Short Communication

Special Issue: Molecular Virology and Control of *Peste des Petits Ruminants* Virus

Prevalence of PPR-virus Antibodies in Sheep, Goats and Camels in Hail, Saudi Arabia

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Abstract | The present study describes the prevalence of peste des petits ruminants (PPR) virus antibodies in sheep, goats and camels at Hail, Bagaa, Shenan and Ghazalah, Saudi Arabia. Serum samples (n=400), collected during 2012–2013 from sick and clinically healthy herds, were subjected to antibodies detection using c-ELISA. Out of examined animals, 83 (62.9%) goats and 70 (33.2%) sheep were detected positive against PPRV antibodies, whereas camels appeared to be seronegative. Based upon the seasonal variations in the antibodies detection, environment appeared to be a significant factor on the level of antibodies in the tested small ruminants population. Taken together, results indicate the seropositivity of PPRV in the region and warrant future large-scale surveillance studies to better assess the situation of the disease in the region.

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Peste des petits ruminant (PPR) is Office International des Epizooties (OIE) notifiable and economically important transboundary viral disease of sheep and goats. It is a highly contagious in domesticated and wild small ruminants, and is currently emerging to cause infections in camels (Albina et al., 2013). The PPR virus, the causative agent of PPR, is a member of the genus *Morbillivirus* in the family *Paramyxoviridae* (Gibbs et al., 1979). For many years, PPR was considered as an African disease localized mainly in western and central Africa (Losos, 1989). It has now become endemic across Sub-Saharan Africa, Middle East, Arabian Peninsula, Turkey, Iran, Iraq, Pakistan, India, Bangladesh, Tajikistan and Kazakhstan in Central Asia (Taylor and Barrett, 2007; Balamurugan et al., 2012; Balamurugan et al., 2014; Simon et al., 2015; Saeed et al., 2015).

Saudi Arabia is a major importer of livestock, the first recorded case of PPR was observed in 1990 (Abu Elzein et al., 1990), ad later it was reported in Eastern central region of the country (Housawi et al., 2004; AL-Afaleq et al., 2004; Al-Dubaib, 2009; Boshra et al., 2015). However, the disease has not been reported from all parts of the country. This study was undertaken to determine the occurrence of antibodies against PPR in the Northern region of Saudi Arabia.

Sera samples were collected during 2012–2013 from non-vaccinated sick and clinically healthy herds of

Table 1: *Cross tabs of the results* species, location and season*

Result		Species				Total
		Sheep	Goat		Camel	
Negative	Count	141	49		57	247
	% within Result	57.1%	19.8%		23.1%	100.0%
	% within Spp	66.8%	37.1%		100.0%	61.8%
Positive	Count	70	83		0	153
	% within Result	45.8%	54.2%		0.0%	100.0%
	% within Spp	33.2%	62.9%		0.0%	38.3%
Total	Count	211	132		57	400
	% within Result	52.8%	33.0%		14.3%	100.0%
	% within Spp	100.0%	100.0%		100.0%	100.0%
		Location				
		Hail	**Bagaa**	**Shenan**	**Ghazalah**	**Total**
Negative	Count	114	74	29	30	247
	% within Result	46.2%	30.0%	11.7%	12.1%	100.0%
	% within Location	54.3%	67.3%	74.4%	73.2%	61.8%
Positive	Count	96	36	10	11	153
	% within Result	62.7%	23.5%	6.5%	7.2%	100.0%
	% within Location	45.7%	32.7%	25.6%	26.8%	38.3%
Total	Count	210	110	39	41	400
	% within Result	52.5%	27.5%	9.8%	10.3%	100.0%
	% within Location	100.0%	100.0%	100.0%	100.0%	100.0%
		Season				
		Wet cold (Nov-March)		**Wet (April-May)**	**Dry hot (June-Oct)**	**Total**
Negative	Count	76		78	93	247
	% within Result	30.8%		31.6%	37.7%	100.0%
	% within Season	52.8%		62.9%	70.5%	61.8%
Positive	Count	68		46	39	153
	% within Result	44.4%		30.1%	25.5%	100.0%
	% within Season	47.2%		37.1%	29.5%	38.3%
Total	Count	144		124	132	400
	% within Result	36.0%		31.0%	33.0%	100.0%
	% within Season	100.0%		100.0%	100.0%	100.0%

sheep, goats and camels (n=400) at Hail, Bagaa, Shenan and Ghazalah regions of Saudi Arabia. The sera samples, received from the field, were stored at –20°C until further analysis. The PPR c-ELISA test kit (310 rue Louis Pasteur, 34790 Grabels, FRANCE, http://www.id-vet.com/produit/id-screen-ppr-competition) developed by Libeau et al. (1995) was used according to the manufacturer protocol to determine antibodies in sera. The prevalence of PPR and the significant differences between species, location and season using Chi-square test were analyzed with SPSS22 (Statistical Package for Social Sciences 22).

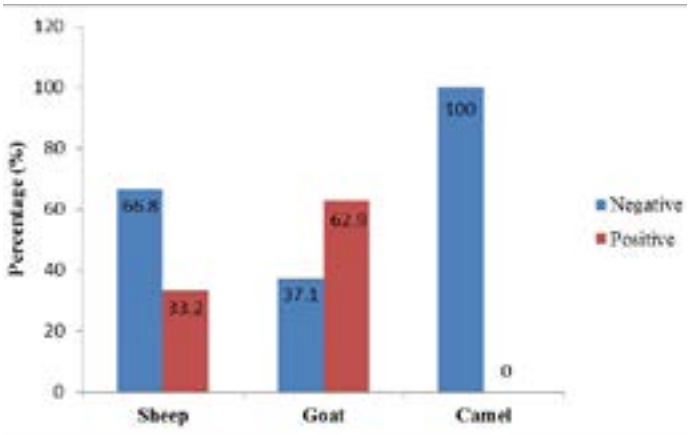

Figure 1: *Seroprevalence of PPR antibodies in sheep, goats and camels as detected by c-ELISA*

Out of 400 tested sera, 153 (38.2 %) were found positive for PPRV antibodies. A total of 83 (62.9%) goats, 70 (33.2%) sheep have shown antibodies against PPRV. However, no tested samples from camels were positive for PPRV antibodies. We next compared the seasonal variations in the detection of antibodies against PPRV. The prevalence of PPRV antibodies was observed to be higher (44.4%) in wet cold season, followed by 30.1% in wet season and 25.5% in dry hot season in all tested samples (Figure 1; Table 1). Seasonal variations appeared to be having significant effect ($p < 0.01$) on the frequency of circulating antibodies in the study (Table 2).

Table 2: *Significant difference between the prevalence and species, location and season*

		Value	df	Asymp. Sig. (2sided)
Species	Pearson Chi-Square	71.508[a]	2	.000
	Likelihood Ratio	89.942	2	.000
	Linear-by-Linear Association	2.491	1	.115
	N of Valid Cases	400		
Location	Pearson Chi-Square	11.263[a]	3	.010**
	Likelihood Ratio	11.462	3	.009
	Linear-by-Linear Association	9.639	1	.002
	N of Valid Cases	400		
Season	Pearson Chi-Square	9.212[a]	2	.010**
	Likelihood Ratio	9.251	2	.010
	Linear-by-Linear Association	9.129	1	.003
	N of Valid Cases	400		

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

PPR is an emerging and geographically spreading disease of small ruminants and camel particularly in Africa and Asia. Although the disease is thought to have been reported in Saudi Arabia in the 1990 (Abu-Elzein et al., 1990), epidemiological information about the spread of PPR in the county is generally scarce. In this study, prevalence of the disease in the Northern regions of the country was estimated. The research estimated the sero-prevalence in sick and clinically healthy sheep, goats and camels at Hail district, Saudi Arabia during 2012–2013. The prevalence reported in this study was lower (38.2%) than reported previously in the country at Al-Hasa in 1988 and 2007 (Abu- Elzein et al., 1990; Al-Dubaib, 2009; Banyard et al., 2010) and higher than that reported in the Al-Qassim region in 2005 (Al-Dubaib, 2009). Variations may be due to seasonal effects, host population density, disease control programs and the social environment that can influence the contact rates (Abu Elzein et al., 1990; Bhanuprakash et al., 2006; Bowden et al., 2008). The high percentage of positivity was found in goats (62.9%) and Hail locality (45.7%) in the wet cold season. This rate of variation among species may be related to the fact that sheep succumb easily to drought and other environmental stresses. Spatial heterogeneity in PPR sero-prevalence has been reported in many areas where PPR is endemic (Bhanuprakash et al., 2006; Bird et al., 2009), and factors such as differences in sample size, age, prevailing management practices, humidity or season influence the occurrence of the disease (Singh et al., 2004).

Our findings provide evidences of widespread of PPR in Hail district, Saudi Arabia likely due to continued transmission within local sheep and goat flocks accompanied with low incidence of mortality related to a particular strains, transmission of PPRV from camels and gazelles to goats may be possible (Abraham et al., 2005; Gur et al., 2010) and/or continuous introduction of virus strains from imported animals from Africa. Further large-scale studies are needed to better identify the situation of the disease, risk factors and the genetic nature of the PPRV, which can help in the implementation of disease control strategies.

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