

## RELATIONSHIP OF MANAGEMENT FACTORS WITH PREVALENCE OF RESPIRATORY PROBLEMS IN BEIRA ANTELOPE (*DORCATRAGUS MEGALOTIS*)

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### Summary

*Most of the Beira antelopes (Dorcatragus megalotis) that ever lived at Al Wabra Wildlife Preservation (AWWP) showed respiratory signs and since winter 2005/2006 many Beiras have died from a Fibrinous Pleuropneumonia Syndrome (FPPS) with Mycoplasma spp. as suspected causative agent. Neither therapies with different drugs nor vaccinations yielded a sustained success against the respiratory disease so far. This study aimed to test if there is a relationship between management factors and the prevalence of respiratory problems, in order to find indications whether changes in management might decrease the risk of respiratory diseases. For this reason, environmental factors such as temperature and humidity as well as individual appearance (coughing, nasal discharge etc.) and feeding of vitamin/mineral supplements were recorded daily for over a year. There was a noticeable increase of affected Beiras during winter months.*

### Introduction

The Beira (*Dorcatragus megalotis*, MENGES, 1894) is a rare antelope that is considered vulnerable by the IUCN (HECKEL et al., 2008). The only facility that keeps and breeds Beiras is the private breeding centre Al Wabra Wildlife Preservation (AWWP) in Qatar. The breeding project that started in the 1980's was not successful until 1999, when a new animal management concept implemented on eight imported animals made the breakthrough. Within 5 years the population increased to 58 animals, possibly due to careful management and intensive monitoring (HAMMER and HAMMER, 2004; NAGY et al., 2008). From March to June 2004, the populations of Nubian ibex (*Capra ibex nubiana*), Iranian wild goat (*Capra aegagrus*) and gerenuk (*Litocranius walleri*) at AWWP were reduced by an outbreak of Contagious Caprine Pleuropneumonia (CCPP). Causative pathogen was *Mycoplasma capricolum* ssp. *capricolum* (Mccp) (ARIF et al., 2007). Although the Beiras were not affected, they were nevertheless vaccinated against CCPP along with other wild ruminants (Caprivax<sup>®</sup>, inactivated Mccp vaccine; Kenya Veterinary Vaccine Production Institute, Nairobi, Kenya; 1ml s.c.) (NAGY et al., 2008; VERHOEVEN et al., 2008).

The first respiratory signs in a Beira at AWWP were seen in October 2000. From then on up to November 2005, the number of individuals that showed respiratory signs per month stayed low (never more than four animals a month), but the majority of all Beiras who ever lived at AWWP were noted with respiratory findings at least once (VERHOEVEN et al., 2008). Then, over winter 2005/2006, a large part of the Beira population was affected with respiratory problems, and the first animals died of a Fibrinous Pleuropneumonia Syndrome (FPPS) of unknown origin (HAMMER et al., 2007). Clinical signs and necropsy made Contagious Caprine Pleuropneumonia (CCPP) likely, but the pathogen of the disease, *Mycoplasma capricolum* ssp. *capricolum* (Mccp), could not be detected (NAGY et al., 2008). However, the disease might be due to Mccp or other mycoplasmas, eventually along with other agents that affect the respiratory tract. Antibody titers yielded no indication for a systematic viral influence

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(LECHENNE et al., 2009). Different drugs and vaccinations as therapy did not lead to the intended success (NAGY et al., 2008; VERHOEVEN et al., 2008).

Before a second outbreak with a high mortality occurred again in winter 2006/2007, it seemed that the population recovered clinically during summer 2006. Although some animals still showed persistent respiratory signs (NAGY et al., 2008; VERHOEVEN et al., 2008). In 2007 the lung problems became more chronic, maybe due to resistance to FPPS or a higher treatment success, and the time between onset of clinical signs and death in affected Beiras became longer (VERHOEVEN et al., 2008).

Because FPPS and respiratory findings in Beiras continue to be a problem at AWWP and neither therapies with different drugs nor vaccinations have been successful so far, this study aimed to test whether there was a relationship between management and environmental factors and the prevalence of respiratory problems, and if the morbidity due to respiratory diseases could be reduced by improvements of the management. Additionally, we tested whether a difference in the occurrence of clinical signs could be noted between two subsets of animals that did or did not receive a particular vitamin/mineral supplement.

## Material and methods

For this study, information about individual Beira antelopes ( $n = 39$ ) were compiled from the AWWP clinical record of each individual animal and the AWWP long-term monitoring of environmental and management factors. A time period of fourteen months from November 2007 to December 2008 was investigated.

The Beiras were kept in small groups at different locations within AWWP. For the evaluation of the environmental and management factors, data were summarised in 2 groups, "SPen" and "O-house", which represent two separate clusters of adjoining enclosures. All enclosures had an air-conditioned shed with a concrete and/or sand floor. During summertime air-conditioning was switched on when outdoor temperatures rose above 35 °C (usually from end of March to beginning of November). During winter, a heater and a red light was put in place and switched on when inside temperatures dropped below 20 °C (usually from mid December till beginning of March). During this period, the animals were locked in overnight.

From a total number of 39 Beira individuals that were involved in this study, 22 had data available for the whole duration of 15 months; 12 died and 5 were born within the observed time. A visual appraisal of individual animals for clinical signs - coughing, serous nasal discharge, mucous nasal discharge, combinations of these symptoms or no clinical signs at all - were recorded on a daily basis for the whole time period, with sporadic exceptions when staff was pressed for time during holidays. Every day at the same time, internal and external temperatures as well as internal relative humidity were recorded. The collected data were evaluated with regard to seasonal fluctuations, as well as to coherences between in- and outside temperatures, temperatures and humidity, and appearance of respiratory signs and temperatures and humidity. When comparing the two enclosure groups, the proportion of sick Beiras for each cluster and month was calculated. The fluctuating group sizes were considered. For the O-house ( $n_{\text{tot}} = 10$ ), 6 to 9 animals could be observed at any given time; for SPen ( $n_{\text{tot}} = 28$ ), the number was 19-24 animals. One animal was excluded because it occurred in both enclosure groups. Every animal that showed respiratory signs was counted as sick, but an insignificant fraction also consisted of Beiras with other signs of sickness such as diminished appetite, apathy or animals that had to be kept at the veterinary station.

The regular diet of the Beiras consisted of fresh and dried alfalfa, fresh foliage, pelleted compound feeds and to a small proportion corn, rolled oats, and mixed vegetables (Tab. 1). In addition, small doses of a phosphorus supplement and vitamin E pellets were also fed regularly to all animals.

All feeding of vitamin/mineral food supplements was recorded (Blattin-Minerals for Bovine<sup>®</sup>, 15 % Calcium, 10 % Phosphorus, 8 % Natrium, 3 % Magnesium, 750,000 IE Vitamin A, 75,000 IE Vitamin D3, 1,000 mg Vitamin E, 6,000 mg Zinc, 2000 mg Manganese, 800 mg Copper, 13 mg Cobalt, 66 mg Iodine, 26 mg Selenium; Höveler Spezialfutterwerke, Dormagen, Germany). Due to small group sizes and changing feeding managements, the feeding of vitamin/mineral supplements were only evaluated during 5 months from August 2008 to December 2008. Twenty-nine animals that received 14 g of mineral supplement per animal and day (scattered over vegetables) were compared to eight animals that did not receive any mineral supplementation. Two animals were excluded from this evaluation because they occurred in both groups during the time period. The occurrence of clinical signs of respiratory disease was compared between animals that did and did not receive vitamin/mineral supplements.

Table 1: Diet of the Beira antelopes at Al Wabra Wildlife Preservation in grams per day.

Beira food in grams	Vegetables (apple, carrot, boiled potato)	Pelleted compound feed	Corn	Fresh alfalfa	Foliage	Alfalfa hay	Rolled oats	Vita-min/Mineral supplement (Blattin-Minerals for Bovine <sup>®</sup> )
Morning	30	75	10	140	350		10	7
Afternoon	30	75	-	140	350		-	7
Total	60	150	10	280	350	ad libitum	10	14

## Results

For O-house outside temperatures ranged from 13.8 °C to 54.2 °C ( $42.0 \pm 8.5$ ) in the reported time period and were highest during July 2008 ( $50.1 \pm 1.7$ ) and lowest during January 2008 ( $29.3 \pm 6.3$ ). O-house inside temperatures showed a similar fluctuation and ranged from 15.2 °C to 53.4 °C ( $28.1 \pm 7.2$ ; maximum internal temperatures) respectively from 11.5 °C to 33.4 °C ( $24.2 \pm 5.5$ ; minimum internal temperatures). The maximum inside temperatures of O-house were in average 13.9 °C ( $\pm 4.4$ ) lower than the corresponding external maximum temperatures, the minimum inside temperatures 17.8 °C ( $\pm 4.5$ ) lower than the corresponding external maximum temperatures. At cooler outside temperatures ( $< 25$  °C,  $n = 8$ ) in O-house, the difference between out- and inside temperatures became smaller (outside temperatures  $20.1 \pm 4.3$ ; maximum internal temperatures  $18.8 \pm 2.8$ ; minimum internal temperatures  $17.7 \pm 2.6$ ). Data for SPen showed similar trends but maximum internal temperatures of SPen ( $32.3 \pm 7.1$ ) were slightly higher than in Okapi ( $28.1 \pm 7.2$ ).

The maximum relative humidity ranged from 20 % to 79 % ( $49.2 \pm 14.2$ ). Humidity and temperatures were reciprocal to each other, so the higher the temperatures the lower was the relative humidity and vice versa.

From a total number of 9676 (100 %) noted observations concerning the respiratory tract from November 2007 to December 2008, the proportion of animals without any signs was the biggest with 65 % ( $n = 6,174$ ). The most often-observed pathologic respiratory sign was serous nasal discharge with 30 % ( $n = 2,833$ ), followed by coughing (2 %,  $n = 202$ ) and serous nasal discharge combined with coughing (also 2 %,  $n = 189$ ). Mucoïd nasal discharge could be detected 129 times (1 %) and mucoïd nasal discharge combined with coughing only 12 times (0 %).

There was no remarkable change in population size during the study period. It was evident for all data combined that a higher proportion of animals did not show clinical signs of respiratory disease at higher environmental temperatures and lower relative humidity (Fig. 1).

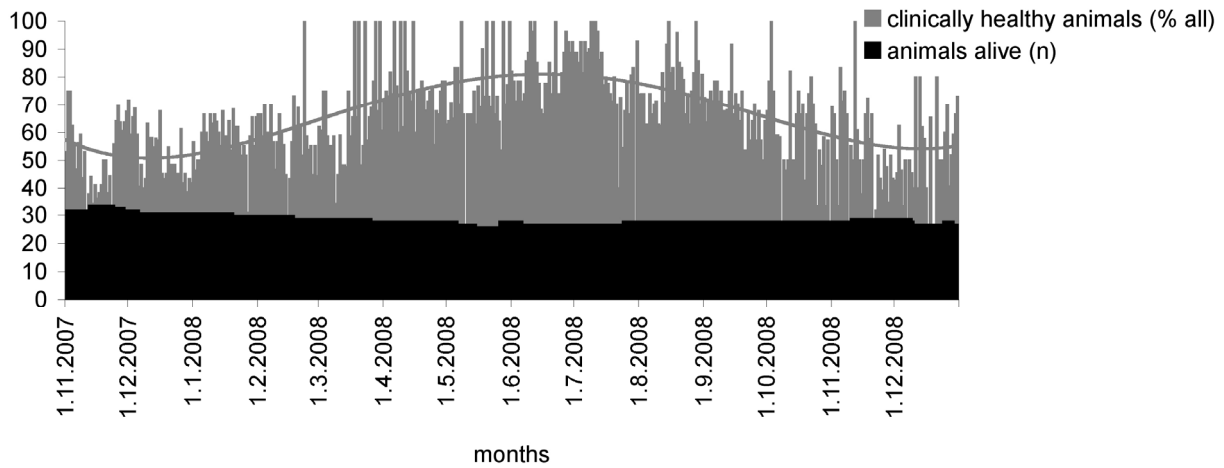


Figure 1 Seasonal fluctuation in the proportion (%) of animals without respiratory signs.

The proportion of sick Beiras per month was on average 14 % ( $\pm 8$ ) higher in SPen (30 % $\pm 10$ , n = 28) than in O-house (16 %  $\pm 10$ , n = 10).

When comparing the groups with and without vitamin/mineral supplementation, it appeared that the group with vitamin/mineral supplement showed a less drastic seasonal fluctuation in the proportion of animals with clinical symptoms than the group without supplements (Fig. 2).

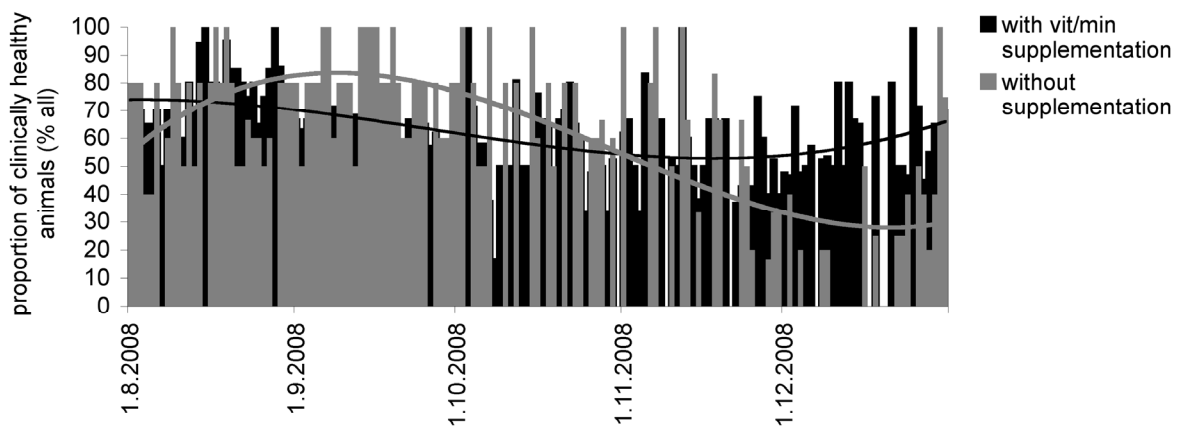


Figure 2: Variation in the proportion of animals without respiratory signs in groups with and without particular vitamin / mineral supplementation.

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## Discussion

We could show that the Beira antelopes at AWWP suffer more from respiratory diseases during winter when temperatures are lower and the relative humidity is higher. In human medicine, it has been recognised that both low and high temperatures are able to induce health effects (KALKSTEIN et al., 1997; MCGEEHIN et al., 2001; HOUGHTON et al., 2001). Especially morbidity and mortality of respiratory and cardiovascular disorders have sometimes a winter peak of very high amplitude (DOUGLAS et al., 1991). Seasonal trends for respiratory diseases have also been described in veterinary medicine. For example in racehorses the odds of having termed inflammatory airway disease (IAD) are most likely from February to April and least likely from August to September (WOOD et al., 2005). There is no clear explanation for the winter seasonality of most disease and death, but with six months phase shifting the findings are the same in the southern hemisphere, so environmental factors must play a part (DOUGLAS et al., 1996). Generally, populations in warmer regions tend to be most vulnerable to cold (THE EUROWINTER GROUP, 1997; CURRIERO et al., 2002). A lack of vitamin D due to less daylight exposure during wintertime is discussed in human medicine to affect macrophage function and cell mediated immunity (YANG et al., 1993; MAXWELL, 1994; DOUGLAS et al., 1996), which could lead to increased susceptibility for infectious diseases. We do not have any data concerning the vitamin D metabolism of the Beira antelopes; but the animals have access to outside enclosures and sun exposure year round.

Considering mycoplasmas as possible causative agents of the FPPS, they are known to be inactivated by heat and sunlight (THIAUCOURT and BÖLSKE, 1996; WESONGA et al., 2004). This might also be a reason for the decreased morbidity in summer. THIAUCOURT and BÖLSKE (2004) describe that the severity of CCPD depends on external factors such as proportion of immune animals, co-existing infections, climatic conditions and stress. To minimise biological stress, the Beiras at AWWP are kept in small groups according to their natural grouping pattern. Their natural diet and behaviour are also taken into account. Furthermore, it is tried not to mix up animals of different health conditions to keep the threat of infection low. But due to low numbers of individuals for breeding and the high infection rate, this is not always possible.

Surveys in parts of the Beira antelope's natural habitat in Southern Djibouti revealed that it is under the influence of a tropical arid climate, with mean annual temperatures around 30 °C (LAURENT and LAURENT, 2002). GIOTTO et al. (2008) investigated a time period from March to June in the same area and noted cooler temperatures (33 °C maximum), night dews and some heavy rainfalls from March to April, whereas from May to June the temperature was warmer (40 °C maximum) and there was neither rainfall nor night dews. Compared to our measurements at AWWP, the inside temperatures seem to be slightly lower, especially the minimum internal temperatures in winter (24.2 °C ± 5.5). To avoid exposure to lower temperatures in winter, the sheds should be kept warm. The heater and red light used as artificial heat sources, showed positive effects at temperatures lower than 25 °C, where inside temperatures did not follow a decrease in outside temperatures any more. This seems to be a simple method to protect Beiras from very low temperatures. Although SPen had slightly higher inside temperatures than O-house, probably due to a new concrete floor that stores the heat and the generally smaller space that is easier to heat, there were more affected animals in SPen than in O-house. Yet, it is unlikely that this is due to the temperature difference.

Studies in horses found that dust loading and poor ventilation are correlated with longer duration of respiratory disorders (BURRELL et al., 1996). We do not have information about the air quality in the Beiras' sheds. With regard to eventually more time being spent inside during wintertime, further investigations in this topic are necessary.

In literature, study results concerning vitamin/mineral supplements on the health of humans and animals are heterogeneous. Some authors could not observe any benefit (AVENELL et al., 2005). It must

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be noted that none of these studies found a negative influence of vitamin/mineral supplements on health. For EL-KADIKI et al. (2005) the evidence of multivitamin and mineral supplements to reduce infections in elderly people was weak and conflicting, but positive effects on health were not excluded. In contrast the data of WINKLER et al. (2005) indicated that the intake of a dietary supplement containing probiotic bacteria plus vitamins and minerals during a period of at least 3 months in winter/spring could reduce the incidence and the severity of common cold infections. Leukocytes, lymphocytes, in particular T-lymphocytes including CD4+ and CD8+ cells, as well as monocytes were significantly higher. Together with the seeming trend of a positive, protective effect of the vitamin/mineral supplementation in the Beira, these findings suggest that vitamin/mineral supplementation in the Beiras should be continued and effects observed further.

The long-term monitoring of Beira individuals proves itself as good system for early detection of acute outbreaks, for recognition of heavily infected animals, their separation and as basis for breeding selection.

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