Improving the efficiency of a candidate ASFV vaccine through feeding spray-dried plasma to pigs

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Introduction

Spray-dried plasma (SDP) is a highly digestible, high-protein level ingredient widely used in feed for weaned pigs. The benefits of SDP on growth performance, gut function, and immunity are well known (1). The objectives of this study were to evaluate the effects of feeding 8% porcine SDP in feed to pigs on the efficacy of a candidate African swine fever virus (ASFV) vaccine and protection of naïve pigs in direct contact with animals infected with ASFV Georgia 2007/01.

Material and Methods

A total of 24 weaned pigs (24 d of age) were randomly assigned to either a control (n=16) or porcine SDP (n=8) feed treatment group. Eight pigs fed the control diet were selected to serve as directly inoculated animals (trojans). At housing, test pigs were divided into two groups of 8 pigs and continued to be fed their respective diets for the entire study. On d 24 of the study, all test pigs were intranasally vaccinated with 2 mL of 10^5 PFU of IRTA-CReSA ASFV vaccine (BA71ΔCD2) (2). At d 19 post vaccination (pv) the 8 non-vaccinated trojan pigs were inoculated by intramuscular injection with 1 mL of 10^3 GEC of ASFV strain Georgia 2007/01. Four trojans were introduced per treatment group 2 d post inoculation (dpi) to expose the vaccinated test pigs to ASFV by direct contact. Trojans pigs were euthanized when they showed clinical symptoms of the disease. Blood samples and nasal and rectal swabs were collected weekly until the end of the study (d 41 pv). All pigs were euthanized and submaxillary, retropharyngeal, and gastro-hepatic lymph nodes (LN), spleen, and tonsil samples collected. All samples were analyzed by RT-PCR and by a new DIVA-PCR to differentiate between ASFV vaccine and wild strain. In addition, specific IgG and IgA antibodies against ASFV in all serum samples were analyzed.

Results and discussion:

In the vaccinated control diet group (V+Control), 1 pig died before vaccination and another pig died d 31 pv (d 10 post exposure, pe) due to acute meningitis. In the vaccinated SDP group (V+SDP) one pig was euthanized d 21 pv to balance the number of pigs within each group to 7 during the exposure period to maintain the ratio of trojans:in-contact pigs in both experimental groups Another pig was euthanized on d 35 pv (d 14 pe) due to intestinal prolapse. Both groups finished the experiment at day 41 pv (d 20 pe) with 6 pigs each. As expected, trojan pigs in both groups died between 5 to 8 dpi with similar onset of fever, viremia, nasal and fecal virus excretion and Ct values in tissue samples. During the exposure period 4/6 from the control diet group did not show fever and the other two showed a peak rectal temperature > 40.5ºC before d 20 pe at the end of the study. The V+SDP group did not show fever, neither PCR+ in blood nor rectal swab. The number of pigs with at least one day with PCR+ in blood, nasal or rectal swabs was higher for the control diet group during the exposure period. Tissue samples at 20 d pe from 5/6 pigs fed with the control diet were PCR+ for ASFV ($P< 0.05$), albeit Ct values were much higher than in trojans pigs. None of the tissue samples from SDP fed pigs were PCR+ for ASFV at any given time after challenge (Table 1). IgG or IgA titers against ASFV were not different between treatment groups. As expected, the few PCR+ samples found before exposure were the vaccine (BA71ΔCD2) ASFV strain, but all samples PCR+ post exposure was Georgia 2007/01 strain DNA.

Table 1: Percentage of pigs with tissue samples ASFV PCR+ at the end of the study (d 41)

	Treatment Groups	
ASFV PCR+ Tissue	V+Control	V+SDP
Submaxillary LN, %	67^b	0^a
Retropharyngeal LN, %	50^b	0^a
Gastro-hepatic LN, %	50^b	0^a
Spleen, %	67^b	0^a
Tonsil, %	83^b	0^a

Row with uncommon superscript differ; ^{a,b} ($P< 0.05$).

In previous studies it was found that vaccinated pigs clear most of the virus at d28 pe (2). However, feeding SDP improved the efficacy of the candidate vaccine likely by improving mucosa integrity and the cell mediated immunity (1).

Conclusions:

Under the conditions of this study, 8% porcine SDP in feed improved the ASFV vaccine prototype efficacy. Thus, pigs fed with SDP showed lower virus load in blood, nasal, and rectal virus secretion after Georgia 2007/01 challenge than those fed with a control diet. Furthermore, no virus was detected in any organ of the SDP fed pigs at the time of sacrifice (d20 pe), thus offering a novel nutritional strategy using SDP to enhance the efficacy of a candidate ASFV vaccine and improve health status of pigs under ASFV conditions.

References

1. Pérez-Bosque et al., 2016. Porcine Health Management, 2:16.
2. Monteagudo et al., 2017. J Virology, 91(21): e01058-17.