Acta vet. scand. 1999, *40*, 213-219.

# Vaccination and Eradication Programme against Aujeszky's Disease in Five Swedish Pig Herds with Special Reference to Herd Owner Attitudes

By *M. Engel* and *M. Wierup*

Faculty of Veterinary Medicine, IME, Swedish University of Agricultural Sciences, Uppsala, and Swedish Animal Health Service, Johanneshov, Sweden.

**Engel M, Wierup M: Vaccination and eradication programme against Aujeszky's disease in five Swedish pig herds with special reference to herd owner attitudes. Acta vet. scand. 1999, 40, 213-219.** – A vaccination eradication programme against Aujeszky's disease (AD), based on the use of gE-negative killed vaccine, was carried out between 1987 and 1992 in 5 Swedish weaner pig producing or farrow-to-finish herds, with 63 to 398 breeding animals. All breeding animals were tested at the start and the end of the programme. Seroprevalence to Aujeszky's disease virus (ADV) ranged between 47% and 100% in the herds at the first test. During the programme, all breeding animals were vaccinated simultaneously every 4 months and ADV-free replacement animals were vaccinated shortly after arrival and boostered within a month. In one herd only, a limited number of fatteners were vaccinated.
The herds were declared free (gE-negative) 12 to 53 months after the start of the programme. When all seropositive breeding animals had been culled, the programme ended after 2 negative tests of the breeding animals. Seroconversion was limited in all herds but one, where initially no isolation unit was available for replacement animals. The attitude of the herd owners towards the programme and the special conditions prevailing in the herds are discussed. It is suggested that vaccination may promote risk behaviour of herd managers.

***Pseudorabies; disease control; human behaviour; risk management.***

## Introduction

Aujeszky's disease (AD), which is caused by *Suid Herpesvirus 1,* brings about large economic losses to pig production throughout the world and several countries are trying to control or eradicate the virus (*Kluge et al.* 1992). In Denmark ADV was eradicated in the 1980's (*Andersen* 1991). The first recorded outbreak of AD in Sweden occurred in 1965 (*Estola et al.* 1965). A national eradication programme was launched in 1991 (*Robertsson & Wierup* 1994) and Sweden was officially declared free of AD in 1996. In preparation for that programme, methods for eradicating the virus from infected herds which did not rely on total depopulation were evaluated. It was found that in some herds Aujeszky's disease virus (ADV) could be eradicated by replacing seropositive animals with seronegative animals in accordance with the herd's replacement programme, whereas in other herds extensive spread occurred (*Engel & Wierup* 1999).

The development of a complementary vaccine and test system (*Van Oirschot et al.* 1986) created an opportunity to temporarily use vaccine to reduce virus circulation when carrying out an eradication programme in a herd infected with ADV. Thus when pigs were vaccinated with a glycoprotein E* (gE) deleted vaccine, they would not produce antibodies against gE, in contrast to pigs infected with field virus and these 2 categories of pigs could be serologically distinguished with a gE ELISA. Previously, vaccination against ADV had not been permitted in Sweden, but this new concept was successfully applied in a Swedish weaner pig producing herd, which achieved ADV-free status after 22 months (*Engel & Wierup* 1989). It was thus decided to extend the programme to more herds. The present report describes the experiences from a vaccination and eradication programme carried out in 5 pig herds.

## Materials and methods

*Herd characteristics*

Three weaner pig producing herds and 2 farrow-to-finish herds (with 63 to 398 sows and boars) in the south of Sweden participated in a vaccination eradication programme. Before entering this programme, all herds had experienced one or more outbreaks of Aujeszky's disease during the 1980's confirmed by virus isolation. Four of the herds were privately owned and one (herd I) was run by an agricultural school. The size and the history of the herds are presented in Table 1. The majority of the sows and gilts of the herds were hybrids (crossbred Yorkshire – Swedish Landrace) and most boars were of Hampshire breed. During the programme the herds were recruiting ADV-free hybrid gilts from external sources for replacement.

In the weaner pig producing herds, the farrowing units and dry sow units were located in separate buildings. Weaned piglets remained in the farrowing unit until sold off at approximately 25 kg bodyweight.

In one of the farrow-to-finish herds (herd I) one building contained 5 separate rooms, each with separate ventilation; one dry sow unit, two farrowing units and two fattening units. A second, older building held dry sow and farrowing pens within the same room.

The second farrow-to-finish herd (herd V) was originally 2 separate herds at 5 km distance which were brought together under one owner at the time when the programme started. Both herds were infected with ADV. After the affiliation, one farm kept adult breeding sows and produced piglets which were transferred to the second farm for fattening. On the weaner pig producing farm the farrowing and dry sow units were located in separate buildings. Plans to build a separate isolation unit for replacement animals were interrupted for economical reasons. During the first 2 years of the programme, the replacement animals were kept on the fattening farm until late pregnancy, within the same building as the fatteners. There were separate rooms for gilts and fatteners, although it sometimes happened that replacement animals were placed in the same rooms as the fattening pigs. The herd went bankrupt 1½ years into the programme, but was refinanced within a few months. Two years after the start of the programme, a third farm was acquired where replacement animals were kept in isolation until late pregnancy.

*Vaccination programme*

The herd owners participated at their own request in the programme, which was launched between November 1987 and February 1989 and continued for a period of 12 to 53 months. At the start of the programme, the entire breeding herds were tested for antibodies to ADV

* Glycoprotein E (gE) was formerly known as glycoprotein I (gI).

Table 1. Herd size and history of Aujeszky's disease (AD) in 5 Swedish pig herds.

| Herd | Type | Number of boars and sows | Previous outbreaks of AD | Number of piglets lost | Suspected source for introduction of ADV | ADV<1 km* |
|---|---|---|---|---|---|---|
| I | Farrow-to-finish | 71 | Dec 84<br>May 88 | 257<br>50 | not known | yes |
| II | Weaner pig producer | 63 | March 87 | 349 | purchase | yes |
| III | Weaner pig producer | 127 | Dec 84<br>May 86 | 73<br>76 | purchase | none |
| IV | Weaner pig producer | 155 | Jan 89 | 235 | purchase | none |
| V | Farrow-to-finish | 398 | March 82**<br>Jan 87 | 800***<br>200 | purchase | yes |

* other known ADV-infected herds within 1 kilometre.
** outbreaks occurring in each of 2 herds that were affiliated at the time of the vaccination programme.
*** at the time of the outbreak, this herd contained approximately 500 sows.

with the ELISA used in routine diagnosis (*Sörensen & Lei* 1986) at the National Veterinary Institute (SVA) in Uppsala, Sweden. On the same occasion, all the breeding animals were vaccinated with gE-negative vaccine. The vaccine used in the programme was PR Vac Killed (adjuvanted with aluminium hydroxide; Norden Laboratories, Lincoln, Nebraska). Temporarily, Auskimune K (adjuvanted with Quil A; SmithKline GmBH, Munich, Germany) derived from the same virus strain was used in herds IV and V, due to problems with delivery of PR Vac Killed. Vaccinations were performed by the local animal health service veterinarians who also recorded the number of animals that had been vaccinated and the vaccination dates.

Animals testing seronegative in the first herd test, received a booster dose after approximately 4 weeks. Thereafter all breeding animals in the herds, regardless of serological status, were revaccinated simultaneously every 4 months. All herds except herd V had isolation units for the replacement animals which were vaccinated at arrival and were boostered 3 to 4 weeks later. Thereafter they were revaccinated simultaneously with the rest of the herd. No fatteners were vaccinated with the exception of herd I where approximately 50 piglets, born to negative sows, were vaccinated at 10 and 15 weeks of age during a period when there still remained progeny of seropositive sows in the fattening units.

When all known seropositive breeding animals had been rotated out of the herd by culling, the programme would end after 2 negative tests of the entire breeding herd. The samples were analysed for antibodies to gE with either of 2 commercially available gE ELISA test kits (Suvaxyn gI test; Duphar B.V., Weesp, The Netherlands or HerdChek Anti-ADV gI; IDEXX Corp., Portland, Maine) in accordance with the manufacturers recommendations, or at the Central Veterinary Institute (CDI) in Lelystad, The Netherlands.

During the vaccination programme, sanitary measures were taken to prevent reintroduction of virus. The herd owners were also advised to keep seropositive and seronegative animals separate whenever possible and to clean and disinfect pens before used by seronegative animals. It was also generally recommended (within existing economic limits) to selectively cull seropositive animals and to keep the population density lower than normal.

Herd I had concurrent problems with atrophic rhinitis and thus choose to maintain strict separation between the old and the new herd (including the offspring) throughout the programme. Thus the entire old herd (including the ADV-free animals) was replaced. New animals were put into empty units which had been cleaned, disinfected and kept empty for at least 2 weeks. Personnel had to change protective clothing before entering the clean units.

## Results and discussion

*Seroconversion*

There was no or very limited seroconversion in 4 of the herds, which were confirmed gE-negative 12 to 26 months after the start of the vaccination programme (Table 2). Spread of virus to the replacement animals occurred only in one of these 4 herds, herd II, in which one animal bought during the programme seroconverted. In herd IV, 15 of the animals which were negative at the start of the programme had seroconverted when tested again at the end of the programme. However, as the vaccination was started during a clinical outbreak, these animals were possibly recently infected but without detectable levels of antibodies in the first test. Limited seroconversion has also been recorded in other longitudinal studies of vaccinated herds (*Engel & Wierup* 1989, *Van Oirschot et al.* 1990, *Duffy et al.* 1991, *Stegeman et al.* 1994, *Van Nes et al.* 1996, *Engel & Wierup* 1997).

More extensive seroconversion occurred in herd V which initially lacked an isolation unit for replacement animals. When all known infected animals had been culled, 3½ years after the start of the programme, the entire breeding herd was tested . Of previously seronegative animals which still remained in the herd, 23 of 72 animals which had earlier been kept in the fattening farm had seroconverted. It is possible that at least some of these animals may have become infected before vaccination, as they were not isolated at arrival. No seroconversion had occurred among 144 sows which had been kept on the isolation farm as gilts. The herd was declared gE-negative 53 months after the start of the vaccination programme.

*Management*

The vaccination schemes were followed in all 5 herds. However, the ambition of the herd owners to achieve eradication of ADV varied. At one end, the agricultural school farm (herd I) was the most motivated to become free as quickly as possible. As a school it was not only guided by commercial principles and it was considered bad for its reputation to be a possible source of infection. The school was disinclined to take risks when carrying out the programme and strict hygiene was enforced. The strict separation between the old and the new herd was implemented mainly with the objective to control atrophic rhinitis. However, it is possible that this had been a sufficient measure in itself to eradicate ADV, even without vaccination. The turnover of animals was accelerated and towards the end of the programme even pregnant sows were culled in order to prepare room for new arrivals. The herd became gE-negative and free of clinical atrophic rhinitis within one year. However, for a period there were serious problems with neonatal diarrhoea in the rejuvenated herd.

Also herds II and III were highly motivated to achieve the goal to eradicate ADV. In herd II, the programme was carried out with a normal replacement rate. In herd III, the majority of the seropositive sows were selectively culled al-

Table 2. Results of a vaccination eradication programme against Aujeszky's disease (AD) in 5 Swedish pig herds.

| Herd | Herd size at start and end of study | | Seroprevalence at start of study | | First herd vacci-nation | Number of herd revacci-nations | Last herd test | Duration of program (first vaccination to last test) | Number of animals sero-converting in gE-ELISA |
|---|---|---|---|---|---|---|---|---|---|
| I | 71 | 52 | 83% | (59/71) | Sep 88 | 2 | Aug 89 | 12 mo | 0 |
| II | 63 | 75 | 100% | (63/63) | Nov 87 | 5 | Jan 90 | 26 mo | 1* |
| III | 127 | 123 | 47% | (60/127) | Feb 89 | 4 | May 91 | 26 mo | 0 |
| IV | 155 | 118 | 69% | (107/155) | Mar 89 | 4 | Jan 91 | 22 mo | 15** |
| V | 398 | 270 | 69% | (274/398) | Mar 88 | 11 | Sep 92 | 53 mo | 23*** |

* seroconversion in a sow bought after the start of the programme.
** 15 animals possibly infected at the start of the programme but without detectable antibodies.
*** seroconversion in one sow belonging to the original herd and 21 sows and one boar bought after the start of the programme, when no isolation unit was available in the herd.

ready within the first year of the programme. Apart from this, the programme was carried out with very little disruption to normal management in these 2 herds.

At the opposite end were herds IV and V. The time was not ideal for eradication for these herds as both had a reduced need for replacement. Herd IV had started up one year previously and the average age of the sows was low (1.5 parities). Herd V which had joined 2 herds wished to reduce the herd size by roughly 100 sows. However, both herd owners were afraid of further clinical outbreaks and were eager to participate in a vaccination programme and thus agreed on a timeplan for the programme. Once the herds had been vaccinated, the anxiety and ambition to stick to the time plan seemed to diminish.

The incentive to eradicate ADV increased considerably in herd IV, during the second year of the programme, as the herd owner decided to expand the business and enlarge the herd size. Thus the programme was speeded up and it was decided to slaughter the remaining known positive sows after weaning of their piglets. The additional 15 reactors discovered at the herd test were immediately removed.

In herd V, economic problems took priority over the ambitions to clean up the herd for the first 2 years of the programme. The fattening farm was partly being rebuilt and the situation was disorganized. There was no isolation unit available for replacement animals during the first 2 years, and it sometimes happened that replacement animals were placed at arrival in the same rooms as the fattening pigs. Vaccination was carried out within one week after arrival, and it is possible that if virus was circulating in the fattening herd the replacement animals could become infected before being vaccinated. Once the herd had refinanced, an isolation farm was acquired for the replacement animals and a plan was made for the culling of the remaining known positive sows.

The relaxed attitude of the owners of herds IV and V, once their herds had become vaccinated, may reflect a general attitude problem associated with vaccination; that vaccination in itself is perceived as the (final) solution to the problems. Once the risk of further clinical outbreaks has become reduced, the herd owner may not feel the time pressure any longer to eradicate the virus; the incentive to take any further measures towards eradication may disappear. This is supported by experiences from France where it was observed that it is much more difficult to obtain eradication or control of AD when vaccination is applied, in comparison to when only sanitary measures are applied (*Vannier et al.* 1997).

If vaccination is perceived as a safeguard against further problems this could actually promote risk behaviour. The mixing of free replacement animals with unvaccinated fatteners in herd V, contrary to basic principles of biosecurity, could be an example of this.

The influence of the herd manager's personality profile on the wellbeing and performance of swine has been studied (*Seabrook* 1984, *Hemsworth & Coleman* 1996, *Ravel et al.* 1996), although the question of personality and risk behaviour has not yet been addressed in veterinary medicine. In human medicine, increased risk behaviour following vaccination is taken into consideration for infectious diseases such as HIV, where a vaccination campaign could result in the opposite effect than the one intended (*Blower & McLean* 1994). In HIV vaccine trials, participants with high risk behaviour are candidates for more intensive risk behaviour counseling prior to and during their participation (*Chesney et al.* 1997).

Before taking on a vaccination programme against AD, it is important that the herd owner is fully aware that ADV vaccine only gives partial protection and that the infection may continue to spread in a vaccinated herd. It is also important that procedures are correctly applied concerning e.g. vaccination intervals, handling of vaccine and injection technique. Preferably the vaccination procedure should be executed or at least supervised by a veterinarian.

Finally, for a vaccination programme to succeed, it is important that basic principles of biosecurity are not violated. It is absolutely necessary that the replacement animals are certified free of infection, and vaccinated in isolation from the rest of the herd. Also, precautions must be taken against reintroduction of virus.

**Acknowledgements**
The authors wish to thank the herd owners for participating in the vaccination programme; the local animal health service veterinarians for valuable help in the field; Dr. T.G. Kimman, CDI, for help with analysing many of the samples and Dr. N. Visser, Intervet, for helpful discussions.

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## Sammanfattning

*Vaccinations och utrotningsprogram mot Aujeszkys sjukdom i fem svenska svinbesättningar: med speciell referens till djurägarattityder.*

Ett vaccinations och utrotningsprogram mot Aujeszkys sjukdom (AD), baserat på användning av gE-negativt avdödat vaccin, utfördes i 5 svenska smågrisproducerande eller integrerade besättningar, med 63 till 398 suggor och galtar. Samtliga avelsdjur (suggor och galtar) testades i början och slutet av programmet. Vid ingångstesten varierade prevalensen av seropositiva avelsdjur mellan 47% och 100% i de olika besättningarna. Under programmet vaccinerades samtliga avelsdjur samtidigt var fjärde månad. Rekryteringsdjur fria från AD-virus vaccinerades strax efter ankomsten och en andra injektion gavs inom en månad. I endast en besättning vaccinerades även ett begränsat antal slaktsvin.

Besättningarna friförklarades 12 till 53 månader efter programmets start. När alla seropositiva avelsdjur hade slaktats, avslutades programmet efter 2 negativa tester av besättningens djur. Serokonvertering var begränsad i alla besättningar utom en, där inslussningsutrymme initialt saknades för rekryteringsdjur. Djurägarnas attityd till programmet och speciella förhållandena rådande i besättningarna diskuteras. Det föreslås att vaccinering kan ge upphov till riskbeteende hos djurägare.

*(Received February 17, 1999; accepted April 21, 1999).*

Reprints may be obtained from: M. Engel, Faculty of Veterinary Medicine, IME, Swedish University of Agricultural Sciences, SE-750 07 Uppsala, Sweden. E-mail: Marie.Engel@epid.slu.se, tel: +46 (0)18-672301, fax: +46 (0)18-673545.