A SUDDEN INCREASE IN SALMONELLA - HOW THE SURVEILLANCE SYSTEM REACTED: A DANISH EXPERIENCE

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Introduction

Denmark has had a serological surveillance of finisher herds since January 1995, and the current surveillance of Salmonella on carcasses has been in place since 2001. Both surveillances are parts of the Danish Action Plan for Salmonella in pigs and pork. Variations in the Salmonella prevalence are evaluated, and if a variation is exceptional, much effort is done to try to find the reason for the variation, to correct it and to learn from it.

In January 2016 there were an alarming high number of positive samples in the carcass surveillance, the highest monthly prevalence seen since the beginning of the surveillance. The serological surveillance showed only a slight and not alarming increase. However, the serological surveillance stayed at an increased level and in May it reached the highest value seen since the beginning of the serological surveillance. But that was with a delay of more than 3 months, compared to the increase in carcass prevalence.

A thorough evaluation of results was carried out during the first 6 months of 2016. The results from the serological surveillance of slaughter pigs and the bacteriological surveillance of pork were supplemented with porcine caecal samples from a national project. To get enough data a further 301 caecal samples were analyzed by the slaughterhouses.

Materials

In the surveillance of Salmonella on pig carcasses swab samples are taken from the carcasses 12 hours after chilling. Each carcass is sampled 4 places, 100 cm² each: on the hind leg near the tail, near the sternum, on the jowl and on the mid-back region. On each slaughterhouse 5 carcasses are sampled on each slaughter day and the samples are analyzed as one pooled sample providing one result per slaughter day. The results are evaluated daily at the slaughterhouses and once a month by Danish Agriculture and Food Council and by the Danish Veterinary and Food Administration.

In the serological surveillance a 10 g meat sample is taken from the neck muscle of randomly selected carcasses at the slaughterhouse, the samples are frozen and sent to the laboratory. The meat juice is analyzed for specific Salmonella antibodies by a mix-Elisa. The results are transferred to the Zoonosis Register owned by the authorities, where they are merged with the herd specific numbers and information sent from the slaughterhouses. The results are evaluated once a month.

National projects outline plans for caecal samples taken at the slaughterhouses. These samples are among others analyzed for Salmonella in accordance with NMKL Method no 187, 2nd Ed., 2016, and reported to the Danish Veterinary and Food Administration. The results are evaluated yearly.
Results

Carcass swabs

During January 2016 the slaughterhouses reported, that they found an alarming increase in the number of Salmonella positive samples from carcasses, Figure 1.

![Figure 1. Salmonella on fresh pig carcasses (bacteriology).](image)

The slaughterhouses could find reasons for some of the positive samples, but not for all of them. They reacted immediately by comprehensive sampling schemes and initiatives along the slaughter lines. This effort led to a decrease already the following month, and with minor fluctuations this decrease was maintained for the rest of the year.

From October 2015 to March 2016 a shift was seen in the prevalence of serotypes. In this period the predominant serotype was Typhimurium including the monophasic with a prevalence of 53 percent compared to a prevalence of 41 percent in the time leading up to October 2015. This shift has maintained up to the writing of this paper, data not shown.

Serological surveillance

The serological surveillance showed only a slight and not alarming increase in January 2016. However, the serological surveillance stayed at an increased level and in May it reached the highest value seen since the beginning of the surveillance. After May the prevalence of serologically positive samples declined to the level before the increase, Figure 2.
Percent positive

Figure 2. Increase in meat juice prevalence (serology).

Caecal samples

The first evaluations of the caecal samples showed no explanation for the increase in the positive carcass swabs at the slaughterhouses. The prevalence of almost 36 percent in March is uncertain as it is based on only 14 samples, Figure 3.

Figure 3. Salmonella positive caecal samples.

However, a more detailed evaluation of the results from the caecal samples revealed a transient increase in the prevalence of Typhimurium and monophasic in the finisher production from November 2015 till March 2016, Figure 4.
Percent positive

Figure 4. Positive caecal samples – Typhimurium and monofasic.

**Antibiotic treatment**

An extraction and analysis of data from the Danish Vetstat database revealed, that there had been an increase of about 10 percent in the use of antibiotics for treatment of gastrointestinal diseases in slaughter pigs in the months December 2015 and January 2016, Figure 5.

Figure 5. The number of 70 kg pigs treated with antibiotic for gastrointestinal diseases per month.

**Discussion**

The dramatic increase in the number of positive swab samples of carcasses appeared in January 2016. However, already in November 2015 a shift in the prevalence of serotypes started, whereby Typhimurium and monophasic became the predominant serotypes. The reason why the dramatic increase did not happen until January was not identified, but it may have been due to an increase in gastrointestinal disorders among the slaughter pigs. As the results of the swab samples are evaluated daily, it makes it possible for the slaughter houses to react promptly on an increase.
The serological surveillance is excellent to distinguish between low and high prevalent herds, but the test has several times proven to be unstable, so an increase always calls for considerations. However, all control procedures at the laboratory showed that the test performed within acceptable range. Therefore the increase in the prevalence of positive serological samples was considered to be real. However, as the serological prevalence is only calculated and evaluated once a month, there is some delay in the reaction to an increase. As there was no evident reason for the increase, it was decided to see, if the caecal samples could provide an explanation.

The increase in caecal samples positive with Typhimurium or monophasic started in November 2015, which is concurrent with the shift in serotypes from the carcass swabs. This support that the distribution of serotypes found at carcass swabs reflects the distribution of serotypes from the primary production.

When the increase in the prevalence of Typhimurium and monophasic was found in the caecal samples pig producers, veterinarians and feed companies were asked, if they had observed anything unusual. Some pig producers and veterinarians answered that they had observed diarrhea in slaughter pigs due to feed of poor quality, while others did not share this observation. The data from the Danish Vetstat database support the hypothesis that there had been gastrointestinal problems among the slaughter pigs around the turn of the year 2015. This may have led to loose faecal contents, which is a known challenge to slaughter hygiene.

Conclusions

This experience taught us that while investigations of signs of increase in Salmonella prevalence in the primary production take months, the surveillance at the slaughterhouses is able to react swiftly on an increase, when the input of Salmonella unexpectedly overloads the slaughter hygiene. This is of greatest importance to food safety, and thanks to the prompt reaction at the slaughterhouses, the Salmonella increase had no impact on the number of human cases of Salmonella infection in the beginning of the year.