Determining the minimum infectious dose of porcine epidemic diarrhea virus in a feed matrix

Abstract #160 - Midwest Animal Science Annual Conference 2015.

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Abstract Text:
Feed has been confirmed as a potential vehicle for porcine epidemic diarrhea virus (PEDV) transfer. In order to determine the overall magnitude of risk and provide the necessary information for future research studies, a study was conducted to determine the minimum dose of PEDV in feed required to induce infectivity using a 10-d-old pig bioassay model. An initial source of PEDV isolate (USA/IN/2013/19338 P7) was serially diluted in 1 log increments to form 9 different PEDV doses ranging from $5.6x10^{5}$ to $5.6x10^{-3}$ TCID50/ml with corresponding PCR cycle thresholds (Ct) of 14.0 to >45, respectively. Aliquots (500 ml) of the PEDV dilutions were mixed in 4.5 kg of a corn soybean meal based swine gestation diet to form 9 experimental treatments that were compared to a control that contained PEDV-negative tissue culture medium. The inoculated feed (100 g) was then mixed with 400 ml of PBS and refrigerated (4°C) overnight before extraction of the supernatant, which was subsequently used for the bioassay (10 ml of supernatant/pig and 3 pigs/dose). The 4 highest feed doses had detectable PEDV RNA ($5.6x10^{4}$, 10^{3}, 10^{2}, and 10^{1} TCID50/g corresponding to a Ct of 27, 30, 33, and 37, respectively) and Ct increased linearly ($P < 0.01$, R^{2} 0.98) as PEDV dose decreased. Every 1 log reduction in PEDV concentration resulted in an increase in 3.4±0.21 Ct in feed with detectable PEDV RNA. When the PEDV was added to the feed, an increase of 9.6±0.4 SEM Ct was observed compared to the tissue culture PEDV concentration for those feed samples that had detectable PEDV RNA. When the supernatant was used to inoculate 10-d-old pigs, fecal sample Ct's ranged from 16 to 27 on d 4 and 6 after inoculation for pigs inoculated with the 4 highest feed doses. No detectable PEDV RNA (Ct >45) was noted in pigs inoculated with the other doses. Infection with PEDV was further confirmed in pigs from these 4 doses by histopathology and PEDV specific immunohistochemistry. In conclusion, these data suggest that PEDV infectivity was correlated with a positive feed PEDV PCR analysis. The minimum infective dose of PEDV in a feed matrix was demonstrated to be $5.6x10^{1}$ TCID50/g and had an equivalent feed PCR Ct of 37. Overall, these data confirm that feed can be a vehicle for PEDV transfer and that a Ct of 37 can lead to infectivity in 10-d-old pigs.

Keywords:
PEDV, feed, bioassay, minimum infectious dose

I attended the Midwest Animal Science Meeting this week in Des Moines and was impressed by the great research presented on production, feeds and feeding, nutrition, etc. One area of interest was PEDv and feed biosecurity. The above abstract is similar to earlier research by Drs. Sagar Goyal, Scott Dee and their colleagues. This work collectively points to the importance of feed biosecurity. One has to wonder how our industry has decreased incidence from 55% last year to approximately 8% this year. Changes in feed ingredients, processing and feed mill biosecurity have no doubt played a major role. See these references for more on feed and PED. Bob Morrison

http://www.pork.org/pedv-2014-research/pedv-feed/

Dee et al. BMC Veterinary Research 2014, 10:176 http://www.biomedcentral.com/1746-6148/10/176