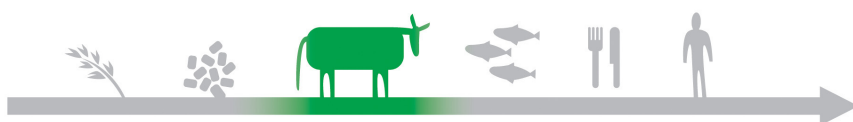
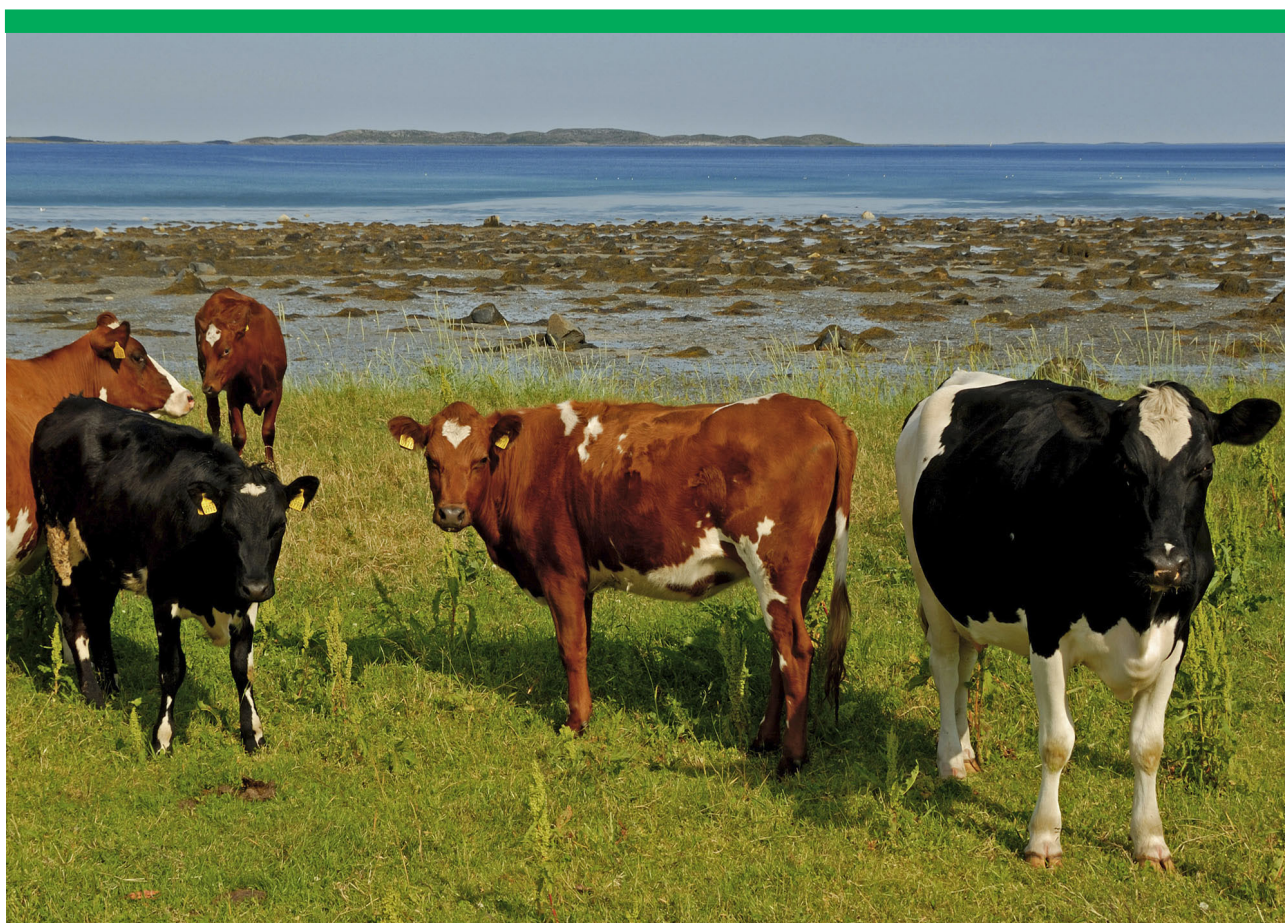


The surveillance programme for paratuberculosis in Norway 2018



Veterinærinstituttet
Norwegian Veterinary Institute

Mattilsynet

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Authors

Annette H Kampen, Girum T Tessema, Angelika Agdestein, Torfinn Moldal, Mette Valheim, Chiek Er

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Summary

In 2018, *Mycobacterium avium* subsp. *paratuberculosis* was not detected in Norway.

Introduction

Paratuberculosis in ruminants is a notifiable disease (List B) in Norway. *Mycobacterium avium* subsp. *paratuberculosis* infection was first diagnosed in cattle and goats in Norway in 1907 and 1934, respectively (1, 2). The control of this disease is enforced by government legislation and includes restrictions on animal movement. In goat herds, government restrictions combined with vaccination have been used to control paratuberculosis. However, in recent years a large proportion of the Norwegian goat herds has undergone a disease eradication programme (3). *Mycobacterium avium* subsp. *paratuberculosis* was detected in sheep for the first time in 2002 and in alpaca in 2014 (4).

A national surveillance programme for paratuberculosis in cattle was established in 1996 (5, 6). The programme was extended to llamas and alpacas in 2000, goats in 2001, and sheep in 2002.

Descriptions of occurrence of the disease in Norway, control measures adopted until 1995, and results from the surveillance programmes from 1996 to 2001, can be found in the annual report for 2001 (6). The number of new infected herds detected since 1996 when the programme started, is given in Figure 1.

Aim

The aim of the surveillance programme for paratuberculosis is to detect and control the infection in the Norwegian ruminant and camelid population.

Materials and methods

In 2018, cattle, goats, sheep, llamas and alpaca were included in the programme. Faecal samples were collected in farms and organs were collected at slaughterhouses by the Norwegian Food Safety Authority.

Active surveillance

Cattle

The target population consisted of all cattle herds delivering milk to dairies during the sampling period and all beef cattle herds receiving state support according to the state register in July 2017. Hundred cattle herds were selected for sampling. Seventy five of these were from counties where paratuberculosis has previously been detected in cattle or goats, and 25 herds were from other areas. Faecal samples from the five oldest animals in each herd were collected.

Goats

Ninety herds were selected by a risk-based strategy for sampling from areas where paratuberculosis has previously been detected in goat herds, while thirty herds were selected from areas where paratuberculosis has not been registered. Faecal samples from the ten oldest goats in each herd were collected.

Sheep

Forty sheep flocks from areas where paratuberculosis has been found in goat herds were randomly selected for sampling. Faecal samples from the ten oldest sheep in each flock were collected.

Llamas and alpacas

Llama and alpaca were introduced as new species to Norway in 1997-98. Since then, new individuals are imported every year, and many originate from countries where paratuberculosis is endemic. Faecal samples from five animals older than four years of age are collected in each herd each year. If the herd

has less than five animals, all animals are sampled. In addition, a few organ samples are collected at slaughter and from animals that die when older than four years.

Passive clinical surveillance

Clinical surveillance has been included in the programme since 2000. For cattle, samples are collected from animals with clinical signs like reduced milk production, weight loss, diarrhoea lasting more than 14 days, in animals that are older than three years of age.

Methods

Faecal samples - PCR

DNA extraction from faecal samples was performed on QIAcube using the QIAamp® DNA Mini Kit (Qiagen) before real-time PCR using the ADIAVET® REALTIME PARATB kit (BioX). This test is based on amplification of the DNA segment IS900 that is specific for *Mycobacterium avium* subsp. *paratuberculosis*.

Faecal samples and organ samples - Bacteriological examination

Organ samples from clinical suspects were analysed by bacterial culture. These samples were first decontaminated with 4% sodium hydroxide and 5% oxalic acid with 0.1% malachite green (7), and then inoculated onto selective and non-selective Dubos medium with mycobactin (2 µg/ml) and pyruvate (4 mg/ml) (8). Incubation time was 16 weeks. In case of faecal samples positive by PCR, further confirmation would have been performed by culture. None of the faecal samples in the 2018 active surveillance programme were positive by PCR, and thus not cultured. However, organ samples from two animals (one goat and one llama) were cultured.

Organ samples - Histopathological examination

Histological examination of samples from jejunum, ileum, ileocecal valve, and mesenteric lymph nodes was performed. The tissue was fixed in 10% neutral-buffered formalin, processed by routine methods and stained with haematoxylin and eosin (HE) and the Ziehl-Neelsen (ZN) method for acid-fast bacteria. Samples showing typical granulomatous lesions with acid-fast bacteria were considered positive for paratuberculosis.

Results

In 2018, samples from 461 cattle, 983 goats, 413 sheep, and 621 camelids or their locations were all tested negative for paratuberculosis. Five samples from cattle were rejected because they were too old at arrival and not suitable for testing. Details on type of samples and number of herds/locations are described in Table 1.

Table 1. Number of samples collected for examination for *Mycobacterium avium* subsp. *paratuberculosis* in 2018.

Species	Type of sampling	Number of animals (herds or locations)			
		Faecal	Kadaver/Organs	Total positive	Total analysed
Cattle	Risk-based samples	465 (93)	-	0 (0)	461 (93)
	Suspected cases	1 (1)	0		
Goat	Risk-based samples	980 (122)	-	0 (0)	983 (124)
	Suspected cases	2 (1)	1 (1)		
Sheep	Random samples	413 (42)	-	0 (0)	413 (42)
	Suspected cases	0	0		
Camelides	Random samples	617 (191)	4 (4)	0 (0)	621 (195)
	Suspected cases	0	0		

Since the surveillance programme for paratuberculosis started in 1996, *M. avium* subsp. *paratuberculosis* has been detected in altogether 35 goat herds (some of these also positive before 1996), 11 cattle herds, six sheep flocks, and two alpaca herds (Figure 1). In the figure, only “newly” *M. avium* subsp. *paratuberculosis* detected cases are presented. A herd that has previously been reported as positive for *M. avium* subsp. *paratuberculosis*, can be counted as a herd with a new cases again if *M. avium* subsp. *paratuberculosis* is reported in a different ruminant species.

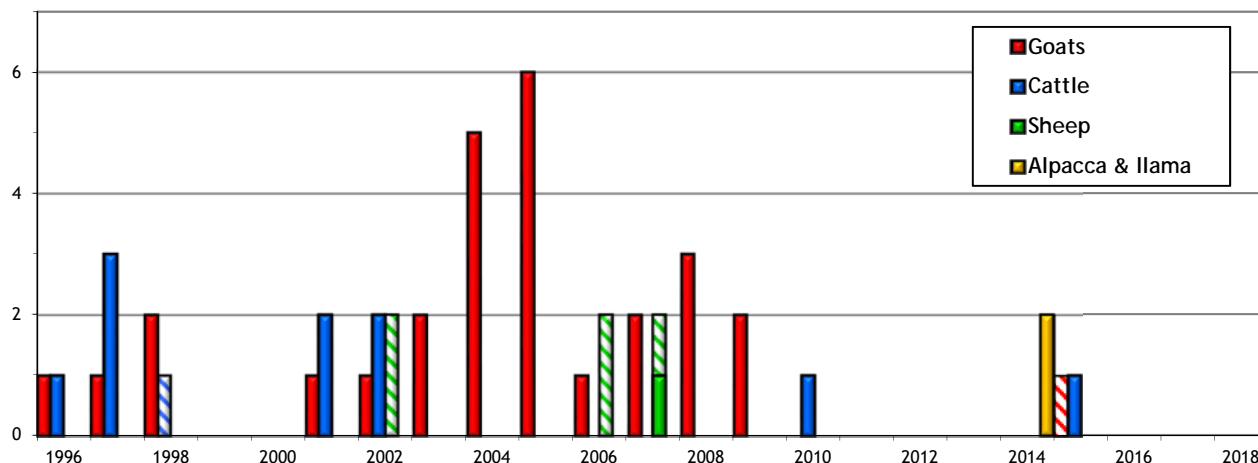


Figure 1. Number of new herds being reported positive for *Mycobacterium avium* subsp. *paratuberculosis* irrespective whether the samples were collected as part of the surveillance programme or not. Striped bars represents herds where another species in the same holding previously was reported positive.

Discussion

Mycobacterium avium subsp. *paratuberculosis* was not detected in Norway in 2018. However, the passive surveillance programme revealed an uncommon case of infection with a non-tuberculosis mycobacterium which is not *Mycobacterium avium* subsp. *paratuberculosis* in one goat, with clinical and pathological findings resembling paratuberculosis. The animal had extensive granulomatous inflammation of the intestines and intestinal lymph nodes, with massive presence of acid fast rods.

Paratuberculosis in goats has previously been detected in six out of the 18 counties in Norway. All the cases among cattle and sheep have been traced to imported animals (seven cattle herds, one sheep flock) or contact with infected goats (three cattle herds, five sheep flocks). Importation of live cattle is limited and largely replaced by importation of semen and embryos.

The dairy organisation (TINE) and the Norwegian Goat Health Services have conducted an eradication programme named “Healthier goats”, targeting caprine arthritis encephalitis, caseous lymphadenitis and paratuberculosis, three infectious diseases that were previously widespread in goats. The programme started in 2001 and initially concentrated on caprine arthritis encephalitis and caseous lymphadenitis. In 2004, paratuberculosis was also added to the eradication programme, targeting areas where paratuberculosis had been detected. In total 612 goat herds were included in the programme from 2001 to 2014 (3).

All goat milk herds in Norway have joined the eradication programme. All known goat herds diagnosed with paratuberculosis have joined the eradication programme or have slaughtered their animals. Hence, Norway is in the unique position in the world of currently having no known cases of paratuberculosis.

Even though the eradication programme has reduced the indigenous source of *M. avium* subsp. *paratuberculosis*, there may be undetected infected goat herds that pose a risk for new infections to other ruminants in the coming years. Furthermore, imports of cattle, sheep, goats, llamas and alpacas present a risk for new introduction of infected animals into the Norwegian ruminant population.

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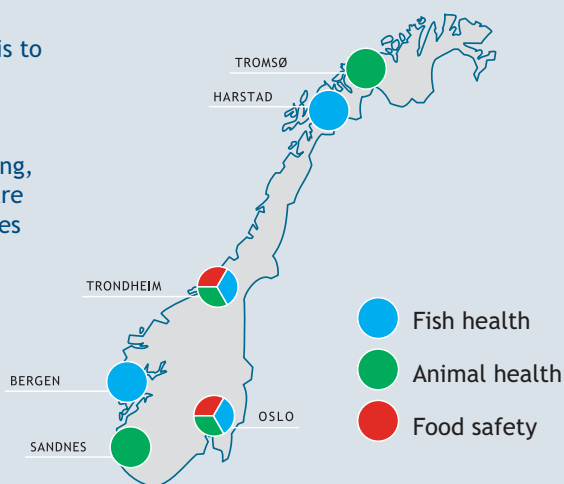
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Veterinærinstituttet
Norwegian Veterinary Institute