



Veterinærinstituttet
Norwegian Veterinary Institute

⋮ Annual Report

The surveillance programme for small ruminant lentivirus infections in sheep and goats in Norway 2019



Comissioned by



The surveillance programme for small ruminant lentivirus infections in sheep and goats in Norway 2019

Content

Summary	3
Introduction	3
Aims	4
Materials and methods	4
Results	4
Sheep	4
Goat	5
Discussion	6
References	6

Authors

Annette H Kampen, Johan Åkerstedt, Grim Rømo, Jorunn Mork, Anne Nordstoga, Siv Klevar

Commissioned by

Norwegian Food Safety Authority



ISSN 1894-5678

© Norwegian Veterinary Institute 2020

Design Cover: Reine Linjer

Photo front page: Colourbox

Summary

One of the 3,264 investigated sheep flocks in the surveillance programme was diagnosed with maedi in 2019. Of 58 tested goat herds, one goat herd was diagnosed with caprine arthritis-encephalitis (CAE).

Introduction

Small ruminant lentivirus (SRLV) comprise the maedi-visna virus (MVV) and the caprine arthritis-encephalitis virus (CAEV), which are closely related. Maedi-visna virus mainly infects sheep, while CAEV mainly infects goats, although cross-infections between the two species do occur. Maedi is a progressive viral pneumonia in sheep first described in Iceland in 1939 (1). The disease occurs in several European countries as well as in other continents. The disease visna is a neuropathogenic manifestation of the infection (1, 2). Caprine arthritis-encephalitis (CAE) causes emaciation, arthritis, encephalitis and sometimes mastitis and pneumonia in goats. Sheep may be infected and produce antibodies against CAEV, but usually show no clinical signs of disease.

Maedi-visna and CAE are classified as list B diseases in Norway and are notifiable to the Office International des Epizooties. In Norway, maedi was officially reported for the first time in 1972 (3).

In November 2002 and January 2003, post-mortem examinations of lungs from two diseased sheep from two different farms in the former Nord-Trøndelag county showed histopathological changes consistent with maedi. During the following investigations more than 15,000 sheep in 300 flocks were serologically examined for maedi-visna infection, and 50 flocks were found to be seropositive (4, 5). The outbreak demonstrated the need for a nationwide surveillance programme, which started in November 2003 (4, 6).

An overview of the number of new infected flocks registered with maedi each year up to 2019 is given in Figure 1.

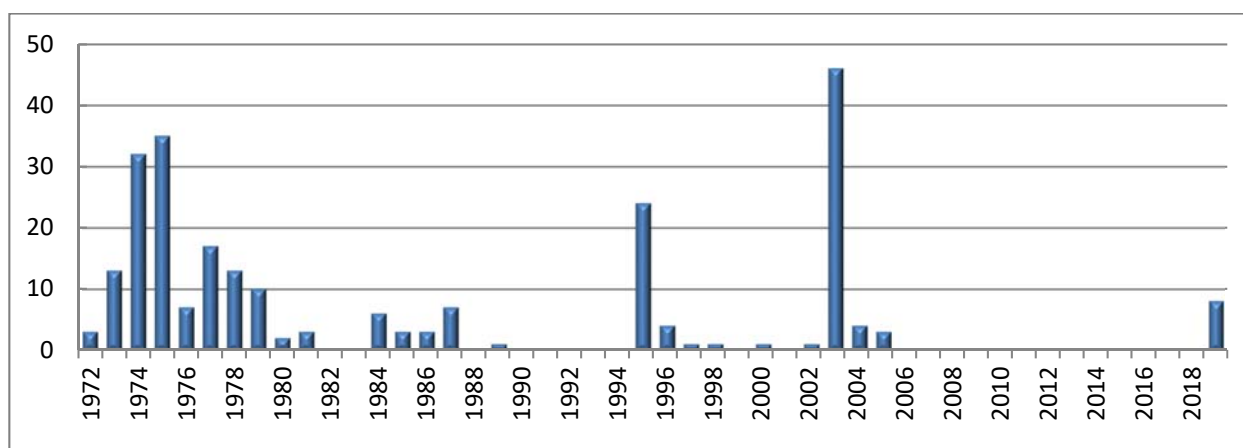


Figure 1. The number of new flocks infected with maedi from 1972 and onwards. The bars for 2003 - 2005 show both seropositive flocks detected through the investigations after the outbreak in the former Nord-Trøndelag county and seropositive flocks identified in the programme. The rise in 2019 represents a new maedi outbreak in Nord-Trøndelag.

Before 2001, CAE was widespread in the Norwegian dairy goat population. 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. The programme started in 2001, and in total 612 goat herds were included in the programme from 2001 to 2014 (7).

Aims

The aims of the surveillance programme for small ruminant lentivirus infections are to document the status for maedi-visna virus and caprine arthritis-encephalitis virus infections in sheep and goats in Norway and to identify infected flocks for disease control.

Materials and methods

The surveillance programme is based on serological examination for SRLV in both sheep and goats.

The plan for 2019, was to collect 9 000 blood samples from sheep at slaughter. A maximum of five animals (>2 years old) were to be sampled per herd any given day. The sampling was done at 17 abattoirs, each slaughtering at least 100 sheep per month in the period January - May, which were the preferred sampling months. A proportion of the animals were sampled in the period September - November. In addition, meat inspectors at the abattoirs were asked to monitor sheep and especially their lungs for detection of suspicious cases consistent with maedi.

In addition, 60 goat herds were randomly selected for collecting flock samples. In goat herds of less than 30 animals, all animals (>2 years old) were sampled. In herds of 30 to 100, 100 to 200, and more than 200 animals, samples from 30, 35, and 40 animals were sampled, respectively.

Serum samples were examined for antibodies against Small ruminant lentivirus with ID Screen® MVV / CAEV Indirect ELISA (ID.Vet, Grabels, France) for initial screening. Samples with inconclusive or positive ELISA results were re-tested in duplicates with ID Screen® MVV / CAEV Indirect ELISA and/or ID Verification® MVV / CAEV Indirect ELISA (ID.vet). If samples were inconclusive or positive, they were further tested with ELISA IDEXX MVV/CAEV p28 Ab Verification Test (IDEXX Laboratories, Maine, USA).

In case of positive or inconclusive results in IDEXX ELISA on a sample taken from a sheep at slaughter, follow up sampling was done on selected animals in the flock of origin as described previously (8). To rule out cross reactions, some inconclusive results in IDEXX were also tested with agar gel immunodiffusion test (AGIDT, Maeditect, Animal and Plant Health Agency (APHA), Weybridge, UK).

Samples with doubtful or positive status in confirmatory or complementary tests were reported, and new blood samples from the suspected animals or herd were requested and tested.

Results

Sheep

A total of 9,222 samples were received in the programme in 2019. Of them, 72 samples were not suitable for analysis and were rejected, and 157 were not tested because the inclusion criteria were not met (mainly too young animals). Leaving 8,993 samples from 3,264 sheep flocks for analysis (Table 1). This was approximately 23.8% of the total number of Norwegian sheep flocks.

In 2019, all, but ten sheep samples, tested negative for antibodies against SRLV. Three samples from a herd in the former Nord-Trøndelag county tested positive with the screening test, whereas the verification ELISA gave either positive, inconclusive, or negative results.

Based on these results, there was a suspicion of maedi in the herd of origin. Follow-up sampling in this herd revealed that 12 out of 26 animals were seropositive for SRLV in the lentivirus ID Screen® MVV / CAEV Indirect ELISA, and four of these 12 samples were also seropositive in IDEXX ELISA. At slaughter, two animals had typical histopathological changes for maedi. Maedi-visna-virus was detected by PCR, and the diagnosis maedi was confirmed in the herd. Of a total of 392 samples from the herd received in 2019, 101 (25.8%) tested positive for SRLV. This number included five additional positive surveillance samples, received later the same year.

The two remaining screening positive samples, from farms in Nordland and Rogaland counties, had negative and inconclusive results respectively with the verification assay. Thirty animals from each of the two farms tested negative on follow-up sampling. Thus, maedi was not suspected in these farms.

One suspected case with lung pathology possibly consistent with maedi was reported from the meat inspectors at one abattoir. All animals over 2 years of age (n=11) in the herd of origin were sampled and found to be serologically negative.

Table 1. The results and total number of sheep flocks within the frame of the Norwegian surveillance programme for maedi 2003-2019.

Year	Total no. of flocks*	No. of flocks analysed	No. of animals analysed	Average no. of animals analysed per flock	No. of positive flocks
2003	18 400	456**	13 951	30.6	1
2004	17 439	1 230	36 911	30.0	1
2005	16 500	940	29 248	31.1	2
2006	15 800	911	27 846	30.6	0
2007	15 400	1 004	29 633	29.5	0
2008	15 059	783	23 235	29.7	0
2009	14 800	417	12 198	29.3	0
2010	14 800	188	5 697	60.6	0
2011	14 500	467	13 628	29.2	0
2012	14 300	479	14 043	29.3	0
2013	14 242	468	13 550	29.0	0
2014	14 218	3 506	9 771	2.8	0
2015	14 425	3 357	9 442	2.8	0
2016	14 561	3 504	9 858	2.8	0
2017	14 463	3 447	9 041	2.6	0
2018	14 337	3 282	8 685	2.6	0
2019	13 734	3 264	8 993	2.6	1

* Based on data from the register of production subsidies as of 31th of July the respective year until 2017. Thereafter, data from 1st of March was used.

** Sampling period: 20th of November to 31st of December.

Goat

A total of 1,751 samples from 58 goat herds were received and tested for antibodies against CAEV (Table 2). This was approximately 4.8% of Norwegian goat herds.

Five out of 35 samples from one herd in Troms county tested positive for SRLV. All animals in the herd (>1 year old) were sampled, and 19 out of 75 follow-up samples were positive for antibodies against SRLV. The flock was concluded to be infected with CAEV.

Table 2. The results and total number of goat flocks within the frame of the Norwegian surveillance programme for small ruminant lentivirus 2019.

Year	Total no. of flocks*	No. of flocks analysed	No. of animals analysed	Average no. of animals analysed per flock	No. of positive flocks
2018	1 246	61	1 663	27.2	1
2019	1 209	58	1 751	30.2	1

* Based on data from the register of production subsidies as of 1st of March the respective year.

Discussion

During the years 2003-2008, ram circles and their flocks registered as members of The Norwegian Sheep and Goat Breeders Association constituted the target population for the programme. Approximately 90% of the Norwegian sheep flocks participating in ram circles were screened for antibodies against maedi-visna virus during 2003 to 2005. These herds were retested during 2006 to 2008. In 2009, breeding flocks of other sheep breeds than those represented by The Norwegian Sheep and Goat Breeders Association were selected for sampling. During 2010-2013, randomly selected sheep flocks were sampled.

From 2014, sheep have been sampled at slaughterhouses, giving a better surveillance of the total population with the use of less resources than needed when sampled on the farms themselves (8). However, less animals were tested per herd, giving less accurate results on the herd level.

In goats, the surveillance is still based on sampling live animals in the herds.

Results from the surveillance and control programme for maedi, including data from November 2003 through 2006, showed a preliminary prevalence of less than 0.2 % positive flocks. Knowledge about the distribution of the disease indicates that it was regionally clustered, and that a more extensive spread of maedi-visna virus from the outbreak in 2003 was prevented by the restrictions on transfer of sheep across county borders. The fact that maedi was not detected in the surveillance programme in the years 2005 to 2018 indicated that the prevalence of the infection in Norway was very low.

The outbreak of maedi in the former Nord-Trøndelag county in 2019 was detected through the surveillance programme. Following diagnosis, contact herd were identified and tested, and four more herds were diagnosed with maedi. Some of the herds involved in the outbreak were also part of the 2003 outbreak, and has since had transfer of animals to other sheep flocks in the same geographical area. Thus it can be argued that the infection possibly has prevailed in sheep flocks in the area. Therefore, all sheep herds in former Nord-Trøndelag county were tested, and another four positive herds were discovered.

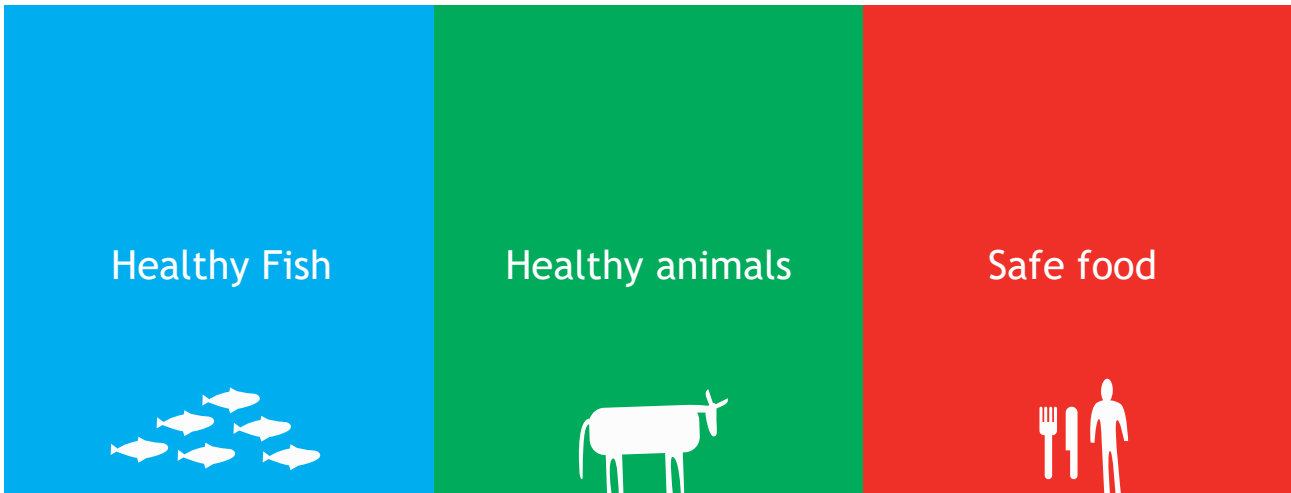
The design of the surveillance programme with testing of few samples from a selection of flocks every year, made it possible for maedi infection to remain undetected in sheep flocks over years. To achieve higher sensitivity of the programme, more animals could be tested. Also, sampling could be targeted on clinical signs consistent with maedi infection, and to geographical areas in Norway, where maedi has occurred in the past.

All dairy goat herds in Norway and many meat and fiber goat herds have joined the eradication programme Healthier goats. This has resulted in improved goat health and welfare in the Norwegian goat industry (7, 9). In addition to the case that was detected in the surveillance programme, CAE was detected in one combined sheep and goat herd in Trøndelag county during the investigation of the maedi outbreak in 2019, and in three small non-commercial goat herds in Agder county that had not been part of the eradication programme. The finding of CAE in several hobby herds as well as in a goat herd where CAE previously had been eradicated, shows that attention and continued surveillance is needed in all types of goat herds.

References

1. Pálsson PA. Maedi-visna. History and clinical description. In: Pétursson G, Hoff-Jørgensen R (editors). Maedi-visna and Related Diseases. Boston: Kluwer Academic Publishers; 1990. p. 3-17.
2. Martin WB, Aitken ID. Diseases of Sheep, 3rd edition. Oxford: Blackwell Scientific Publications; 2000.
3. Krogsrud J, Larsen HJS, Rimstad E. Mædi og lungeadenomatose [Maedi and lung adenomatosis, No]. *Nor Vet Tidsskr.* 1996; 108: 729-36.
4. Sviland S, Nyberg O, Tharaldsen J, Heier B T, Mork J. The surveillance and control programme for maedi in Norway. In: Mørk T, Hellberg H (editors). Surveillance and control programmes for terrestrial and aquatic animals in Norway. Annual report 2003. Oslo: National Veterinary Institute; 2004. p. 89-95.

5. Kampen AH, Tharaldsen J, Åkerstedt J, Norström M, Nestvold OK, Myhre JL, Nyberg O. Diagnosis and investigations of an outbreak of maedi in Norway 2002 - 2005. Proceedings of the 6th International Veterinary Vaccines and Diagnostics Conference; Jun 25 - 29. Oslo, Norway; 2006. p. 91-2.
6. Mork J, Jarp J. The surveillance and control programme for maedi in Norway. In: Fredriksen B, Mørk T (editors). Surveillance and control programmes for terrestrial and aquatic animals in Norway. Annual report 2001. Oslo: National Veterinary Institute; 2002. p. 109-15.
7. TINE Rådgiving, Helsetjenesten for geit. Syk - friskere - friskest. Sluttrapport prosjekt Friskere geiter 2001-2015. [Healthier goats project, final report 2001-2015, No]. Ås: Helsetjenesten for Geit; 2016.
8. Kampen AH, Skaar K, Tarpai A, Klevar S. The surveillance programme for lentivirus infection in sheep and goats in Norway 2018. Surveillance programmes for terrestrial and aquatic animals in Norway. Annual report 2018. Oslo: Norwegian Veterinary Institute; 2019.
9. Muri K, Leine N, Valle PS. Welfare effects of a disease eradication programme for dairy goats. *Animal*. 2016; 10: 333-41.



*Scientifically ambitious, forward-looking
and collaborative- for one health!*



Veterinærinstituttet
Norwegian Veterinary Institute

Oslo

Trondheim

Sandnes

Bergen

Harstad

Tromsø

postmottak@vetinst.no
www.vetinst.no