RESEARCH ABSTRACT

SWINE HEALTH

Title: Viral structural components that enable vaccine-induced protective immunity against contemporary high morbidity and high mortality PRRS virus – **NPB #12-176**

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Scientific Abstract

The production of interferon (IFN)-α by an animal in response to a viral infection is known to be a principal determinant of the animal's ability to fight the infection. In addition, this substance is also known to play a major role in promoting the development of vaccine-induced adaptive immunity, thus acting akin to a vaccine adjuvant. Accordingly, the ability of a vaccine to stimulate an IFN-α response would be expected to have an impact on the strength of the protective immunity elicited by the vaccine. The goal of this project was to determine the strength of cross-protective immunity provided by two different PRRS live virus vaccines that have either a high (strain G16X) or low (strain Ingelvac PRRS MLV) capacity to provoke an IFN-α response in swine following their administration. The level of protective immunity elicited in grower pigs by either of these two vaccines was determined by challenging vaccinated animals with a genetically divergent (heterologous) and highly virulent PRRS virus, termed LTX1. While both PRRS live virus vaccines used for this project belong to the Type 2 North American (NA) lineage 5, the LTX1 strain, belongs to the "Canada-like" lineage 1. Type 2 PRRS viruses belonging to lineage 1 were introduced gradually during the last 10 years into in the U.S. from Canada and now represent the predominant Type 2 PRRS lineage in the Midwestern United States. A vaccination and challenge study was conducted with two groups (n=6) of 7 week-old pigs, which were immunized with either of the two PRRS virus vaccines. Two additional groups of pigs were not vaccinated and served as controls. Four weeks after vaccination, one of the unvaccinated groups and both of the vaccinated groups were challenged with the PRRS virus strain LTX1 and monitored for 14 days. Pigs in the mock-vaccinated group had a significant (>50%) reduction in weight gain during the observation period as compared to the strict control group that was not challenged. The mock vaccinated and challenged pigs also exhibited high levels of viremia throughout the 14 days of observation and at the end of the study (14 days post-challenge) all 6 pigs also had a high level of virus in their lungs. Pigs inoculated with the G16X vaccine exhibited a relatively high systemic IFN-α response within 4 days after vaccination. Immunization of the animals with either vaccine (G16X or Ingelvac PRRS MLV) similarly counteracted the negative effect of challenge with LTX1 virus in their growth as measured by body weight gain and at 14 days after challenge was not different from that of the strict control group. Vaccination with G16X resulted on a lower peak viremia at 7 days after challenge and also promoted the elimination of the challenge virus from the serum by 10 days post challenge in 80% (4 of 5) of the pigs vaccinated with G16X as compared to a higher level of viremia and only 16% (1 of 6) virus elimination in the group vaccinated with the Ingelvac PRRS MLV. Vaccination with G16X also resulted in 4 orders of magnitude reduction in the amount of virus present in the lung 14 days after challenge as compared to the amount of virus that was present in the lung of the mock-vaccinated and challenged control pigs. In contrast, the average reduction of challenge virus in the lungs the Ingelvac PRRS MLV-vaccinated animals was less than 3 orders of magnitude. In a second study, the G16X vaccine was also found to be able to also provide cross-protective immunity against another lineage 1 virus. The results of this study indicate that the level of IFN-α response to immunization with a PRRS MLV vaccine can be used as a predictive parameter of the potential effectiveness (potency) of PRRS virus vaccine and that the use of this biological property of this virus as selection criteria for vaccine strain selection will aid in the development of a more effective PRRS virus vaccine. In summary, the G16X vaccine was found capable of providing cross-protection from disease resulting from either of two different type 2 (North American-like) PRRS viruses belonging to lineage 1, which is now a predominant lineage in commercial swine farms in the American Midwest.