

EPIDEMIOLOGY OF SELECTED INFECTIOUS DISEASES IN ZOO-UNGULATES: SINGLE SPECIES VERSUS MIXED SPECIES EXHIBITS

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Abstract

The study analyses the epidemiology of selected infectious diseases of 65 different species within the four families of bovids, cervids, camelids and equids in one czech and nine German zoos. It is based on a survey of all epidemiologic data since 1998. Furthermore 900 blood samples taken between 1998 and 2005 are screened for the presence of antibodies against selected viral and bacterial pathogens. The results are linked to the epidemiologic data.

Introduction

The concept of mixed species exhibits increasingly becomes important in European zoos. It is an important form of behavioral enrichment, it optimizes the use of space and it is of great educational value for visitors, giving them an impression of ecological connections. But until now it has not been elucidated whether the kind of exhibit may lead to an increase in the prevalence of specific infections.

The aims of this study are to evaluate the exposure of zoo-ungulates to a variety of disease pathogens that can be transmitted between different species and to assess the epidemiology of mixed exhibits.

We are interested in the following questions:

1. Which selected infectious agents are zoo ungulates exposed to?
2. What is the seroprevalence against these agents?
3. Is there a correlation between seroprevalence and the following factors:
 - animal exhibition system (single species / mixed species exhibit)
 - population density and animal movements
 - interspecific contact rates
4. Do specific agents in mixed exhibits appear only in single or in all of the involved species?

In this paper we report preliminary results of a serologic survey performed in ten different zoos. The seroprevalence of selected pathogens of bovids, cervids, equids and camelids are evaluated for single and mixed species exhibits.

Material and Methods

We collected data on both single and mixed species exhibits on

- group composition (exhibit system, number of animals, their origin, birth date, sex)
- veterinary data (quarantine, vaccinations; serologic and post mortem findings)
- epidemiologic data (size and design of the enclosures; quantity and quality of interspecific contact; other animals looked after the keeper; temporary separation during birth; cleaning intervals; contact with neighbor animals etc.)

Blood samples are being tested for evidence of exposure to the following pathogens:

1. Bovine herpesvirus 1 (BHV 1)
2. Caprine herpesvirus 1 (CHV 1)
3. Cervide herpesvirus 1 (HVC 1)
4. Malignant catarrhal fever virus (MCFV)
5. Bovine viral diarrhea virus (BVDV)
6. *Chlamydomphila psittaci*
7. *Coxiella burnetii*
8. *Mycobacterium avium* ssp. *paratuberculosis*

Blood samples were obtained by zoo veterinarians during immobilization when animals were examined or transported. They represent 42 species of bovids, 11 species of cervids, 6 species of camelids and 6 species of equids. The sample set is assembled from blood banks from 1998 through 2002 (sera) and own sampling from 2003 through 2005 (plasma, buffy coat). None of the animals examined were vaccinated against any of the above mentioned pathogens.

The study is conducted at the following zoological gardens:

1. Berlin Tierpark Friedrichsfelde
2. Berlin Zoo
3. Dortmund Zoo
4. Dvůr Králové Zoo, Czech Republic
5. Gelsenkirchen Zoo
6. Hagenbeck Tierpark, Hamburg
7. Hanover Zoo
8. Karlsruhe Zoo
9. Leipzig Zoo
10. Wilhelma Zoological / Botanical Garden, Stuttgart

Plasma is stored at -20°C, buffy coats at -80°C until use. Serologic tests are performed by:

- ***Virus-neutralization test to detect antibodies against BHV 1, CHV 1, HVC 1 and different BVDV stains.***
- ***Enzyme linked immunosorbent assay to detect antibodies against Chlamydomphila psittaci, Coxiella burnetii, M. avium ssp. paratuberculosis and OvHV 2 antigen.***

Preliminary Results

The exhibits were classified with regard to the cohabiting animals as follows:

- 1 single species exhibit: one family, one species
- 2 mixed species exhibit: one family, minimum two species
- 3 mixed species exhibit: min. two families, minimum two species
- 4 petting zoo

Table 1 shows that among the tested bovids, cervids and camelids only four individuals were positive to BHV-1, three of them living in a single species exhibit. Two of them were also positive to CHV-1 and to HVC-1. In total, 141 individuals are seropositive reactors for MCFV, 80 of them living in single species exhibits, 38 in mixed species exhibits and 23 in the petting zoo.

Discussion

Our preliminary results show that neither BHV-1 nor CHV-1, HVC-1 or BVDV appear to be widespread in the zoos investigated. 27% of the animals showed antibodies against MCFV. Out of 46 bovid species 20 were positive, out of 12 cervid species 3 were positive and out of 4 species of camelids none was positive. There seems to be no association between the number of seropositive reactors for MCFV and the exhibit system. Whether there is a correlation with population density, animal movements or interspecific contact rates has still to be proved. Presently, the seroprevalence against *Chlamydomphila psittaci*, *Coxiella burnetii* and *M. avium* ssp. *paratuberculosis* is not yet investigated.

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Table 1. Preliminary serologic results of bovids, cervids, and camelids of ten different zoos.

Exhibit category	Number positive/ number tested				
	Bovine herpesvirus 1 (BHV 1)	Caprine herpesvirus 1 (CHV 1)	Cervide herpesvirus 1 (HVC 1)	Bovine viral diarrhea virus (BVDV)	Malignant catarrhal fever virus (MCFV)
1: single species exhibit	3/269	2/115	2/225	4/249	80/245
2: mixed species exhibit	0/38	0/15	0/33	0/25	2/40
3: mixed species exhibit	1/218	0/139	0/152	1/215	36/202
4: petting zoo	0/27	0/28	0/42	0/43	23/43