Veterinary Microbiology 137 (2009) 45–50

Contents lists available at ScienceDirect

Veterinary Microbiology

journal homepage: www.elsevier.com/locate/vetmic

Population dynamics of swine influenza virus in farrow-to-finish and specialised finishing herds in the Netherlands

W.L.A. Loeffen [a,*], W.A. Hunneman [a], J. Quak [b], J.H.M. Verheijden [c], J.A. Stegeman [c]

[a] Department of Swine Health, Animal Health Service, P.O. Box 9, 7400AA Deventer, The Netherlands
[b] Central Veterinary Institute of Wageningen UR (CVI), P.O. Box 65, 8200AB Lelystad, The Netherlands
[c] Faculty of Veterinary Medicine, University of Utrecht, P.O. Box 80151, 3508 TD Utrecht, The Netherlands

ARTICLE INFO

Article history:
Received 24 June 2008
Received in revised form 19 December 2008
Accepted 2 January 2009

Keywords:
Swine influenza
H1N1
H3N2
H1N2
Incidence
Herd type
Population dynamics

ABSTRACT

Influenza virus infections with subtypes H1N1, H3N2 and H1N2 are very common in domestic pigs in Europe. Data on possible differences of population dynamics in finishing pigs in farrow-to-finish herds and in specialised finishing herds are, however, scarce. The presence of sows and weaned piglets on the same premises may, however, affect the exposure of finishing pigs to influenza viruses. In a longitudinal study on 14 farrow-to-finish herds and 15 finishing herds, groups of pigs were followed by repeatedly testing the same animals for antibodies against all three influenza virus subtypes (H1N1, H3N2 and H1N2). At the end of the finishing period, the seroprevalences in farrow-to-finish and specialised finishing herds were 44.3% and 62.0%, respectively for H1N1, 6.6% and 19.3%, respectively for H3N2, and 57.2% and 25.6%, respectively for H1N2. For all three subtypes, the incidence of influenza virus infections was highest at the beginning of the finishing period in farrow-to-finish herds, while the incidence of influenza virus infections was highest at the end of the finishing period in finishing herds. Respiratory disease, probably related to the influenza infections, was observed in five of these herds only, but also occurred at the beginning of the finishing period in farrow-to-finish herds and at the end of the finishing period in finishing herds. The observed differences of population dynamics of influenza virus may affect choice and timing of intervention measures.

1. Introduction

Influenza virus infections in swine are very common. In several studies in European countries, seroprevalences for the swine influenza strains H1N1 and H3N2 were found to be in the range of 20–80% in finishing pigs at the end of the finishing period and in sows (Masurel et al., 1983; Haesebrouck and Pensaert, 1986b; Yus et al., 1989; Elbers et al., 1990, 1992; Teuffert et al., 1991; Groschup et al., 1993; Ewald et al., 1994; Brown et al., 1995b; Maes et al., 1999; Maldonado et al., 2006). A more recent subtype, H1N2, seems to originate from the UK where it was found for the first time in 1994 (Brown et al., 1995a). H1N2 was subsequently reported from Belgium (Van Reeth et al., 2000), Italy and France (Marozin et al., 2002), Germany (Schrader and Suss, 2003), and Spain (Maldonado et al., 2006). Many, if not all of these strains are related to the original H1N2 strain from the UK (Marozin et al., 2002). Seroprevalence studies in Belgium (Van Reeth et al., 2000) and Spain (Maldonado et al., 2006) resulted in high seroprevalences of approximately 70% and 50%, respectively for H1N2, but both studies were carried out in sows.

Studies in finishing pigs so far give overall estimates of the seroprevalence at the end of the finishing period. However, it is not clear at what moment during the finishing period these infections take place, nor do they

* Corresponding author. Present address: Central Veterinary Institute of Wageningen UR (CVI), P.O. Box 65, 8200AB Lelystad, The Netherlands. Tel.: +31 320 238696; fax: +31 320 238668.
E-mail address: willie.loeffen@wur.nl (W.L.A. Loeffen).

0378-1135/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.vetmic.2009.01.004

differentiate between finishing pigs in specialised finishing herds (FHs) and finishing pigs in farrow-to-finish herds (FFHs). The presence of sows and piglets on the same premises as the finishing pigs may, however, affect the population dynamics of swine influenza in these herd types, and thus also affect the choice and timing of intervention measures, like vaccination or zoosanitary measures.

Longitudinal studies were therefore carried out to be able to compare the seroprevalences and incidences of swine influenza virus infections at different ages in finishing pigs in both herd types. This allowed us also to determine whether there are differences in the population dynamics of swine influenza virus infections in finishing pigs in farrow-to-finish herds versus finishing pigs in specialised finishing herds.

2. Materials and methods

2.1. Selection of herds

In the Netherlands, there are three regions with a high pig density (Fig. 1). In these regions the average pig density is more than 600 pigs per square kilometre. In contrast, the average pig density in the remaining part of the Netherlands is below 100 pigs per square kilometre. From the three pig-dense regions all herds with >400 finishing pigs were selected for possible participation in the study. This selection included 27% of the Dutch swine herds, housing 69% of the Dutch finishing pig population.

In each category (farrow-to-finish and finishing herds) 64 herds were randomly selected. A written request for participation in a longitudinal serological survey was sent to these farmers. Vaccination against swine influenza was not allowed. The first 15 in each category returning a positive response were included in the study. One farrow-to-finish herd that applied for the survey withdrew shortly before the survey actually started and could not be replaced on such short notice. Thus, 29 herds finally participated. In 11 of the finishing herds the investigated pigs originated from only one breeding herd, in three finishing herds the pigs originated from two breeding herds and in one finishing herd the pigs originated from three breeding herds.

Fig. 1. Location of the three most pig-dense regions in the Netherlands and the location of the herds participating in the longitudinal study (farrow-to-finish herds (▽) and finishing herds (Δ)).

2.2. Sampling

All farms were visited three (finishing herds) or four (farrow-to-finish herds) times during the months of January to May 1999. In each herd one compartment was followed in a longitudinal study and blood samples were collected during each visit.

In finishing herds one compartment where the piglets were 12 weeks old was sampled during the first visit. On average, these piglets arrived 2–3 weeks before on the farm. Pigs were tagged individually during the first sampling to allow for resampling of the same pigs during subsequent visits. The second blood samples were taken 4 weeks later (age of 16 weeks) and a final sample was taken within 1 week before the first pigs from that compartment were delivered to the slaughter house (on average at the age of 22 weeks). Piglets within the sampled compartment always originated from one breeding herd. During the finishing period no other pigs were added to that compartment.

In farrow-to-finish herds one compartment where the piglets were 8 weeks old was sampled during the first visit. Pigs were tagged individually during the first sampling to allow for resampling of the same pigs during subsequent visits. The second series of blood samples was taken 4 weeks later (age of 12 weeks), the third another 4 weeks later (age of 16 weeks) and the final series of samples was taken within 1 week before the first pigs from that compartment were delivered to the slaughter house (on average at the age of 22 weeks). Tagged piglets were kept together in the same compartment until slaughter, but while being transferred to the finishing facilities, piglets from two compartments were sometimes mixed. However, during the finishing period no other pigs were added to that compartment anymore.

The sample size for each compartment was calculated so that with an estimated seroprevalence of 50% and a confidence of 0.95 the margin of error was less than 20%. This resulted in sample sizes of 16–24 pigs per compartment using the formula for simple random sampling (Thrusfield, 1995). Within a compartment an equal number of pigs were sampled per pen, as far as the total number of samples allowed for this. Within each pen, pigs were selected at random (haphazardly).

All farmers were asked to record all clinical signs and medications in the compartment under study.

2.3. Serological examination

All sera were tested in a hemagglutination inhibition (HI) test (Kendal et al., 1982) for antibodies against