High seroprevalence of bluetongue virus antibodies in Sheep, Goats, Cattle and Camel in different districts of Saudi Arabia

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Abstract

Aim: To estimate the prevalence and distribution of serum antibodies to BTV in different domesticated animals in different localities of Saudi Arabia.

Materials and Methods: A total of 4845 field sera collected from different animal species within 10 districts in the Kingdom of Saudi Arabia were screened for the presence of group-specific BTV antibodies by competitive ELISA (c ELISA).

Results: The overall BTV antibody prevalence was 54.1%, 53.3%, 44.8% and 25.7% in sheep, goat, cattle and camel respectively (at 95% confidence level). The Jizan and Eastern Province districts were the regions with the highest prevalence resulting 65.8% of sheep, 68.2% of goats, 49.3% of cattle, 44% of camel in Jizan and 65.8% of sheep, 62.5% of goats, 53.4% of cattle, 28.5% of camel in Eastern Province positive to c-ELISA. The second highest rate was in Najran district where the seropositivity for Bluetongue was found to be 60% of sheep, 57.9% of goats, 47.2% of cattle and 29.3% of camel. Our results recorded positive animals in all examined districts which indicate serological evidence of exposure to infection was widely distributed all over the country.

Conclusions: These results demonstrate the high occurrence of the BTV that emphasize the necessity to a well-defined control strategy for preventing and controlling the BTV in Saudi Arabia.

Key words: Bluetongue virus; c-ELISA; Saudi Arabia; Seroprevalence

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Introduction

Bluetongue virus (BTV) is an arbovirus (arthropod borne virus) that belong to the genus *Orbivirus* within the family *Reoviridae* [1] BTV is a small (80 nm in diameter) icosahedral virus of a double-layered protein coat with a ten-segmented, double-stranded RNA genome that encode four non-structural (NS1, 2, 3 and 3A) and seven structural (VP1-VP7) proteins [2,3,4]. There are 24 immunologically distinct BTV serotypes (BTV1 to BTV24) currently recognized worldwide, and recently described Toggenburg virus is proposed to be a 25th serotype [5].

BTV is the causative agent of bluetongue disease, which can infect all ruminants although the disease is normally most evident in sheep [6]. It is capable of inducing a severe haemorrhagic disease with high mortality rate especially in naive domestic sheep [7]. Sheep and some wild ruminants display a variety of clinical manifestations, ranging from subclinical infections or mild disease, to acute or even fatal disease [8]. In contrast, cattle, while commonly infected in endemic and epizootic areas, rarely develop clinical disease [9]. However; the strain of BTV serotype 8 that has invaded northern Europe is unusual because a large number of infected cattle also developed clinical signs [10]. So, cattle are important in transmission and acting as reservoirs for the BTV [11]. Camelids have also been reported to be susceptible to experimental BTV infection and induced antibodies against BTV but coursed asymptomatically in llamas (*Llama glama*) (BTV-10) [12] and in dromedary camels (BTV-1) [13]. however; a severe clinical form with lethal BTV-1 infection was reported in naturally infected llamas [14]. The disease is not contagious from animal to animal but is spread by biting midges of the *Culicoides* genus which are the natural biological vectors of the BTV [15,16]. The incidence of bluetongue disease is therefore closely related to the distribution of the various *Culicoides*

Table-1: The distribution of samples and antibody prevalence in different districts of Saudi Arabia

District	Sheep			Goat			Cattle			Camel			Total Prevalence
	SC	SP	P(%)	SC	SP	P(%)	SC	SP	P(%)	SC	SP	P(%)	
Riyadh	367	206	56.1%	315	165	52.3%	62	28	45.1%	195	36	18%	435/939(46.3%)
Eastern Province	225	147	65.3%	179	112	62.5%	88	47	53.4%	140	40	28.5%	346/632(54.7%)
Mecca	137	70	51%	144	68	47.2%	40	12	30%	87	27	31%	177/408(43.4%)
Taif	210	115	54.7%	180	100	55.5%	98	45	45.9%	96	16	16%	276/584(47%)
Baha	116	61	52.9%	105	59	56%	93	41	44%	48	12	25%	173/362(47.7%)
Asir	210	118	56.1%	181	93	51.3%	93	39	41%	78	36	46%	286/562(50.8%)
Northern borders	142	65	45.7%	73	39	53.4%	50	20	40%	55	5	9%	129/320(40.3%)
Hail	150	40	26.6%	95	23	24.2%	42	14	33.3%	69	13	18.8%	90/356(25.2%)
Jizan	126	83	65.8%	107	73	68.2%	77	41	49.3%	59	26	44%	223/369(60.4%)
Najran	95	57	60%	88	51	57.9%	72	34	47.2%	58	17	29.3%	159/313(50.7%)
Total	1778	962	54.1%	1467	783	53.3%	715	321	44.8%	885	228	25.7%	2294/4845(47.3%)

species which are normally associated with warm or hot climatic conditions [17]. The area where BTV and its vectors are present has been limited to latitudes between 40°N and 35°S. Exceptions include regions of Asia and western North America, where BTV infection of ruminants occurs as far as 50°N [17,18]. The presence and distribution of *Culicoides* in Saudi Arabia has been reported [19-22]. Due to its ability to spread rapidly under suitable circumstances, BT is classified by the World Organization of Animal Health [23] as a notifiable disease (former List A). During outbreaks, affected countries are banned from trading in livestock and livestock products triggering serious socio-economic effects [24]. The recent detection of eight additional BTV serotypes in the USA strongly suggests that the changes in BT distribution first detected in Europe may be a worldwide phenomenon, perhaps as a consequence of climate change [25].

The epidemiology of BTV infection is poorly defined in much of the world, including extensive portions of Asia and the Middle East, the species and serotypes of BTV that occur within the Middle East are poorly defined [26]. A wave of abortions, stillbirths and deformities in sheep at Al-Ahsa in the eastern region of Saudi Arabia due to BTV in the second half of 1999 [27]. BTV has been reported in several Middle Eastern countries (Egypt, Jordan, Syria, Turkey, Cyprus, Iraq, Iran, Oman, Qatar, Yemen and Saudi Arabia) since 1951 [28-31]. Abu Elzein *et.al.* [32] recorded the exposure of sentinel ruminants to BT virus serotypes 10, 12, 15 and 20. Also, a novel BTV serotype has been identified in Kuwait in 2010 [33].

The aim of this study was to estimate the prevalence and distribution of serum antibodies to BTV in different domesticated animals in different localities of Saudi Arabia.

Materials and Methods

Samples: A total of 4845 field sera from 1778 sheep, 1467 goat, 715 cattle and 885 camel were randomly collected between January and March 2011 by the district field veterinarians from most of districts of the Kingdom of Saudi Arabia (Table-1). In general, at least 30 samples were collected from each herd/flock based on the estimated seroprevalence of 10% and a confidence limit of 95% to detect at least one positive animal [34]. If the population size in a herd/flock was less than 30, as many animals as possible were sampled. All the sera were transported on ice and submitted to the Central Veterinary Diagnostic Laboratory in Riyadh where stored at –20°C until tested.

Competitive Enzyme linked Immunosorbant Assay(c-ELISA): The Bluetongue Competitive ELISA Kit: (BDSL; Biological Diagnostic Supplies Ltd., Surrey, UK) were used. The test is based on the detection of antibodies specific to the highly conserved segment 7 (VP7) of BTV. It is therefore designed to detect infection by any type of BTV and/or vaccination by any vaccine presenting the VP7 antigen. The test was carried out as described in the protocol supplied by the manufacturers, and the percentage inhibition (PI) values were calculated as described by Afshar *et.al.* [35]. Samples with PIs equal to or greater than 50% were considered to be positive, and those with PIs of less than 50% were taken as negative.

Results

The distribution of samples and antibody prevalence by region are shown in (Table 1). Positive animals were found in all examined districts. The overall BTV antibody prevalence was 54.1%, 53.3%, 44.8% and 25.7% in sheep, goat, cattle and camel respectively (at 95% confidence level). The Jizan and Eastern Province districts were the regions with the highest prevalence resulting 65.8% of sheep, 68.2% of goats, 49.3% of cattle, 44% of camel in Jizan and 65.8% of sheep, 62.5% of goats, 53.4% of cattle, 28.5% of camel in Eastern Province. The second highest rate was in Najran district where the seropositivity for Bluetongue was found to be 60% of sheep, 57.9% of goats, 47.2% of cattle and 29.3% of camel.

Discussion

Bluetongue affects both domestic and wild ruminants, and its origin is probably African. It was first identified in South Africain Merino sheep in the late 18th century [36]. Various techniques have been used to detect antibodies against BTV. These include agar gel immunodiffusion (AGID),haemagglutination-inhibition, complement fixation and ELISA, which are serogroup specific and serum neutralization, which is serotype specific. Only AGID and competitive-ELISA are recommended as prescribed tests for international trade in the OIE Manual of Standards for Diagnostic Tests and Vaccines [23]. Protein VP7 is one of the major inner capsid proteins [37] on which several serogroup specific diagnostic assays are based to differentiate antibodies to BTV from those to other orbiviruses, such as epizootic hemorrhagic disease virus [38-40]. There is no well-defined control strategy for BTV and no vaccine is currently available for the strains of blue tongue in Saudi Arabia (F. Bayoumi, personal communication, Oct. 2010). The diagnosis of BT includes early recognition and notification of a suspect clinical situation by the field veterinarians, and/or clinical inspection by veterinary inspectors of the veterinary authorities and laboratory tests on blood to detect the specific antibodies.

As per our Knowledge, this is the first study that estimates the prevalence and distribution of antibodies to BTV in different domesticated animals in most localities of Saudi Arabia. Our results revealed high seroprevalence (47.3%) of BTV infection which was comparable to that has been described amongst ruminants in regions of Iran (34.7% seroprevalence) [26], Turkey (29.5% seroprevalence) [41], India (up to 45.7% seroprevalence) [42] and Pakistan (48.8% seroprevalence) [43]. Also, seroprevalence of BTV infection was reported in 73% of camels in Chad and 17.8% in Niger by agar gel diffusion test [43] and in two camel-rearing regions of Somaliland (13.96%) [45].

Due to the large number of circulating BTV serotypes, it is generally impossible to predict the serotype for a specific season or area. Furthermore, several serotypes tend to circulate simultaneously [6]. The highest proportion of seropositives in different livestock in Jizan, Najran and Eastern Province districts could be attributed to climatic factors that favour the maintenance and recirculation of the BTV in its vertebrate and non-vertebrate hosts in addition to the nearness of Jizan and Najran districts to the Horn of Africa (Ethiopia, Somalia, Eritrea and Djibouti), where the enzootic nature of BTV in large regions of the African continent is reported [46] and there were possibility of windborne carriage of infected Culicoides from distant endemic areas [47]. According to FAO reports, Sudan and Somalia are the two countries in the Horn of Africa with largest volume of ruminants, while Saudi Arabia is the biggest market for livestock exports from the Horn of Africa and animals trade is highest between Somalia and Ethiopia to the gulf area. These trades from the Horn of Africa (Ethiopia, Somalia, Eritrea and Djibouti) into Yemen and gulf area are likely to increase mixing of animals and therefore new emerging diseases [48]. Furthermore, there is an unrestricted flow of livestock into Jizan and Najran districts from the neighboring south borders (from Yemen) where bluetongue virus (BTV) is endemic.

Conclusions

The obtained results showed that a high incidence of BT antibodies has been detected among sheep, goats cattle, and camels in the Kingdom of Saudi Arabia that indicate serological evidence of exposure to infection was widely distributed all over the country. There are no restrictions on the movement of animals from one region to another within the country. Thus, outbreaks may also occur due to transportation of animals. Consequently, a well-defined control strategy for preventing and controlling the BTV may be based not only on vaccination plans and vector eradication but also restriction on the movement of animals from one region to another within the country. Further studies are being undertaken to determine the BTV serotypes that are circulating in Saudi Arabia.

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Competing interests

Authors declare that they have no competing interests.

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