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Field evaluation of the efficacy, compatibility and serologic profiling of a combined vaccine against porcine reproductive and respiratory syndrome and *Haemophilus parasuis* in nursery pigs

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ABSTRACT

The aim of the study was to compare the efficacy and compatibility of a separate or combined vaccination against the porcine reproductive and respiratory syndrome (PRRS) and *Haemophilus* (*H.*) *parasuis*. The study was conducted in a 1200 head nursery farm. A total of 360 piglets at an age of 26 days were randomized into three groups. Group A was vaccinated separately against *H. parasuis* (Porcilis®Glässer) and PRRS (Porcilis®PRRS), group B was vaccinated with a combined vaccine of both vaccines and group C remained unvaccinated as control group. The compatibility was evaluated by measurement of the body temperature and a palpation score of the injection site 0, 4, 24 and 72 h after vaccination. During the nursery and the fattening period the average daily weight gain (ADWG), the number of runts and the mortality was evaluated. Additionally blood samples were taken every 2 weeks during the nursery period to perform an OppA-ELISA and a PCR for PRRS virus. No significant difference could be seen regarding the body temperature between group A and group C. Piglets which were vaccinated with the combined vaccine showed a significantly higher body temperature 4 and 72 h post vaccination than piglets from group A. The palpation score was significantly higher in group A 4 and 24 h post vaccination compared to the control group, whereas no significant difference was observed between group A and B. No significant differences between groups were seen in the ADWG during the nursery period. The mortality rate during the nursery period was significantly higher in group C than in group A. The ADWG during fattening was significantly higher in the vaccinated groups than in group C. A PRRS genotype1 field virus was detected at the end of the nursery period. No significant differences were observed in the number of OppA-ELISA positive animals, but vaccinated pigs seemed to react earlier. All pigs of the vaccinated groups that were positive in the OppA-ELISA did not develop Glässer's disease and remained in the study until slaughter. The combined administration had no negative influence on efficacy but

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showed a slightly worse compatibility than the separate administration of both vaccines. The results of the present study indicate that vaccination against Glässer's disease using Porcilis®Glässer might influence the results of the OppA-ELISA.

1. Introduction

Modifications in husbandry and improvements in productivity appear to have coincided with increasing problems of Glässer's disease caused by infection with *Haemophilus (H.) parasuis* (Aragon et al., 2012). Concurrent viral infections may also have an influence on the increasing incidence of Glässer's disease (Oliveira and Pijoan, 2002). Own studies demonstrated a correlation between the infection with *H. parasuis* and the presence of the porcine reproductive and respiratory syndrome virus (PRRSV) genotype 1 in pigs with polyserositis (Palzer et al., 2015). Data in literature regarding this association between *H. parasuis* and PRRSV are divergent; in some studies associations between these two pathogens could be ascertained (Li et al., 2009; Solano-Aguilar et al., 1997) while in others no association was observed (Cooper et al., 1995; Segalés et al., 1999). In the United States, *H. parasuis* infections are often found in herds with chronic PRRSV infections (Zimmerman et al., 1997). A higher incidence of secondary bacterial infections might be due to the immunosuppressive properties of PRRSV (Done and Paton, 1995). In Asia it was proved that a highly pathogenic PRRSV accelerates an *H. parasuis* infection in a model with conventional pigs (Yu et al., 2012). However, field observations indicating that PRRSV leads to a higher incidence of secondary infections could not be consistently reproduced under experimental conditions (Zimmerman et al., 2012). A possible cause of the influence of PRRSV on *H. parasuis* infections could be the decreased functional capability of porcine alveolar macrophages to kill bacteria in pigs exposed to PRRSV, which indicates a negative effect of the virus (Solano et al., 1998). Thus, vaccination against PRRSV could also be a possible method to control Glässer's disease. In cases of PRRSV infection vaccination can be a valid tool to reduce clinical problems in the herd. Martelli et al. (2009) showed a reduction of respiratory problems by vaccinating 4-week-old piglets with a modified live vaccine of the PRRSV genotype 1 against infection with a heterologous field strain. The clinical protection was associated with a marked activation of the cell-mediated immune response. Similar results were shown by Mavromatis et al. (1999). They demonstrated the protective property of a PRRSV live vaccine based on genotype 1 against the respiratory manifestation of PRRSV during the fattening period when the piglets were vaccinated in the 6th week of live. Although an economically significant level of protection after PRRSV can be provided to a variety of field strains, it is not certainly clear how immunological protection against one isolate will translate to broadly cross-protective immunity (Murtaugh and Genzow, 2011). This issue is of particular importance because of the large variety of different PRRSV strains that are present in Germany and Europe (Stadejek et al., 2013). A study from North-Western Germany showed that the PRRSV (Type 2) vaccine strains and PRRSV (Type 1) wild-type virus can be detected in numerous farms and PRRSV (Type 2) vaccine strains can even be detected in non-vaccinated pigs (Grosse Beilage et al., 2009). A vaccination against *H. parasuis* in herds which have problems with Glässer's disease can also result in a reduction of clinical signs and economical losses (Palzer et al., 2007). Protection of pigs against Glässer's disease can even be provided if the vaccination is carried out early at the age of 2 and 4 weeks (Miniats et al., 1991). A new opportunity for the diagnostics of *H. parasuis* was revealed with the detection of a highly immunogenic protein which was identified as the oligopeptide permease A (OppA), which is a component of the ATP-binding cassette (ABC) transporter system in *H. parasuis* (Macedo et al., 2010). Testing of serum samples obtained from non-clinical, clinical, and convalescent pigs suggested that colonized healthy pigs do not respond immunologically with antibodies against this protein, whereas survivor pigs generated high titers of antibodies against *H. parasuis* OppA (Oliveira, 2013). Galina Pantoja et al. (2014) performed a serologic profiling of *H. parasuis*–vaccinated sows and their litters using a novel oligopeptide permease A enzyme-linked immunosorbent assay. Their results indicated that *H. parasuis* vaccination of gilts will not maintain serologic responses in the OppA-ELISA over their reproductive lifetimes.

The aim of the present study was to test a separate and a combined vaccination against PRRSV and *H. parasuis* in a field trial to evaluate the clinical effect and the compatibility of the two vaccination strategies. Additionally the serological response in an enzyme-linked immunosorbent assay (ELISA) based on the *H. parasuis* species-specific protein oligopeptide permease A (OppA) of pigs vaccinated with Porcilis®Glässer in a *H. parasuis* positive nursery should be evaluated.

2. Materials and methods

The study was conducted in a 1200 head nursery managed all-in all-out. The pigs are housed in ten different pens in one compartment. Ventilation is done by underfloor extraction. Two-phase feeding is carried out with a commercial diet for nursery pigs via wet feeders. All animals originate from one farrow-to-wean farm. Weaning took place at an average age of 26 days (±2 days). The farrow-to-wean farm vaccinates its sows against PRRSV (Porcilis®PRRS, Intervet Deutschland GmbH, Unterschleissheim, Germany), no other PRRSV vaccine was used in the sow farm in the last 3 years. In the past repeated cases of Glässer's disease and PRRSV induced pneumonia were

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