Evaluation of welfare aspects in suckling piglets after intradermal vaccine application with the IDAL injector

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Introduction
The purpose of this study was the scientific evaluation of welfare aspects of an intradermal vaccination method for suckling piglets under field conditions. Local reactions within three days after vaccination, behavioural responses and performance data of the piglets vaccinated intradermally were compared to piglets conventionally immunized by intramuscular injection.

Materials and Methods
The study was carried out on a commercial German pig farm. On the 7th day of life, 672 suckling piglets in three batches were vaccinated with Porcilis® M Hyo ID ONCE; 338 of those using the IDAL injector, and 334 with conventional needle injection-systems. On the following three days, the site of injection was evaluated, scoring the size of swelling from 0 to 5 (none, <pea, pea, bean, hazelnut, dove egg).

Piglets were weighed individually one day before vaccination and eight days later. Video-recordings were performed during ten days, starting two days before vaccination in order to assess piglets’ resting and activity behaviour. Per batch, two litters vaccinated intradermally and two control litters were observed. Scan Sampling in chromatic intervals of five minutes between 9-10 a.m., 1-5 p.m. and 7-9 p.m. was carried out.

For statistical analyses, IBM SPSS Statistics, version 22 (IBM Corp., Armonk, NY, USA) was used.

Results
- Vaccination using IDAL injector took 11 seconds, on average, whereas for conventional vaccination 17 seconds were needed.
- Concerning daily weight gain, no significant difference between piglets with intramuscular injection (258g/d) and piglets with intradermal vaccination (247g/d) was found.
- The swelling of the injection site on the first day after vaccination was more apparent in piglets vaccinated intradermally, indicating a good immune response (Fig. 1), but abated within one week (Fig. 2).
- Piglets vaccinated with IDAL injector showed more activity behaviour and more suckling behaviour than piglets vaccinated conventionally by needle-systems (Fig 3).

Conclusions
The IDAL applicator is easy to handle and enables fast vaccination. In piglets receiving intradermal vaccination, more soft tissue reactions were found, showing a desired local immune reaction. There was no influence of the vaccination method on daily weight gain. Piglets vaccinated intradermally with IDAL injector showed less lying and more suckling behaviour after vaccination than intramuscularly vaccinated piglets.

* indicates a significant difference between IDAL group and control group (p < 0.05).

First presented at ESPHM 2015.
Comparative study to determine PCV vaccination immune response following different administration routes (IM VS ID)

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INTRODUCTION
This abstract is part of a broader study on welfare benefits of intradermal needle-free vaccination in piglets. This study describes the immune response following PCV vaccination of pigs either intradermally with a needle-free IDAL injector or conventionally with a needle-syringe.

MATERIAL AND METHODS
A total of 339, 28 day old piglets were distributed in 3 groups: i) vaccinated with Porcilis® PCV ID intradermally and needle free with IDAL (IDAL); ii) vaccinated with Porcilis® PCV intramuscularly (IM); iii) control, not vaccinated (Control). At the time of vaccination, all pigs were picked up by their hind legs and vaccinated according to the treatment (control pigs were touched with the hand). IgG (Ingezim Circo IgG, Ingenasa) and γ-IFN SC levels (ELISPOT assay) were determined in 75 and 25 piglets, respectively, at day of vaccination and 21 days later.

RESULTS
Seroconversion at day 21 was detected in 24 out of 25 piglets from the IDAL group and 25 out of 25 piglets from the IM group; none of the Control animals seroconverted to IgG. On day 21, IM piglets presented a greater log2 IgG titre (mean ± SE=3.3 ± 0.17) than IDAL piglets (mean ± SE=2.90 ± 0.14) (p=0.001). Cell-mediated immune response 21 days post-vaccination, measured as PCV specific γ-IFN SC (ID-17.89 SC/10^6 PBMC vs IM-26.41 SC/10^6 PBMC), was not significantly different between IDAL and IM groups, while both groups were statistically different from the Control group (p<0.001). All results are summarized in Table 1.

CONCLUSIONS
Both intramuscular and intradermal vaccination induced a clear and detectable humoral and cellular immune response based on IgG and γ-IFN SC values, indicating that both vaccination routes induce a solid immune response.

Additionally the present data support that IgG levels are an easy and valuable test that can be used to confirm Porcilis PCV ID and Porcilis PCV vaccination.

TABLE 1
Humoral and Cellular immune response 21 days post-vaccination

<table>
<thead>
<tr>
<th></th>
<th>IM</th>
<th>IDAL</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgG (mean±sd log2)</td>
<td>3.3±0.17*</td>
<td>2.9±0.4*</td>
<td>neg</td>
</tr>
<tr>
<td>% IgG Seroconversion</td>
<td>100% (25/25)</td>
<td>96% (23/24)</td>
<td>0% (0/26)</td>
</tr>
<tr>
<td>γ-IFN (SC/10^6 PBMC)</td>
<td>26.4*</td>
<td>17.9*</td>
<td>2.0*</td>
</tr>
</tbody>
</table>

* ** values with different superscripts within a row are statistically significantly different (p<0.001).
Comparison between the immune responses induced by a new intradermal PCV2 vaccination and a classical intramuscular one in three weeks old piglets.

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INTRODUCTION
PCV2 is one of the most important pathogens for the swine industry worldwide and is involved in Porcine Circovirus Associated Diseases (PCVD). The major tool for controlling PCVD is routine vaccination, in combination with good management practices and biosecurity measures. Intradermal vaccination, recently available also for PCV2, is a new efficient tool for immunization (1) and has the advantage to target antigen presenting cells in the epidermis in close proximity to skin-draining lymph nodes (2). This field trial aims at assessing the immune response elicited by Porcilis® PCV ID (MSD Animal Health) administered by a needle free device, compared with a commercial vaccine administrated via the more conventional intramuscular route.

MATERIAL AND METHODS
The study was done as a randomized blinded design in a farrow-to-finish sow herd with a history of PCV2 disease. Six-hundred 10-14 day-old piglets were randomly assigned to either: ID: one-shot ID vaccine, IM: one-shot IM vaccine or C: control. At weaning (21 days), pigs were ID, IM or mock vaccinated according to their group. Pigs were weighed at three time points. Twenty-five piglets per group were sampled at regular intervals during the study. Average daily weight gain (ADWG), humoral (AMI) (by ELISA, IPMA) and cell-mediated (CMI) immune responses to PCV2 (by INF-γ-ELISPOT) and PCV2 viremia (by using qPCR) were assessed and measured.

RESULTS
ADWG was similar for both vaccinated groups. At four and six weeks post-vaccination (pv) the intradermally vaccinated animals had statistically significantly higher number of IFN-gamma SC compared to the intramuscularly vaccinated pigs and controls. ELISA titer was significantly different (p<0.05) between ID and IM vaccination 2 and 4 weeks pv. The PCV2 load measured by qPCR in the blood was shown in few animals and none of the viremic pigs had a viral load > 10^6, suggesting a condition of subclinical PCV2 infection. At about 18 weeks of age, a slight increase of ELISA antibodies was detected in association with the mentioned poor PCV2 natural infection.

CONCLUSIONS
The ID route of PCV2 vaccine administration (Porcilis® PCV ID) resulted in a more robust and prompt increase of both AMI and CMI compared to the traditional intramuscular vaccine. Interestingly, in the ID animals, 4 weeks post-vaccination the level of ELISA antibodies were significantly higher as compared to the IM vaccinated.

REFERENCES
1. Sno et al., 2016, Trials in Vaccinol, 5:24-31
Comparative field efficacy of an intradermal PCV2 vaccine and a licensed intramuscular PCV2 vaccine

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INTRODUCTION

Intradermal needle free vaccination has several benefits over intramuscular vaccination, i.e. no needle eliminates the risk of broken needles and potential consumer safety issues, reduces handling stress and also reduces the risk of self-injection. Despite the advantages, intradermal needle free vaccination needs to deliver at least the same level of efficacy and safety expected from intramuscular vaccination. As with any intervention in pig farming, the impact on performance needs to be monitored to ensure the intervention brings benefits, in welfare, health and economics. In this study, we compared the efficacy of a new PCV2 intradermal vaccine, Porcilis® PCV ID, against a licensed intramuscular PCV2 vaccine in a commercial farm in England.

MATERIAL AND METHODS

An indoor farrow-to-finish unit with 500 sows was selected for this study. This farm is PRRS positive (though not clinically present) and PCV2 has been previously identified circulating in this unit through serology. Two hundred and eighty (280) pigs were included in this study. The inclusion day (vaccination) coincided with the weaning day, at 28 days of age.

Pigs were individually identified with electronic ear tags and randomly allocated to either group A (N = 141 pigs), vaccinated with Porcilis PCV ID (0.2 ml) with the IDAL injector or group B (N = 139 pigs), vaccinated intramuscularly with a needle and syringe with a licensed PCV2 vaccine (1 mL). To make this a blinded study, farm management and study monitors were masked to the treatments and treatment groups were commingled. All pigs were individually weighed at the time of vaccination, end of nursery, grower stage and before slaughter. Blood samples were collected to assess PCV antibody titres (AlphaLISA-PCV type 2) and viraemia at the same time points. Health was assessed by recording mortality and by tracking pigs that were excluded from the study because they needed to be euthanized or taken to hospital pens.

RESULTS

At weaning (W), end of nursery (N), grower (G) stage and finishing (F), live weights were not significantly different between groups (Figure 1). A: W - 8kg, N - 17.24kg, G - 42.49kg, F - 95.6kg; B: W - 7.97kg, N - 17.18kg, G - 42.49kg, F - 94.4kg. The average daily live weight gain (Figure 2) from weaning to nursery for group A and group B was 0.395 and 0.353 kg / day respectively, from the nursery stage to the grower stage for group A and group B was 0.477 and 0.730 kg / day respectively, from the grower stage to the finishing stage for group A and group B was 1.085 and 1.081 kg / day respectively and from weaning to slaughter for group A and group B was 0.804 and 0.793 kg / day respectively. No significant difference was found at any of the time points, despite the numerically higher growth of 11 g / day from weaning to slaughter for group A, vaccinated with Porcilis PCV ID.

The percentage of pigs that died in group A and B or were removed from the study and taken to hospital pens (mortality and morbidity) was of 4% for group A and 10 % for group B (Figure 3).

PCV2 antibody titre responses significantly higher for Porcilis PCV ID group at the end of nursery, grower and finishing stage. At the finishing stage, 52% of the samples for group A, vaccinated with Porcilis PCV ID, had a detectable level of antibodies, whereas only 6% (1 sample) of the pigs included in group B had any detectable level of antibodies (Figure 4).

CONCLUSIONS

Under the conditions of this study, ID vaccination resulted in significantly higher antibody titres at the end of nursery, grower and finishing stage. In contrast, only one of the pigs of group B had detectable levels of antibodies against PCV2 during the finishing phase. This may be explained by the long duration of immunity of Porcilis PCV ID. This significantly higher humoral response may explain the 124 kg higher average slaughter weight (though not significant) of the Porcilis PCV ID vaccinated pigs. Both vaccines were able to control PCV2 viraemia. In summary, Porcilis PCV ID performed equally well or better than an intramuscularly administered PCV2 vaccine.
Assessment of PCV2 and *Mycoplasma hyopneumoniae* intradermal vaccination on swine production parameters

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**INTRODUCTION**

Pig production depends on control of major pathogens to ensure health, welfare and sustainability of pig producing enterprises. To ensure sustainability of pig producing companies, all interventions should be assessed to ensure they result in a return on investment. This study assessed the impact of PCV2 and Mycoplasma hyopneumoniae (Mhyo) vaccination by intramuscular vaccination or intradermal vaccination (using the IDAL injector) on pig health and performance.

**MATERIAL AND METHODS**

An indoor farrow-to-finish unit with 200 sows with history of PCV2 circulation and Mhyo like lesions was selected for this study. The farm was PRRS MLV vaccinated with no clinical disease present. At weaning (28 days of age), 119 pigs were randomly allocated to one of two treatment groups, group ID (N = 61), vaccinated with Porcilis® PCV ID (0.2 ml) and Porcilis® M Hyo ID ONCE (0.2 ml) or group IM (N = 58), vaccinated concurrently with a 2 ml PCV2 intramuscularly and a Mhyo vaccine (0.2 ml intradermally). All pigs were weighed at the time of vaccination and before slaughter, 113 days after vaccination. Blood samples were collected for PCV2 viraemia at the same time points. Respiratory tracts were assessed at slaughter and scored for Mhyo like lesions (EPL) using the Goodwin (Goodwin R.F. et al, 1967) scoring system, up to a maximum of 55 per lung.

**RESULTS**

Live weight at vaccination (weaning) was not significantly different between the two treatment groups: ID 6.3 kg (1.3 standard deviation (SD)) and IM 6.4 kg (1.2 SD). PCV2 ELISA titres were not significantly different between groups and all samples were negative for PCV2 antigen when tested with a commercially available PCV2 PCR (Lifetech). The average live weight before slaughter was significantly (p < 0.05) higher for the ID vaccinated pigs than for the IM pigs: ID 74.2 kg (6.73 SD) and IM 70.9 kg (7.31 SD) respectively (Figure 1). Average daily live weight gain from weaning to slaughter (113 days period) was also significantly higher (p < 0.05) for the ID than IM group, 601 and 571 g / day respectively (Figure 2). Enzootic Pneumonia like lesions (EPL) at slaughter were not significantly different between the two groups: the ID pigs (N = 55) had an average EPL of 3.8 and the IM pigs (N = 57) had an average EPL of 3.6. A total of 11% of the lungs from ID pigs had pleurisy, compared to 18% of the lungs from IM pigs (Not significant).

**CONCLUSIONS**

Under the conditions of this study, ID pigs had a significantly higher ADG than IM pigs, resulting in a higher average live weight at slaughter. The extra 3.3 kg of live body weight represented a significant increase in profitability of £1.90 per pig at slaughter (including feed cost).
Field efficacy of Porcilis® PCV ID concurrently administered with Porcilis® M Hyo ID ONCE

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INTRODUCTION
PCV2 is the cause of Porcine Circovirus Disease and M. hyopneumoniae is the primary agent of enzootic pneumonia. Vaccination against both pathogens minimizes the economic impact resulting from infection. Although intramuscular vaccines against PCV2 are routinely used in the swine industry, no intradermal vaccines have been available until now. The objective of this study was to assess the efficacy of the intradermal administration of Porcilis® PCV ID given alone or concurrently with Porcilis® M Hyo ID ONCE in a Hungarian swine farm with confirmed PCV2 and M. hyo infections. (Porcilis® PCV ID on one side of the neck and Porcilis® M Hyo ID ONCE on the other side).

MATERIAL AND METHODS
A total of 1322 healthy, 18-24 day old suckling piglets were allocated randomly, within litters, to one of four treatment groups: 1) vaccinated intradermally with Porcilis® PCV ID (group PCV), 2) vaccinated intradermally with Porcilis® PCV ID and Porcilis® M Hyo ID ONCE concurrently (group PM), 3) vaccinated intradermally with Porcilis® M Hyo ID ONCE (group M), 4) untreated (control group). The primary efficacy parameters were PCV2 viraemia, M. hyo lung lesions at slaughter and average daily weight gain (ADWG) during finishing. Secondary parameters were the overall ADWG (from vaccination to slaughter), mortality, morbidity, PCV2 faecal shedding, and pleurisy lesions.

RESULTS
The PCV group had significantly better weight gain than the Control group as well as group M during the finishing phase and overall (p<0.0001). The differences with the control group were of 48.7 and 30.8 g/day for the finishing and overall periods, respectively and for the M group, 37.3 and 24.7 g/day for the nursery phase, finishing and overall periods, respectively and compared to the M group, were 23.0, 46.9 and 35.7 g/day, correspondingly. The PM group had a significantly better weight gain than the Control group and group M during all phases of the study (p<0.0001). The differences with the Control group were of 19.4, 58.3 and 41.9 g/day for the nursery phase, finishing and overall periods, respectively and compared to the M group, were 23.0, 46.9 and 35.7 g/day, respectively. Vaccination with Porcilis® M Hyo ID ONCE significantly reduced the mean lung lesion score (Goodwin & Whittlestone) from 7.7 (control) and 6.4 (PCV group) to 3.4 (PM group) and 4.2 (M group) (p<0.05).

CONCLUSIONS
Based on study results, intradermal vaccination with Porcilis® PCV ID administered as a single dose or concurrently with Porcilis® M Hyo ID ONCE is effective under field conditions. In addition, intradermal vaccination with a needle free IDAL injector demonstrated to have several benefits over intramuscular vaccination, such as, easy application, reduced vaccine volume, no muscle damage due to needle breakage and less stress on animals and administrator.
Onset of Immunity of Porcilis® PCV ID concurrently administered with Porcilis® M Hyo ID ONCE

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The objective of this investigation was to record the onset of immunity of a recently registered intradermal (ID) vaccine, Porcilis® PCV ID in Dutch pig herds. The vaccine was administered alone or concurrently with Porcilis® M Hyo ID ONCE (Porcilis® PCV ID on one side of the neck and Porcilis® M Hyo ID ONCE on the other side).

MATERIAL AND METHODS

Pigs were vaccinated ID using the needle free IDAL injector with Porcilis PCV ID (PCV group), with Porcilis with Porcilis® PCV ID and Porcilis® M Hyo ID ONCE concurrently (PM group), with Porcilis® M Hyo ID ONCE (M group) or left untreated. The PCV2 study included: 15 3-week-old pigs per group that were vaccinated with PCV, PM or left untreated. Two weeks later pigs were infected with a field isolate of PCV2 and 18 days later all pigs were necropsied. Serum samples taken at the time of vaccination and at two, three, four and five weeks later were examined for PCV2 antibodies (Ab) and the presence of PCV2 nucleic acid by quantitative PCR. Furthermore, fecal swabs were taken at the time of challenge and at one, two and three weeks later, during necropsy, inguinal lymph node, tonsil and lung samples were collected for detection of PCV2 nucleic acid. The M. hyo study included: 20 3-week-old piglets per group and were vaccinated with M, PM or left untreated. Three weeks later pigs were infected with a M. hyo culture originating from a Danish field isolate. Three weeks post-challenge lung lesions were scored upon necropsy, and blood samples were collected for serology.

RESULTS

PCV2: At vaccination, all groups had similar Ab titers. After vaccination and challenge, the mean Ab titer in PCV and PM pigs was significantly higher than the mean Ab titer in the controls. Sera and swabs were negative for PCV2 nucleic acid at challenge. During the post challenge period the viral load for PCV and PM pigs was significantly reduced compared to the controls. The viral load in lymphoid tissues and lung was also significantly lower in PCV and PM pigs compared to the controls groups (P<0.05). There was no significant difference between PCV or PM pigs.

M. hyo: At vaccination, all pigs were serologically negative for M. hyo, and positive for PCV2. PM pigs had the same PCV2 antibody level until challenge, whereas antibody levels decreased in the controls. The lung lesion scores of M and PM pigs were significantly lower than those of the controls group (P<0.05). There was no significant difference between M and PM pigs.

CONCLUSIONS

Based on the results, concurrent use of Porcilis® PCV ID and Porcilis® M Hyo ID ONCE, using the needle free IDAL injector, protects pigs against PCV2 and M. hyo from two and three weeks post-vaccination on, respectively. In addition, the intradermal vaccination has several benefits over intramuscular vaccination, including no needle breakage or carcass damage, lower vaccine volume and is more operator/animal friendly.
Porcilis® PCV ID vaccination concurrently administered with Porcilis® M Hyo ID ONCE reduces mortality in Hungary

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INTRODUCTION
PCV2 is the cause of Porcine Circovirus Disease and M. hyopneumoniae is the primary agent of enzootic pneumonia. Vaccination against both minimizes the economic impact resulting from infection. The objective of this study was to assess the efficacy of the intradermal application of Porcilis® PCV ID administered alone or concurrently with Porcilis® M Hyo ID ONCE in a Hungarian pig herd with confirmed PCV2 and M. hyo infections (Porcilis® PCV ID in one side of the neck and Porcilis® M Hyo ID ONCE in the other side), with emphasis on mortality.

MATERIAL AND METHODS
A total of 1810 healthy, 18-24 day old suckling piglets were allocated randomly, within litters, to one of three treatment groups: 1) vaccinated intradermally with Porcilis® PCV ID (group PCV), 2) vaccinated intradermally with Porcilis® PCV ID and Porcilis® M Hyo ID ONCE concurrently (group PM), 3) untreated (Control group).

To obtain the required data, the first 940 pigs were weighed individually at admission, at the end of the nursery period, and before slaughter as well as all medication administered to these pigs was recorded. Also, all pigs that died during the study were examined to establish the cause of death. From each group, approximately 40 animals were selected; blood samples were drawn and faecal swabs were taken on regular intervals to determine the PCV2 viral load by qPCR and antibody titres against PCV2 and M. hyo in the serum by ELISA.

RESULTS
The PCV and PM groups had a significantly better weight gain than the Control group during the finishing period and overall (p<0.0001). The differences with the Control group were of 44.5 and 50.9 g/day for the finishing and overall period, respectively.

Mortality was significantly lower in the PCV and PM groups than in the Control group with 9% mortality for the PCV and PM groups and 14% for the Control group (p<0.002).

PCV and PM groups were significantly less viraemic than the Control pigs (p<0.05).

Morbidity and faecal shedding were not statistically different across treatments.

CONCLUSIONS
Based on the study results, intradermal vaccination with Porcilis® PCV ID administered single dose, alone or concurrently with Porcilis® M Hyo ID ONCE decreased mortality and viraemia as well as improved ADG under field conditions. In addition, intradermal vaccination with a needle free IDAL injector has several benefits over intramuscular vaccination, including: easy application, reduced vaccine volume, no muscle damage due to needle breakage and less stress on animals and administrator.

TABLE 1

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Age at vaccination</th>
<th>Mortality</th>
<th>ADWG</th>
<th>Blood samples and faecal swabs taken at … weeks post vaccination</th>
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</thead>
<tbody>
<tr>
<td>PCV</td>
<td>606</td>
<td>3 weeks</td>
<td>Nursing, finishing and overall period</td>
<td>Nurse, finishing and overall period</td>
<td>0, 4, 7, 10, 13, 16, 20</td>
</tr>
<tr>
<td>PM</td>
<td>602</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>602</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FIGURE 1
Average daily weight gain compared to control

FIGURE 2
% mortality following vaccination with PCV, PM, or unvaccinated control

FIGURE 3
Mean PCV2 DNA load in sera (groups: PCV, PM, and control)
Preliminary results on the behavioural response of sows to intradermic vaccination

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In commercial pig production, sows are often vaccinated against PRRS several times per gestation period which can result in acute and chronic fear due to the painful procedure. This preliminary experiment investigated whether intradermal vaccination (IDAL) reduces sow’s fear reaction to the vaccination procedure and has an effect on resting pattern and general activity compared to the traditional vaccination intramuscularly. Two treatments (IDAL and Traditional) were performed with 6 replicate pens of gestating sows (14 sows per pen), using the vaccine Porcilis PRRS® (MLV European strain). Behavioural indicators of fear or pain at the time of injection (high pitch vocalizations, retreat attempts, turning back, changes in activity) were recorded at individual level. Resting pattern and general activity were recorded the day before and after the vaccination by means of scan samplings and analyzed by means of non-parametric GEE models using the GENMOD procedure.

The reactivity of each individual sow towards a person present in the pen was evaluated using the fear to human test validated by the Welfare Quality® for sows. The frequency of sows exhibiting an acute fear (or pain) response at the time of injection was significantly lower in the IDAL sows for the four indicators studied (high pitch vocalizations, IDAL=15.4% vs. Traditional=95.6%, \( \chi^2 = 56, p<0.0001 \); retreat attempts, IDAL=2.6% vs. Traditional=56.5%, \( \chi^2 = 28, p<0.0001 \); turning back, IDAL=5.1% vs. Traditional=69.6%, \( \chi^2 = 36, p<0.0001 \); change in behaviour, IDAL=18% vs. Traditional=95.6%, \( \chi^2 = 53, p<0.0001 \).) Sows from the traditional vaccination treatment decreased (\( p=0.039 \)) activity the day after vaccination compared to IDAL sows. No significant difference was observed for the other resting patterns.

Fearful reaction towards the assessor significantly (\( \chi^2 = 12, p=0.0006 \)) increased in Traditional sows compared to IDAL sows the day after vaccination. Indeed, 33% of Traditional sows that did not show any sign of fear before the vaccination exhibited a total withdrawal from the observer during the fear to human test the day after vaccination, compared to 3% in the IDAL group. Those preliminary results show that intradermal vaccination can be a very promising strategy to reduce fear and pain reaction of gestating sows when vaccinated.
Full Service on Target: a screening system for pneumonia and biosecurity in herds with intradermal *Mycoplasma hyopneumoniae* vaccination

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**INTRODUCTION**

Control of *Mycoplasma hyopneumoniae* vaccination + optimization of management and housing conditions

**AIM:** Comparison of Intramuscular vs Intradermal *M. hyopneumoniae* vaccination in farms with different biosecurity level

**MATERIAL AND METHODS**

Vaccination against *M. hyopneumoniae*:
- Control (historic intramuscular; IM) vs Intradermal (Porcilis® Mhyo ID Once, MSD; ID)
- Biosecurity audit via Full Service on Target

**CONCLUSION**

- A significant reduction of Mycoplasma-like lesions was demonstrated after intradermal *Mycoplasma hyopneumoniae* vaccination when compared with intramuscular vaccination
- Improvement of biosecurity contributed to a numerical reduction of pneumonia
Efficacy of intradermal Mycoplasma vaccination compared to conventional control strategies

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Introduction
Although intramuscular (IM) vaccination is most commonly used to administer swine vaccines, intradermal (ID) vaccination has demonstrated a lot of advantages. MSD Animal Health has an ID needle-free device (IDAL®) that reduces iatrogenic transmission of systemic pathogens and reduces pain and stress. Intradermal vaccination is highly immunogenic, and due to the high presence of dendritic cells in the dermis, the immune response is in some cases even higher than via IM (1). The aim of this study was to prove safety and efficacy of an ID vaccination against M. hyopneumoniae, and compare results with conventional IM and antibiotic control strategies against enzootic pneumonia.

Materials and Methods
The trial was done in 2 farms located in Murcia (Spain). Farm A, a two site farm with 1250 sows, was PRRSv positive and unstable. Until July 2012, an Mhyo commercial vaccine was applied (IM) at 1 week of age. From July 2012 to March 2013, M.hyo vaccination was substituted by a macrolide treatment administered in fattening feed. The results were not as expected, and protocol was changed to vaccination of piglets with Porcilis® Mhyo ID ONCE until today. Farm B (1175 sows with two sites too) was also positive to PRRSv. In this farm, piglets were vaccinated at 1 week of age with a commercial Mhyo vaccine. Due to a PRRS outbreak in sows in March 2013, Porcilis® Mhyo ID ONCE at 14 days of age was introduced to reduce the potential iatrogenic PRRS transmission and stress in viremic piglets. To measure efficacy of the control strategies, Mhyo lung lesions were evaluated at slaughter (1 to 5 score; 2000 lungs-Farm A and 1800-Farm B). A historical comparison was done of performance data from 75 batches in fattening pigs. The Linear Method (GLM: program SPSS 15.0) was used for the statistical analysis.

Results
Lung Lesion Score at slaughterhouse of Farm A was as follows:
Prevalence of lesions 32.47% Macrolide group vs 16.85% IDAL group; Disease Index 0.6 in Macrolide Group vs 0.32 in IDAL; and severe lesions 3.07% in Macrolide group vs 1.9% in IDAL group (all parameters p>0.05). In Farm B, the results of IM vs IDAL vaccination were 19.4% vs 20.9% in prevalence of lesions, 0.41 vs 0.36 in Disease Index and 3.55 vs 1.6% of severe lesions (p>0.05). Performance data are summarized in Table 1.

Conclusion
Intradermal needle-free IDAL Mhyo vaccination was safe and efficacious when compared to previously used conventional IM vaccination or antibiotic treatment strategies in the study farms, with comparable results in lung lesion score and improved performance parameters such as ADWG and FCR.

References

<table>
<thead>
<tr>
<th></th>
<th>ADWG (g)</th>
<th>FCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm A IDAL</td>
<td>667ᵃ</td>
<td>2.46ᵇ</td>
</tr>
<tr>
<td>Farm A (Macrolide strategy)</td>
<td>656ᵃ</td>
<td>2.53ᵇ</td>
</tr>
<tr>
<td>Farm B IDAL</td>
<td>690ᵃ</td>
<td>2.49ᵇ</td>
</tr>
<tr>
<td>Farm B (IM strategy)</td>
<td>651.2ᵃ</td>
<td>2.58ᵇ</td>
</tr>
</tbody>
</table>

Values with different superscripts in the same column are significantly different (p<0.01).
Field efficacy study of an intradermal vaccination against *Mycoplasma hyopneumoniae* with the needle-free IDAL device

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**INTRODUCTION**

*Mycoplasma hyopneumoniae* (M hyo) is the causative agent of enzootic pneumonia. M hyo leads to poor growth rates and reduced feed conversion ratios. The control of M hyo infections requires an optimization of housing conditions, management practices and vaccination (1). An intradermal vaccination targets epidermal and dermal dendritic cells (DC). The activation of DCs stimulates the adaptive immune response which is necessary for the protection against M hyo (2,3).

The aim of the present study was to assess the efficacy of an intradermal needle-free vaccination with Porcilis® M Hyo ID ONCE under field conditions.

**MATERIAL AND METHODS**

The study was carried out in a commercial 1000 sow farrow-to-finish farm in the north-eastern part of Germany in 2013. The piglets were allocated to two vaccine groups (VC1, needle-free and VC2, needle) receiving the vaccine and one control group (CG) receiving only adjuvant at three weeks of age (VC1 (n=138): Porcilis® M Hyo ID ONCE, IDAL; VC2 (n=144): M+PAC®, i.m. CG (n=138): Diluvac forte). The efficacy of the vaccine was determined by comparing performance parameters such as bodyweight at the end of finishing and average daily weight gain (ADWG) between day 21 and the end of finishing (day 145). Furthermore, the percentage of pneumonic lung lesions observed in each lobe (0-100%) was scored at the slaughterhouse based on the scoring system of Christensen et al. 1999 (4).

**RESULTS**

Body weights at the end of finishing and the ADWGs did not differ significantly between VC1 and VC2. The bodyweight (BDW) of pigs from vaccinated groups was significantly higher (p ≤ 0.005) than the BDW of the control group. The ADWG (Table 1.) within the finishing and the entire study period was significantly higher for the vaccinated animals compared to the control group.

Table 1. Performance parameters: average daily weight gain (g/day) and body weight (kg)

<table>
<thead>
<tr>
<th>Period</th>
<th>VC1</th>
<th>VC2</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDW</td>
<td>3. week</td>
<td>6.25</td>
<td>6.18</td>
</tr>
<tr>
<td>ADWG</td>
<td>3. - 11. week</td>
<td>434.82</td>
<td>438.12</td>
</tr>
<tr>
<td>BDW</td>
<td>11. week</td>
<td>30.16</td>
<td>30.28</td>
</tr>
<tr>
<td>ADWG</td>
<td>11. - 24. week</td>
<td>913.44*</td>
<td>924.54*</td>
</tr>
<tr>
<td>BDW</td>
<td>25. week</td>
<td>112.30*</td>
<td>113.49*</td>
</tr>
<tr>
<td>ADWG</td>
<td>3. - 25. week</td>
<td>731.89*</td>
<td>740.03*</td>
</tr>
</tbody>
</table>

*1, 2, 3, p ≤ 0.005; 4, 5, 6, p ≤ 0.004; 7, 8, 9, p ≤ 0.004; 10, 11, 12, p ≤ 0.004

Analysis of the percentage of pneumonic lung lesions showed a significantly lower mean lung lesion score of the pigs vaccinated with Porcilis® M Hyo ID ONCE and M+PAC® (VC1 and VC2) compared to those of the control group (Fig. 1).

**CONCLUSIONS**

The study results support that the intradermal administration of Porcilis® M Hyo ID ONCE is efficacious by improving the average daily weight gain and the bodyweight at the end of finishing. No differences concerning the performance parameters were observed between the intramuscular and intradermal vaccinated piglets. The current study achieved a significant reduction of the mean lung lesion score at slaughter indicating an improvement of the lung health. These results are consistent with the observed shortening of the finishing period of the vaccinated pigs in this study.

**REFERENCES**

2. Bernardy et al. 2008 Vaccine(26): 6368-72
4. Christensen et al. 1999 Disease of Swine 8th edition: 927-8

**ACKNOWLEDGMENT**

We thank MSD Animal Health for the financial support of this study.
Field safety of an intradermal vaccination against *Mycoplasma hyopneumoniae* with the needle-free IDAL device

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**INTRODUCTION**

*Mycoplasma hyopneumoniae* (M hyo) is widespread in the pig population worldwide and leads to major economic losses due to reduced daily weight gain and increased medication costs. Vaccination is an important strategy to control the clinical diseases associated with M hyo including PRDC. Needlefree injection eliminates not only the risk of needle residues in pork carcasses (1) and the risk of self-injection but also reduces the haematogenous transmission of infectious diseases (2).

The aim of the present study was to assess the safety of the inactivated M hyo vaccine, Porcilis® M Hyo ID ONCE.

**MATERIAL AND METHODS**

The study was carried out in a commercial 1000 sow farrow-to-finish farm in the north-eastern part of Germany in 2013. The piglets were allocated to two vaccine groups (VC1, needle-free and VC2, needle) receiving the vaccine and two control groups (CG1, needle-free and CG2, needle) receiving only adjuvant at three weeks of age (VC1 n=138: Porcilis® M Hyo ID ONCE, IDAL; VC2 n=144: M+PAC®, i.m.; CG1 n=70: Diluvac forte IDAL; CG2 n=68: Diluvac forte i.m.). 84 piglets were randomly included for the safety assessments in which clinical observations and an injection site reaction score were recorded for seven days after vaccination. The diameter (0-4 scorepoints), the consistency of the local induration (0-3 scorepoints) and signs of inflammation such as redness and warmth (0-1 scorepoints) were assessed. By summing up these scorepoints an average daily and a total (day 0 – day 7) local reaction score were generated. Furthermore, the rectal temperature was evaluated for 4 days after vaccination.

**RESULTS**

An overview of clinical observation results is shown in Table 1. The maximum duration of each clinical sign was one day. There were no differences between the treatment groups concerning the frequency distribution of these clinical observations.

Table 1. Results of clinical observation

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of pigs with corresponding clinical observations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MyoIDonce</strong></td>
<td>n=28</td>
</tr>
<tr>
<td>Control i.d.</td>
<td>n=13</td>
</tr>
<tr>
<td><strong>M+PAC</strong></td>
<td>n=30</td>
</tr>
<tr>
<td>Control i.m.</td>
<td>n=13</td>
</tr>
</tbody>
</table>

- **Depression**: 0 0 1 0
- **Anorexia**: 0 0 0 0
- **Sneezing**: 5 2 10 2
- **Coughing**: 0 0 1 0
- **Dyspnoea**: 1 0 0 0

In general, the observed injection site reactions (ISR) were of minor extent with a maximum diameter of 1.5 cm. The amount and quality (diameter, consistency and signs of inflammation) of injection site reactions did not differ significantly between the animals within the two control groups. The course of local reactions over the observation period is shown in Fig. 1.

Seven days after injection local reactions of a low grade (1cm diameter) were still observed in some of the intradermally injected piglets. The average total injection site reaction score was significantly higher for the piglets of VC1 compared to CG1 and VC1 compared to VC2 (Fig 2.)

The mean rectal temperatures of the vaccinated and unvaccinated piglets remained within the physiological range over the observation period.

**CONCLUSIONS**

No systemic side effects were observed in any of the vaccinated pigs. These results support that the needle-free intradermal administration of Porcilis® M Hyo ID ONCE is safe. The differences between the groups concerning the ISR are due to differences in vaccine formulations but not due to the way of application as both control groups received the same adjuvant. It is important to note that a strong immune response may be associated with distinct adverse local reactions.

**REFERENCES**


**ACKNOWLEDGMENT**

We thank MSD Animal Health for the financial support of this study.