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Exposure-response models of the relationship between core body temperature and semen quality in stallions experimentally infected with equine arteritis virus

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Equine viral arteritis (EVA) is a respiratory and reproductive disease of equids which is caused by infection with a strain of equine arteritis virus (EAV). In stallions it has been observed to be associated with temporary reductions in sperm quality, due in part to heat stress associated with fever. Using an existing data set, our primary aim was to identify an exposure-response model consistent with observed data on core body temperature (CBT) and each of four semen quality measures. Seven stallions were experimentally infected with the Kentucky 84 strain of EAV and followed for 198 days (6.5 months) post-infection. Effects on ejaculated sperm characteristics were realized not concurrently with exposure, but over the course of the 67-day spermatogenic cycle. Exposure-response models were therefore evaluated within a distributed lag time series framework, while controlling for ambient temperature and seasonal effect. Response variables included the percentage of morphologically normal spermatozoa (PMN), the percentage with progressive motility (PPM), the percentage with total motility (PTM) and sperm concentration (SC). For PMNS, there was evidence of a linear threshold exposure-response relationship, with above-threshold CBT associated with increased morphological abnormalities and below-threshold CBT having no effect on PMNS. For both motility measures, there was evidence of a V-shaped linear threshold exposure-response relationship, with above-threshold CBT associated with reduced motility and below-threshold CBT associated with increased motility. The findings suggest that in stallions experimentally infected with EAV, threshold exposure-response models explain the observed data on CBT and ejaculated sperm characteristics significantly better than simple linear exposure-response models.

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