FIELD EVALUATION OF THE EFFICACY OF VACCINATION AGAINST PORCINE PROLIFERATIVE ENTEROPATHY DEPENDING ON THE VACCINATION PROTOCOL AND FARM MANAGEMENT SYSTEM

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Abstract

The purpose of the study was to determine the efficacy of Enterisol Ileitis vaccine administered orally in water against porcine proliferative enteropathy. For a comparison, two administration protocols were used for the vaccination: individual oral drench or via drinking water accessible to the herd. The efficacy of the vaccine was studied on breeding, commercial, and fattening swine farms. As has been found, the percentage of immunised pigs that required further therapeutic action, during the fattening period, was significantly lower than that observed in the control (non-treated) group. Besides, the number of culled and Lawsonia intracellularis positive pigs was reduced. Better efficacy was found with individual oral drench applications than via drinking water. In addition, the vaccination had a positive impact on daily weight gain. In general, better results were observed on breeding and commercial farms than on fattening farms.

Key words: swine, porcine proliferative enteropathy, Enterisol® Ileitis vaccine, vaccination response.

According to McOrist and Smits (4) and the data reported in other publications, porcine proliferative enteropathy (PPE) caused by Lawsonia intracellularis, is an important disease that affects swine populations throughout the world. Losses due to PPE include daily weight gain, feeding costs, and a longer fattening period, as well as a greater number of culled animals and deaths before slaughter. Despite quite good chemotherapeutic effects of such drugs as tiamulin and tylosin, it has been found that in a long-term, the vaccination of the entire herd is more efficient and economical (3). This has also been confirmed by other authors (4-6). It has been found (1) that oral administration of live attenuated oral vaccine Enterisol® Ileitis Boeringer Ingelheim to young pigs ensures high-level protective immunity to pigs against the pathogenic strain of L. intracellularis. The same authors reported that the protection was effective with both individual oral drench applications and administration of the vaccine to a group of animals in drinking water. The differences, as compared to the control (non-immunised animals) were statistically significant, and they were mainly observed in macro- and microscopic lesions in the ileum, daily weight gain, decreased shedding of L. intracellularis, and reduced number of culled animals and deaths.

Bearing in mind the facts mentioned thus far, the authors of the present investigation have attempted to evaluate the efficacy of the vaccine under Polish conditions, in breeding, commercial, and fattening pig farms.

The investigation was aimed at the evaluation of the efficacy of oral vaccination against PPE with Enterisol® Ileitis, especially by comparison of individual oral drench applications with administration of the vaccine to a herd via drinking water. The investigation was conducted on breeding, commercial, and fattening farms in order to find the effects of farm management systems on post-vaccine immune responses.

Material and Methods

Pigs and experimental protocol. In total, 3,070 pigs, aged 3-16 weeks from eight swine farms (one breeding, five commercial, and two fattening) were
randomly selected for the investigation. At each farm, the animals were divided into two groups: group I (experimental) and group II (control, non-immunised, receiving placebo). Group I consisted of 2,636 pigs and group II comprised 434 pigs. Group I was subdivided into subgroup A (1,718 pigs) vaccinated with the use of individual oral drench method and subgroup B (918 pigs) to which the vaccine was administered via drinking water (from drinkers and drinking troughs). Every experimental group had a control group, which received placebo.

**Vaccine.** Enterisol® Ileitis (Boeringer Ingelheim Ltd.) vaccine was a lyophilisate containing attenuated live strains of *Lawsonia intracellularis* (MS B3903), isolated in Denmark from a pig with diagnosed acute hemorrhagic PE. One 2 ml dose of reconstituted vaccine contained at least 1x10^4.9 TCID50 (maximum 1x10^6.1 TCID50).

Prior to the application, the lyophilisate was diluted with an appropriate diluent. Three days before and four days after immunisation, the pigs were not administered any antibiotics in order to avoid inactivation of the bacterial strain. The dose of the vaccine administered via drinking water was measured and adjusted to the number of pigs destined for the vaccination. A dose of 2 ml was designated to each pig. The vaccine was blended with skimmed milk and added to drinking water (30 ml of milk per 1 litre of drinking water) in order to avoid inactivation of the bacterial strain by the chlorine present in the water. Since there is a limit of 4 h for the intake of the vaccine after it has been prepared, the animals had no access to drinking water prior to vaccine application. A dose of the vaccine was prepared in the same manner for individual oral drench applications. The pigs were vaccinated in the post-weaning period (>3 weeks of age).

**Laboratory examinations.** A nested PCR was used to find the *L. intracellularis*-positive pigs, using the methods described by Żmudzki (7). The material (faeces) for the studies on the presence of DNA of *L. intracellularis* was collected from the rectum of 20 randomly selected pigs from both groups on each of the eight farms a few weeks before the pigs were supposed to reach the slaughter weight.

**Evaluation of the immunisation effects.** In addition to the number of *L. intracellularis*-positive pigs, the effects were evaluated with regard to the number/percentages of the immunised animals, from the day of the vaccination until slaughter time; the number/percentages of animals, which did not reach 85 kg b.w. (culled pigs) until the date of shipment to an abattoir. Average daily weight gain of the immunised and control animals (indicators of the efficacy of vaccination) was determined with regard to the difference in body weight on the time of the vaccination and on the date of shipment to the abattoir, divided by the number of fattening days. For this purpose, 50 pigs (the same number of males and females) were randomly selected from each group.

The results were analysed statistically, using a Student’s t-test (2). The arithmetic mean (x) and standard deviation were determined for the analysis. The differences between the mean values obtained in the groups and subgroups were considered significant at P<0.05.

**Results**

No post-vaccination complications, such as diarrhea, skin reddening or itching, or anaphylactic shock were observed in the pigs.

Fig. 1 shows the percentages of treated, culled, and *L. intracellularis*-positive pigs from the day of vaccination until slaughter time in the experimental group I, subgroups A and B, and the control (II).

Fig. 1 shows that the percentage of treated animals was significantly lower in the experimental than in the control group (11.9% and 28.1%, respectively). The percentages of culled animals were: 7.4% in the experimental group and 12.4% in the control. The presence of *L. intracellularis* in the faeces was found in 14.3% of pigs in the experimental group and 22.5% of pigs in the control group.

As can be seen in Fig. 2, the differences resulting from the method of vaccination, affecting the percentages of pigs that required further treatment, (differences in the percentages of pigs that required further treatment, resulting from the method of vaccination?) were insignificant (0.9%) and to the favour of individual oral drench applications. Greater, but statistically insignificant was the difference between the groups in the case of culled animals (2.5% lower number as compared to the pigs immunised by individual oral drench applications). A markedly higher difference was found in pigs shedding *L. intracellularis* in faeces (expressed in 12% lower number of pigs shedding – immunised by individual oral drench applications).

In addition, the data shown in Fig. 2 confirmed the results obtained previously (Fig. 1) showing that irrespective of the administration protocol, immunisation with Enterisol® Ileitis proved to be justifiable, because it reduced the number of animals that needed treatment as well as the percentage of culled and *L. intracellularis*-positive pigs.

Besides, the pigs immunised with Enterisol® Ileitis exhibited better daily weight gains than the non-immunised ones. It is worth noting that the effect on daily weight gain was better with individual oral drench applications than with administration of the vaccine via drinking water (Fig. 3).

Figure 4 shows the results of individual oral drench applications and administration of the vaccine via drinking water, observed on breeding, farrow-to-finish, and fattening farms. The mean values of treated pigs immunised by individual oral drench applications on breeding and commercial farms were identical, but markedly lower than those observed in fattening farms (by 8.1% and 16.2%, respectively).
Fig. 1. Summary results after administration of Enterisol vaccine in prophylaxis of *L. intracellularis* infections. 2,636 experimental and 434 control pigs from eight farms were used in the trial.

Fig. 2. Summary results of individual and collective vaccination with Enterisol vaccine in prophylaxis of *L. intracellularis* infections.
Fig. 3. Summary results estimating the influence of different kinds of vaccination against *L. intracellularis* infections on body weight gains.

Fig. 4. The efficacy of Enterisol Ileitis depending on farm management system.
The lowest percentage of culled animals (1.7%) was observed on breeding farms, next on the fattening units (2.3%) and farrow-to-finish farms (5.3%). The percentage of treated animals on breeding farms was 6.8% and the percentage of culled animals was 5.2%. The percentages on farrow-to-finish farms were higher (12.1% and 17%, respectively). The highest percentage of treated animals was on the fattening units (20%), where the percentage of culled animals was low (2.8%). The percentages on breeding and farrow-to-finish farms were 5.2% and 17%, respectively. The obtained results indicate that the production technology had an influence on the efficacy of vaccination performed on fattening unit, breeding and farrow-to-finish farms.

**Discussion**

The data presented in this paper were obtained in field experiments. For this reason, their value is lower than if they would be performed under laboratory conditions. However, it seems quite likely that the use of a large number of animals in the present investigation could have reduced the imperfections connected with the field conditions. In addition, the selection of the animals from eight farms with varied management systems (breeding, farrow-to-finish, and fattening) and environmental conditions must have resulted in obtaining the results similar to those prevailing in practice. Suitability of the investigations was also connected with the proper selection of the indices for the evaluation of the efficacy of the vaccine, i.e.: the number of therapeutic interventions in vaccinated and control animals, the number of culled animals, and those shedding *L. intracellularis*.

Similar studies with the use of Enterisol® Ileitis against PPE were conducted by McOrist and Smits (4). The results they obtained were comparable with those obtained in the present investigation and they confirmed that the administration of the vaccine was justified because it reduced the losses due to PPE. The results of the present investigation also show that individual drench application offers a better preventive protection against *L. intracellularis* than vaccination via drinking water. This effect was mainly seen in the reduced number of the animals shedding the bacteria, which is of great importance in the prophylaxis of the disease.

The results obtained in the present study, under the conditions prevailing in Polish environment, were in agreement with the results reported by McOrist and Smits (4), which proved that the vaccination favourably affected daily weight gain of the pigs. In this case, also individual drench applications proved to be more effective than administration of the vaccine via drinking water.

The effects of the vaccination varied depending on the type of the management system on pig farms. The mean percentages of treated animals on breeding and farrow-to-finish farms were lower as compared to those observed on the fattening units, which means that the environmental conditions positively affecting the immune system were better in the former. The lowest percentages of culled animals were on the breeding farms, that confirms the previous statement. However, they proved to be higher on the farrow-to-finish farms than on the fattening units, which was contradictory to the previous finding. It is difficult to explain such a result, but it seems quite likely that it was due to the specific conditions of the field studies. Generally, it is impossible to compare the results obtained in the present investigation with the results obtained by other authors, since no comparison of the efficacy of vaccination against PPE has been carried out with regard to the management system on breeding, farrow-to-finish and fattening units. However, such a correlation exists, which has been proved in the present study as well as by McOrist and Smits (4) as well as the data on the effects of environmental conditions on PPE infections (3). It can therefore be concluded that the losses on pig farms due to PPE infections can be efficiently reduced by both Enterisol® Ileitis vaccinations as well as satisfactory environmental conditions.

**References**