This study was funded by the Abu Dhabi Food Control Authority (ADFCA)-Abu Dhabi-UAE. The authors gratefully acknowledge the critical review and editing of this manuscript by Dr. Yassir. M. Eltahir, Department of preventive medicine, University of Nyala. Thanks is due to Dr. Ibrahim Mohammed Abdulla. PhD. Associate professor, Statistics College of Business and Economics, University of United Arab Emirate-UAE for the clustering analysis and method of calibration of sample size. We are indebted to Abu Dhabi, Alain and Western region Veterinary Services staff for their help in the field. Sincere appreciation is to the Central Veterinary Laboratory, Ministry of Environment and Water, Sharja, for the provision of Laboratory facilities.

REFERENCES

Abou-Eisha, A.M., 2000. Brucellosis in camels and its relation to public health. Asuit. Vet. Med. J., 44(87): 54-64.

Abbas, B. and H. Agab, 2002. A review of camel brucellosis. Prev. Vet. Med., 55: 47-56.

Afzal, M. and M. Sakkir, 1994. Survey of antibodies against various infectious disease agents in racing camels in Abu Dhabi, United Arab Emirates. Rev. Sci. Tech., 13: 787-792.

Alton, G.G., L.M. Jones, R.D. Angus and J.M. Verger, 1988. Techniques for the Brucellosis Laboratory. 1st Edn., Institut National de la Recherche Agronomique, Paris, pp: 21-145.

Annapurna, S.A., I. Srikrishna and K. Prabhudas, 2012. Seroprevalence Study of Human Brucellosis by Conventional Tests and Indigenous Indirect Enzyme-Linked Immunosorbent Assay. The Scientific W. J. Article ID 104239, pp: 5.

Deutcher, W., 2006. Klimadatenbank. WWW.dwd.de. Deutscher Wetterdienst, Offenbach, Germany.

Farouk, U.M., I. Salisu, A. Ikwe and O.J.O. Bale, 2011. Prevalence of Bovine Brucellosis and Risk Factors Assessment in Cattle Herds in Jigawa State. ISRN Veterinary Science, DOI: 10.5402/2011/132897.

Gameel, S.E.A.M., S.O. Mohammed, A.A. Mustafa and S.M. Azwai, 1993. Prevalence of camel brucellosis in Libya. Trop. Animal Health Prod., 25: 91-93.

Hirsh, D.C. and C.Y. Zee, 1999. Veterinary Microbiology. Blackwell Science Ltd., USA, pp: 196-202.

Hussein, A.A.A., A.S.M. Sayed and M.A. El-Feki, 2005. Seroepidemiological study in human brucellosisin assiut govermorate. Egeypt. J. Immunol., 12: 49-56.

Kabagambe, E.K., P.H. Elzer, J.P. Geaghan, J. Opuda-Asibo, D.T. Scholl and J.E. Miller, 2001. Risk factors for Brucella seropositivity in goat herds in eastern and western Uganda. Prev. Vet. Med., 52: 91-108.

Khorasgani, R., M. Esmaeili, M.R. Pourkarim, A.R. Mankhian and T.Z. Salehi, 2008. Anti-brucella antibodies in blood donors in boushehr. Iran Comparat. Clin. Patho., 17: 267-269.

Moustafa, T., E.A. Omer, S.M. Basyouni and A.S. El-Badawi, 1998. Surveillance of brucella antibodies in camels of the eastern region of Abu Dhabi, United Arab Emirates. Proceeding of the 3rd Annual Meeting for Animal Production Under Arid Conditions, United Arab Emirates University, 1: 160-166.

Nielsen, K.H. and J.R. Duncan, 1990. Animal Brucellosis. Flor., CRC Press Int., Boca Raton, pp: 238.

Ocholi, R.A., J.K.P. Kwaga, I. Ajogi and J.O.O. Bale, 2005. Abortion due to *Brucella abortus* in sheep in Nigeria. Rev. Sci. Tech. Off. Int. Epiz., 24: 973-979.

OIE, 2008. Manual of Standard for Diagnostic Tests and Vaccines: Bovine Brucellosis. OIE, Paris, pp: 624-659.

Pfeiffer, D.U., 2002. Veterinary Epidemiology-An Introduction. Royal Veterinary College, Hawkshead Lane, United Kingdom, pp: 34-36.

Radostits, O.M., C.C. Gray, K.W. Hinchcliff and P.D. Constable, 2007. Veterinary Medicine: A Textbook of the Diseases in Cattle, Horses, Sheep, Pigs and Goats. Saunders Elsevier, London, UK.

Refai, M., 2002. Incidence and control of brucellosis in the Near East region. Vet Microbiol., 90: 81-110.

Robinson, A., 2003. Guidelines for Coordinated Human and Animal Brucellosis Surveillance. FAO Animal Production and Health Paper 156, ISSN: 0254-6019.

Solmaz, H., M. Tutuncu, H. Akhan, A. Aksakal, T. Gulhan and B. Boynukara, 2004. Brucellosis in horses around Van, Turkey. Indian Vet. J., 81(7): 748-749.

Walker, R.L., 1999. Brucella. In: Hirsh, D.C. and Y.C. Zee (Eds.), Veterinary Microbiology. Blackwell Science Inc., London, pp: 196-203.

Wernery, U. and O.R. Kaaden, 2002. Infectious Diseases of Camelids. Blackwell Science Inc., London, pp: 99-116.

Yasmin, E.E. and R.N. Remya, 2011. Prevalence of brucellosis in the sultanate of Oman with reference to some Middle-East countries. Vet. Res. J., 4(3): 71-76.