

more rapid development of the larvae, reduced residual effect of treatment or a combination of both. These data show an alteration from the situation as was found when ivermectin was introduced and can be considered as an early warning for the development of ivermectin resistance.

Evidence of host adaptation in *Lawsonia intracellularis* infections

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Lawsonia intracellularis is the causative agent of proliferative enteropathy (PE), an emerging concern in horses and an endemic disease in pigs. Enterocyte hyperplasia is a common lesion in PE but there are differences regarding clinical and pathological presentations among affected species. We hypothesize that host susceptibility to *Lawsonia* infection depends on the species of origin of the bacterial isolate. The objective of this study was to evaluate the susceptibilities of horses and pigs to *Lawsonia* infection using equine and porcine isolates. Twelve 4-month-old foals were divided into three groups (n=4/group) and infected with an equine [1] or a porcine [2] isolate and a saline solution (negative-control group). An identical experimental design was applied to 18 3-week-old pigs divided into three groups (n=6/group). Two pigs from each group were euthanized 21 days post-inoculation (PI) for evaluation of gross lesions and the level of infection by immunohistochemistry (IHC). The animals were monitored for clinical signs, average daily weight gain, fecal shedding of *Lawsonia* [2], and humoral serological response [1] during 56 days PI. Fecal shedding (Figure 1A; $p < 0.05$) and serologic response were higher and longer in foals infected with the equine isolate compared with foals infected with the porcine isolate or with the negative-control group. One equine-isolate infected foal developed severe clinical signs, did not respond to the supportive care and was euthanized 24 days PI. Typical lesions and marked presence of *Lawsonia* antigen was identified by IHC. Similarly, reduced average daily gain and diarrhea were observed in pigs infected with the porcine isolate. Only porcine isolate-infected pigs demonstrated proliferative lesions associated with the presence of specific *Lawsonia* antigen by IHC. Additionally, these animals showed higher and longer shedding of bacteria in the feces (Figure 1B; $p < 0.05$) and serologic response compared with equine isolate-infected pigs. Clinical signs, longer periods of shedding and stronger serologic immune responses were observed in animals infected with species-specific isolates. The results support our hypothesis that host susceptibilities can be driven by the origin of the bacterial isolate. Currently, comparative genomic analysis is being conducted in order to associate these phenotypic

characteristics with potential genomic variations between porcine and equine isolates.

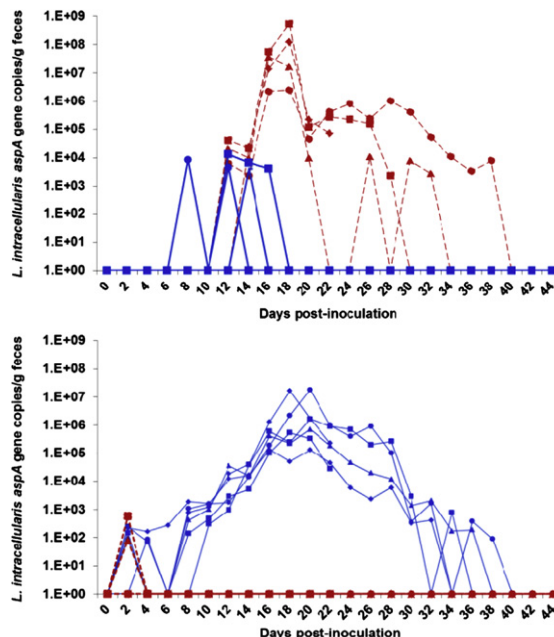


Figure 1. Fecal shedding of *Lawsonia* (blue-solid line = porcine isolate-infected animals; red-dashed line = equine isolate-infected animals).

References

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- [2] Guedes RMC, et al. Onset and duration of fecal shedding, cell-mediated and humoral immune responses in pigs after challenge with a pathogenic isolate or attenuated vaccine strain of *Lawsonia intracellularis*. Vet Microbiol 2003;91:135.

Equine coronavirus, a possible cause for adult horse enteric disease outbreaks

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Little information about the clinical and pathological consequence of equine coronavirus (ECoV) infections in adult horses is currently available in the literature. In this retrospective study, we determined the prevalence of ECoV in fecal samples from horses that had diarrhea using a fecal real-time PCR panel, and used viral isolation, history, clinical signs, and laboratory results to assess the pathophysiological significance of ECoV as an etiological agent in equine enteric pyrogenic disease in the adult horse. A total of 560 fecal samples from 560 horses of all ages were tested using a panel of ten real-time PCR assays specific for equine bacterial, viral and protozoal agents. Of the 560 fecal samples, thirty five (6.25%) tested positive for ECoV nucleic

acid by real-time RT-PCR. All ECoV positive horses in this study were older than one year. In addition to diarrhea, clinical presentation of ECoV PCR positive horses included colic and pyrexia. The most common laboratory abnormality was neutropenic leukopenia. The 525 fecal samples negative for ECoV serves as strong control showing that ECoV is not a common incidental finding in horses fecal samples. 16/35 horses were from outbreaks (clusters of more than one horse with a positive clinical presentation and positive ECoV PCR result within a single farm). 3/16 horses associated with outbreaks tested positive for co-infections with *Cryptosporidium* species, but all 3 were associated with horses only positive for ECoV within the same farm. Of the 35 total ECoV positive horses, 8 were co-infected: 4 with *Cryptosporidium* species, 1 with equine rotavirus, 1 with *C. difficile* toxin A & B, 1 with *C. perfringens* enterotoxin A, and 1 with salmonella species. ECoV outbreaks were identified in 4 states: CA, WA, ID, and NJ. ECoV was successfully isolated from multiple fecal samples submitted from outbreaks in ID and WA. Sporadic ECoV PCR positive cases with clinical signs were found in 11 states: CA, TX, MI, PA, ID, MT, NM, NJ, VA, NH, and WA. The presence of clinical signs, laboratory abnormalities and the molecular and virological findings suggest that ECoV is associated with diarrhea outbreaks in adult horses. Results of this retrospective study indicate that ECoV should be considered as an important enteric, potentially contagious, viral pathogen of adult horses. More experimental study is needed to better define the virulence and pathophysiology of US ECoV strains in horses to further the understanding of coronavirus infections in the horse.

Parasitological, clinical and serological examinations on the progress of *Parascaris equorum* infections in foals

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Parascaris equorum causes infections in young horses worldwide. Despite the ubiquitous prevalence of this infection there is still a considerable lack of information e.g. on the course of infections in stud farms, its clinical relevance also in the context of other infectious diseases and the serological conduct of the infection. To monitor the course of *P. equorum* infection we performed coproscopical examinations and took blood samples on a weekly basis on 190 foals from a big German stud over a period of 25 weeks. The faecal samples were examined using the FLOTAC technique and the blood samples were frozen until the serological examinations. During the course of the study, the copromicroscopic analysis showed a *P. equorum* infection rate of approx. 60 per cent in this herd. The mean weekly faecal egg per gram (epg) counts started to become positive in foals 9 weeks of age. This is somewhat earlier than expected according to the prepatency period of at least 10 weeks and indicates that foals are being exposed to ascarid eggs directly after birth. The mean eggs steadily

increased reaching with a peak epg of 171 (SD \pm 345, range 0-2292) at the end of the trial when foals were 25 weeks old. Ascarid eggs isolated from the faeces were cultivated to generate larvae which were used for producing a larval excretory-secretory antigen (ES). This antigen was examined SDS-PAGE chromatography. By Western Blot analysis using sera from five coproscopically positive and negative foals, each, marked similarities within each of the two groups and explicit difference between groups were encountered. Thus, the larval ES antigen preparation appeared to be suitable for use in ELISA tests. In first tests with positive and negative sera and a secondary antibody directed against IgG antibodies a differentiation was found to be possible. Ongoing analyses aim at the evaluation and optimization of the ELISA test and the characterization of the serological profile during the course of infection.

Occurrence of *Anoplocephala perfoliata* in Swedish horses and possible associations with colic

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The tapeworm *Anoplocephala perfoliata* is common worldwide in horses; the prevalence varies from 50 to 65%. Nevertheless, the significance of tapeworm infections is uncertain and still under debate. The parasite was previously thought to be of little or no clinical significance. However, studies in the UK suggest that tape worm infections are associated with ileo-caecal colic, especially when the infection intensity is high. Currently, little is known about the association between *A. perfoliata* infections and colic in horses under Scandinavian conditions. The aim of this study is to evaluate a possible association between infection with *A. perfoliata* and colic signs in Swedish horses. The study, which started in 2011 and will include 150 horses, (75 cases and 75 control horses) visiting either of two equine veterinary clinics in the south of Sweden. The cases are horses treated for colic symptoms. For each colic horse, a non-colic horse of the same age and with no history of colic is chosen as control. Faecal and blood samples are taken from all horses and submitted to the National Veterinary Institute (SVA). Moreover, a questionnaire on deworming routines, grazing history colic symptoms, colic treatment etc is filled in by the horse owner and the clinician. The fecal samples are analyzed for tapeworm eggs with a modified flotation technique based on 30 g of faeces. Sera will be tested for the presence of *A. perfoliata* antibodies by the ELISA method of Proudman and Trees. So far, a total of 120 samples and questionnaires have been submitted to SVA. The prevalence for *A. perfoliata* in the case group is 18%, while it is 6% in the control group. Fisher's 2-sided test presented a P-value of 0,095. An association between colic and the presence of *A. perfoliata* could not be ruled out based on the current data generated. More data points are needed to complete this analysis. Results from the assays and the questionnaires will be analyzed and presented.