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SEROLOGICAL SURVEY, AN IMPORTANT TOOL FOR CAMEL DISEASE STATUS OF A ZONE OR A COUNTRY

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ABSTRACT

A serological survey was carried out in the United Arab Emirates over the last five years on the dromedary camel population. We followed the OIE Camel Ad hoc group recommendations which was established in 2008 and 2010. This group worked out a comprehensive disease list for Camelids which can be downloaded from the OIE's homepage www.oie.int. The diseases investigated by CVRL follow the OIE listed camel diseases, the results of which are presented here. Our serological survey included 17 infectious diseases divided into viral, bacterial and parasitic diseases. This investigation also addressed the applicability of serological tests for use in camels. This approach was also necessary as many serological tests have never been evaluated for camels and are therefore not mentioned in the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals from 2016. Our serological investigations showed three different patterns:

- Dromedaries can get infected by several pathogens exhibiting disease and producing antibodies.
- Dromedaries can get infected by several pathogens producing only antibodies but no disease.
- Pathogens do neither produce disease in dromedaries nor antibodies.

Key words: Serological survey, viral, bacterial and parasitological diseases

Over the last 5 years, a serological survey was conducted on bacterial, viral and parasitic diseases on the dromedary camel population of the United Arab Emirates. The choice of infectious diseases selected for this survey, followed the recommendations of the OIE Camelid Ad hoc group. This group met at the OIE headquarters in Paris in 2008 and 2010 and compiled a comprehensive list of infectious diseases for camelids, which can be downloaded from the OIE homepage: www.oie.int and studied in the 2014 book on camel diseases (Wernery *et al,* 2014). The recommendation of the camelid experts included not only a list of diseases but also proposed to evaluate certain serological tests for use in camelids as most of the tests are not mentioned in the OIE Terrestrial Manual from 2016 because they are not evaluated. First investigations on this subject were already performed by Wernery *et al* (2007 and 2008). The purpose of our serological survey was therefore twofold, firstly to receive data of the health status of the UAE's dromedary population and secondly to investigate the applicability and suitability of serological tests commercially available for use in camelids.

Materials and Methods

In total 17 infectious diseases were investigated of which 6 were bacterial, 8 were viral and 3 were parasitic diseases. The results were compiled in 3 separate tables showing information of test methods used, manufacturer details with email addresses, results of our investigations and in the last column brief explanations were given about the disease status for each infectious disease.

Results and Discussion

Tables 1, 2 and 3 show which infectious diseases were investigated with which results. Four of the 6 bacterial diseases presented in Table 1 produced not only antibodies but also clinical signs. The clinical signs are briefly summarised in the last column of the Table 1. The clinical presentation of Leptospirosis and Anaplasmosis are unknown and there is some doubt if the camel is susceptible to Leptospirosis. However, antibodies against many different serovars have been found (Wernery *et al,* 2014). As there are no clinical signs observed for both diseases so far, the author prefers the term Leptospira and Anaplasma infections instead of "osis".

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In total 8 viral diseases were investigated and as can be seen from Table 2, four of them do not produce a disease in Old World Camels (OWCs) with the exception of Foot-and-Mouth Disease (FMD) in Bactrians (Laska *et al,* 2008). Results of experimental infections and clinical observations from the field confirmed that 2 closely related camel species of Bactrian and dromedary camels possess noticeably different susceptibilities to FMD. Bactrians may contract the disease, dromedaries not (Hohoo *et al,* 2001; Laska *et al,* 2008; Wernery *et al,* 2014). WNF and BVD viruses produce antibodies in camels, but no disease in OWCs, but in New World Camels (NWCs). Rift Valley Fever and Camelpox are the remaining 2 viral diseases which can have a severe clinical impact on camels. Knowledge regarding viral infections in camelids and their economic impact has greatly increased over the years, but there is still a lack of understanding as to whether or not camelids are susceptible to a wide range of important other viral diseases affecting livestock and wildlife.

This lack of knowledge is strikingly associated especially to the Bactrian camels and therefore more research has to be done. This camel conference, the first in China, gives us the opportunity that laboratories working on camel diseases in different countries, come together, cooperate on many subjects as it was proposed by the OIE Camelid Ad hoc group some time ago.

There is not only a lack of knowledge concerning viral diseases but also bacterial diseases. A typical example is Haemorrhagic Septicaemia (HS). The opinion between camel scientists vary widely if HS occurs in camels and therefore a comprehensive study is necessary to clarify the disease complex 'pasteurellosis in camelids' so that diseases with similar clinical pictures, such as anthrax, salmonellosis and endotoxaemia, are less likely to be confused with pasteurellosis. So far bovine *P. multocida* serotypes B:2 and E:2 which produce HS have not been isolated from camels.

Indirect ELISAs (iELISA) are often used for the diagnosis of infections in camelids, but they are firstly not evaluated and lack sensitivity as they include either anti-ruminant or anti-bovine conjugates and not anti-camel. This is important as the Camelidae family possess a unique immune system devoid of light chains (Hamers-Casterman *et al,* 1993).

The ruminant conjugates in commercial test kits possess, however cross-reactivities to camels for example to bovine 73% identity, equine 73% identity, rabbit 66% identity and to mouse only 54% identity. It is therefore obvious that non-species-specific conjugates would require profound studies of indirect ELISAs for camelid diagnostic to minimize false positives and negatives. Ideally, anti-camelid conjugates should replace non-species-specific conjugates. There are several commercial anti-camel conjugates on the market.

Table 1. Test kit details for the serological investigations of antibodies to 6 bacterial diseases, their results and disease status of the UAE camel population.

Bacterial Disease	Test Details	Manufacturer	Email	Results			
				Total sera	Positive %		Disease Status
Tuberculosis Tb	Lateral Flow	Diagnostic Systems Inc. USA	info@chembio.com	1.607	7	0.4	M. bovis and other biovars produce disease
Brucellosis	RBT	Vircell - Spain	info@vircell.com	26.375	1324	5	Very common mainly *B. melitensis*
Anaplasma Infection (Rickettsiales)	Competitive ELISA *A. marginale,* ovis, centrale	VMRD, USA	order@vmrd.com	1.713	9	0.5	Subclinical, no disease
Leptospira Infection	Microscopic Agglutination Test (MAT)	You keep your own strains alive in lab.	Weybridge, UK	212	21	12	*L. copenhageni, L. ballum, L. autumnalis, L. tarassovi, L. javanica,* no disease
Caseous Lymphadenitis (CLA)	Indirect ELISA CVRL	Inhouse indirect ELISA with LPD	CVRL DUBAI in-house cvrl@cvrl.ae	481	48	36	Caseous Lymphadenitis very common in China, Mongolia, East Africa also with internal abscesses
Para-tuberculosis	Indirect ELISA CVRL	Inhouse indirect ELISA with MAP (Purified extract)	CVRL DUBAI in-house cvrl@cvrl.ae	381	6	1.6	Very common, devastating disease in Saudi Arabia and other countries, untreatable.

Table 2. Test kits details for the serological investigations of antibodies to 8 viral diseases, their results and disease status of the UAE camel population.

Viral Disease	Test Details	Manufacturer	Email	Results			
				Total sera	Positive %		Disease Status
FMD	cELISA	Cedi Diagnostics B.V.	cedidiagnostics@wur.nl	1.631	0	0	Dromedaries resistant, Bactrians not
PPR	cELISA	Biological Diagnostic Supplies Ltd. (BDSL)	mail@bdsl.uk.com	1.910	0	0	Questionable, infection trial negative
WNF	cELISA	ID Vet	idvet.info@id-vet.com	1.612	41	2.5	No disease but infection virus isolated, lineage 1a
RVF	cELISA	Biological Diagnostic Supplies Ltd. (BDSL)	mail@bdsl.uk.com	1.120	8	0.7	Severe disease, abortion some imported camels are positive
BT	cELISA	ID Vet France	idvet.info@id-vet.com	1.703	358	21	No disease, no virus isolated, 28 serotypes
Camelpox	SNT	CVRL	inhouse cvrl@cvrl.ae	2.340	2000	85	External and internal pox lesions, not in Australia
BVD	cELISA	Institut Pourquier France	info@institut-pourquier.fr	1.210	19	1.6	Questionable, but severe disease in NWCs
EBL	cELISA	Institut Pourquier France	info@institut-pourquier.fr	1.200	0	0	No disease

Table 3. Test kits details for the serological investigations of antibodies to 3 parasitological diseases, their results and disease status of the UAE camel population.

Parasitic Disease	Test Details	Manufacturer	Email	Results			
				Total sera	Positive %		Disease Status
Surra *T. evansi*	iELISA	In house CVRL	cvrl@cvrl.ae	45.567	1.530	1.5	Very common, anaemia sudden death not in Australia
Toxoplasmosis	Direct Agglutination	Bio-Mérieux France	biomerieux.com	1119	48	40	No disease, but high sero-prevalance
Neosporosis	cELISA	VMRD, Inc.	vmrd@vmrd.com	1119	157	14	Old World Camels no disease, NWCs abortion

Three parasitic diseases were serologically investigated of which Surra is the most prevalent one. It occurs in all camel rearing countries except Australia and is mainly caused by *Trypanosoma evansi*.

Toxoplasma and Neospora parasites produce antibodies in camelids but no disease in OWCs has been observed.

Over the last two decades our knowledge on infections in the camel family has greatly increased by field or laboratory investigations, but there is still a lack in different fields. This conference gives us the opportunity to narrow this gap.

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