SURVEILLANCE OF INFECTIOUS DISEASES

IN ANIMALS AND HUMANS IN SWEDEN 2022

Chapter excerpt:
Paratuberculosis

SVA NATIONAL VETERINARY INSTITUTE

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Cover: A cultivation of *Salmonella* at the Public Health Agency of Sweden.
Photo: Nicklas Thegerström/DN/TT. Cover design by Rodrigo Ferrada Stoehrel.

Reporting guidelines: Reporting guidelines were introduced in 2018 for those chapters related to purely animal pathogens. The guidelines build on experiences from several EU projects, and have been validated by a team of international experts in animal health surveillance. The aim is to develop these guidelines further in collaboration within the global surveillance community and they have therefore been made available in the form of a wiki on the collaborative platform GitHub (https://github.com/SVA-SE/AHSURED/wiki). Feel free to contribute!

Layout: The production of this report continues to be accomplished using a primarily open-source toolset. The method allows the source text to be edited independently of the template for the layout which can be modified and reused for future reports. Specifically, the chapter texts, tables and captions are authored in Microsoft Word and then converted to the LaTeX typesetting language using a custom package written in the R software for statistical computing. The package uses the pandoc document conversion software with a filter written in the lua language. Most figures and maps are produced using R and the LaTeX library pgfplots. Development for 2022 has focused on generalising the R package to accommodate conversion into formats other than LaTeX and PDF, with a focus on markdown files which can be published as HTML websites using the Quarto publishing system. The report generation R package and process was designed by Thomas Rosendal, Wiktor Gustafsson and Stefan Widgren.

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Paratuberculosis

Figure 30: In 2022, bulk milk samples from 288 dairy herds were tested for paratuberculosis. All were negative. Photo: Bengt Ekberg/SVA.

BACKGROUND

Paratuberculosis, caused by *Mycobacterium avium* subsp. *paratuberculosis* (MAP), is a common disease of ruminants in most parts of the world. Until today, detected outbreaks in Sweden have been managed through whole herd stamping-out, tracing and sanitation measures, with the goal of eradicating the disease and to prevent spread of infection, should it be introduced.

The limited number of outbreaks of paratuberculosis that have been detected in Sweden have all been directly or indirectly linked to imported beef cattle. The latest case of paratuberculosis was detected in 2005, in an imported beef bull. Paratuberculosis has never been detected in dairy cattle, other ruminant species or wildlife in Sweden.

Previous active surveillance

Several screenings in cattle were initiated after detection of a positive beef cow in 1993:

- Screening of 200 dairy herds in the years of 2000, 2003 and 2005.
- Screening of sheep herds during the years 1993–2011, first with serology, then with faecal culture.
- In 2007–2009 faecal culture screening of beef herds with animals imported during 1990–2005. In 2012, another screening of beef herds with animals imported during 2005–2011 was conducted.
- Risk-based screening of older cows at abattoirs in 2009–2010, including cows older than six years with signs of weight loss, resulted in 1211 sampled cows.
- In 2012–2013, bovine practitioners were encouraged to look for and sample cows with low bodyweight, with or without diarrhoea and 258 samples were analysed by faecal PCR.

DISEASE

Paratuberculosis, also known as Johne's disease, causes chronic diarrhoea and emaciation, resulting in suffering and death. If present, the disease causes great economic losses due to reduced milk production, reproductive losses and increased replacements of affected animals.

The incubation period ranges from months to several years. In areas with endemic infection, clinical disease is most commonly seen at the age of 2–5 years. The bacteria are excreted in the faeces of an infected animal and the normal transmission route is faecal to oral. There is no reliable method to detect the infection in the individual animal during the incubation period.

The zoonotic potential of MAP is a recurring question and there are ongoing discussions about MAP as a possible contributing factor to the development of Crohn's disease in humans.

LEGISLATION

Paratuberculosis has been included in the Swedish Act of Epizootic diseases since 1952 (SFS 1999:657 with amendments). Vaccination is prohibited by law and notification of the infection is mandatory on clinical suspicion (SJVFS 2021:48 (K3)). The Swedish Board of Agriculture decides on actions when MAP is detected in a herd. Paratuberculosis is a listed disease (category E) in the Animal Health Law, (EU) 2016/429. SJVFS 2021:23 (K28) complements AHL with provisions as regards measures to prevent spread of Paratuberculosis in Swedish cattle establishments.

SURVEILLANCE

The overall purpose of the surveillance is to document freedom from bovine paratuberculosis and to allow for early detection of the infection and prevent possible spread by early detection of the infection.

Passive surveillance

Notification, sampling and diagnostic testing are mandatory in animals of any ruminant species exhibiting clinical signs that lead to suspicion of paratuberculosis. Sampling includes faecal samples from live animals and postmortem samples from dead or culled animals. The latter consists of samples from the ileal wall, ileal contents and ileocaecal lymph nodes as well as any macroscopic lesions in the intestines. Wildlife is sampled when paratuberculosis is suspected at post mortem.

Post mortem examinations

Since 2004 sampling is performed on all ruminants above one year of age submitted for post mortem examinations as part of the enhanced passive surveillance for paratuberculosis. Samples are taken from the ileal wall, ileal contents and ileocaecal lymph nodes and submitted to the National Veterinary Institute (SVA). Most of examined animals have been cattle, the others being predominantly sheep but also a few goats and exotic ruminants like bison and camelids.

Active surveillance

Programme for targeted surveillance in beef cattle

In the voluntary programme, the target population is beef herds that sell animals for breeding. The programme is managed by Farm & Animal Health and financed by the Swedish Board of Agriculture. In total, at the end of 2022, the voluntary programme for bovine paratuberculosis encompassed 446 herds, of which 434 were of the highest status within the programme. The voluntary targeted surveillance programme includes all main beef breeding herds and a smaller number of dairy herds selling calves to beef herds within the programme.

In affiliated herds, the test method was changed during 2021 from individual faecal samples annually for three years to individual blood samples which are collected annually for two consecutive years from all cattle over two years of age. Serological positive samples are followed up with individual faecal samples from all cattle over two years of age and retested serologically the following year. Herds affiliated to the programme are only allowed to trade with herds of the same status or higher to maintain their level within the programme. After two years of negative test results, the blood sampling is replaced by post mortem examination of all deceased or euthanised cattle on the premises where paratuberculosis cannot be excluded as a cause of culling. In the case affiliated beef herds have sheep in contact with the cattle, the sheep are sampled as well.

Bulk milk testing

To improve the surveillance in the cattle population, to also include the dairy cattle, it was decided in 2019 to implement annual bulk milk testing. This surveillance component was designed to demonstrate, with a 99% probability and a detection level of 5%, that the Swedish cattle population is free from paratuberculosis, considering an annual 0.1% probability of introduction. To reach this goal, the aim was to randomly collect and test bulk milk samples from 285 dairy herds.

Abattoir testing

In parallel to the bulk milk testing, a surveillance component designed to demonstrate an equivalent confidence of freedom from paratuberculosis in beef cattle herds was implemented in 2020. This is based on testing of serum samples collected at slaughter.

Health controls for export reasons

Testing for MAP is performed for export reasons when requested. The choice of analysis depends on the recipient country.

Diagnostic tests

Blood from the voluntary programme, the abattoir testing and the bulk milk samples and are analysed with the ID Screen Paratuberculosis Indirect commercial ELISA kit (Innovative Diagnostics, Grabels, France) on an automated ELISA system (Tecan, Männedorf, Switzerland). Positive reactions in the screening test are confirmed using the IDEXX Paratuberculosis Verification Ab Test (IDEXX Laboratories, Westbrook, Maine, United States), also an indirect commercial ELISA kit but with improved specificity by using individual negative control samples. Any positive serological reactions are followed up with faecal samples for pathogen detection with PCR.

In addition, samples collected from clinical suspicions are analysed with direct PCR. Real-time PCR is performed using a commercial kit.

Tissue samples and faecal samples from post mortem surveillance is cultured for four months (cattle) or six months (sheep and goat). Direct PCR on a new preparation from the stored samples are performed on cultures with mould overgrowth.

All diagnostic analyses are performed at SVA.

RESULTS

Passive surveillance

In 2022, one clinical suspicion of paratuberculosis was investigated. The animal was sampled and tested negative for MAP with PCR, and the suspicion was ruled out.

Table 13: Cattle sampled for paratuberculosis in 2022.

Surveillance in cattle	No. of sampled animals	No. of herds
Beef herd surveillance programme	387	18
Cattle sampled at postmortem	206	150
Cattle sampled for export	12	3

Table 14: Exotic ruminants sampled for paratuberculosis in 2022.

Surveillance in exotic ruminants	No. of sampled animals	No. of herds
Exotic and wild kept ruminants sampled at postmortem[A]	6	4
Exotic and wild kept ruminants sampled for export	4	2

[A] 1 alpaca, 2 deer, 2 bison and 1 moose

Table 15: Sheep and goats sampled for paratuberculosis in 2022.

Surveillance in sheep and goats	No. of sampled animals	No. of herds
Sheep/goats sampled in cattle herds within the beef herd surveillance programme	6	1
Sheep sampled at postmortem	58	50
Goats sampled at postmortem	11	7
Sheep sampled for export	1	1

Active surveillance

Bulk milk samples from 288 dairy herds were tested, all with negative results. In the abattoir serum sampling, 1568 analyses of samples from at least 808 herds were conducted. One sample from one herd had a positive serological test result. In the herd of origin of the test positive cow, individual faecal samples from all cattle over two years of age were collected and analysed with PCR with negative results and MAP was excluded. Moreover, 387 cattle samples from 18 herds, and 6 sampled sheep or goat from 1 herd, were analysed within the programme in beef herds. One sample from one herd had a positive serological test result. In the herd of origin of the test positive cow, individual faecal samples from all cattle over two years of age were collected and analysed with PCR with negative results and MAP was excluded. For export reasons, 12 cattle and 1 sheep were tested. At post mortem examination, 281 animals were sampled: 206 cattle, 58 sheep,11 goats, 2 deer, 1 alpaca, 2 bison and 1 moose. No cases of MAP were detected in the examinations completed in 2022 (Tables 13, 14 and 15). Based on surveillance from present and previous years the Swedish cattle population can be considered free from paratuberculosis with a probability of >95%.

DISCUSSION

If present at all, the prevalence of paratuberculosis in Swedish ruminants remains at a very low level. However, a previous evaluation of the paratuberculosis surveillance programme indicated that the surveillance sensitivity was decreasing. In order to improve the surveillance sensitivity in the dairy cattle population and beef cattle herds not affiliated to the voluntary programme, testing of bulk milk samples and abattoir serum samples were added to the surveillance programme during 2019 and 2020. Adding these surveillance components, will enable us to reach the desired level of freedom from paratuberculosis at 99% in Swedish cattle within the next couple of years.

The two positive serological samples in the surveillance during 2022 were considered to be false positives because of the detailed follow-up investigations. The test specificity for the serological test was previously estimated to >99.5%. The testing applied to Swedish cattle herds during the period 2020–2021 indicate that the specificity of the test is higher. During this period, 4105 samples were tested with 5 samples positive which were considered false positives after confirmatory testing. This indicated that the specificity of the serological screening test may be as high as 99.85%.

The risk of introduction of paratuberculosis to Swedish herds is assessed to be very low, due to the low number of animals brought in from other countries. The screenings of beef herds with cattle imported from 1990–2011 was targeting the highest risk group of animals for introduction of MAP into Sweden; MAP has never been detected in any other breeds or species than beef cattle and all cases have been traced back to imported animals with the latest case in 2005.

REFERENCES

Frössling J, Wahlström H, Ågren E, Cameron A, Lindberg A, Sternberg-Lewerin S (2013) Surveillance system sensitivities and probability of freedom from *Mycobacterium avium* subsp *paratuberculosis* infection in Swedish cattle. Prev Vet Med 108:47–62.

Rockström U (2011) Slutrapport; Undersökning avseende paratuberkulos i nötkreatursbesättningar som varit sista besättning till djur, vilka importerats till Sverige under 1990 till 2005. Jordbruksverkets diarienr 33–4861/11.

Sternberg Lewerin S, Ågren E, Frössling J, Bölske G, Holmström A, Lindberg A, Szanto E, Viske D (2007) Control of paratuberculosis in Sweden. In the proceedings of: 9th ICP, Japan, Nov 2007.