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AN OUTBREAK OF EXCESSIVE NEONATAL MORTALITY IN FOUR DANISH MINK FARMS

I. DESCRIPTIVE EPIDEMIOLOGICAL INVESTIGATIONS

By

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JØRGENSEN, POUL H. and ANETTE G. BØTNER: *An outbreak of excessive neonatal mortality in four Danish mink farms. I. Descriptive epidemiological investigations.* Acta vet. scand. 1983, *24*, 488—498. — An outbreak of increased mortality among mink kits in 4 Danish mink farms in 1982 is described. A comparison with data from 4 non-affected farms revealed obvious differences in neonatal mortality in the period from parturition until May 15th (early neonatal mortality) and in the period from May 15th to June 30th (late neonatal mortality) between the 2 groups of farms. The populations are described in terms of age, origin, types of mink and the extent of transfer of breeding females among the farms. Postmortal examination showed consistent pathological changes, but the etiology and pathogenesis of the diseases is uncertain until now. The increased mortality of kits, however, was accompanied by increasing numbers of Aleutian Disease (AD) positive reactors in the 4 populations.

mink; neonatal mortality; mink kits; Aleutian Disease; descriptive epidemiology.

In the middle of May 1982 an increased mortality among mink kits was registered in 4 Danish mink farms. The breeding results in 1982, estimated as the number of liveborn kits per mated female, were until then considered satisfactory.

All affected kits exhibited pronounced symptoms of respiratory disease with accelerating dyspnoe. The death, presumably caused by hypoxia, followed within 24 h after the first manifestation of the symptoms. The etiology of the disease is so far uncertain, and adequate therapy has not been found.

This report provides an epidemiological description of the disease problems in the affected farms and summarizes data which will be further discussed in a subsequent report on analytic epidemiological aspects of the outbreak (*Bøtner & Jørgensen* 1983).

MATERIALS AND METHODS

Populations

The increased mortality among kits was apparently restricted to 4 farms, designated farms A, B, C and D. They are located at least 10 kilometers apart and are supplied with feed from different mink feed manufacturing units. Other farms receiving feed from these manufacturers did not experience any disease problems in the spring of 1982.

In the early spring of 1982 trade with breeding females took place among the 4 farms. Farm A supplied, directly or indirectly, the other 3 farms with breeding females. The extent of movement of animals is pictured in Fig. 1.

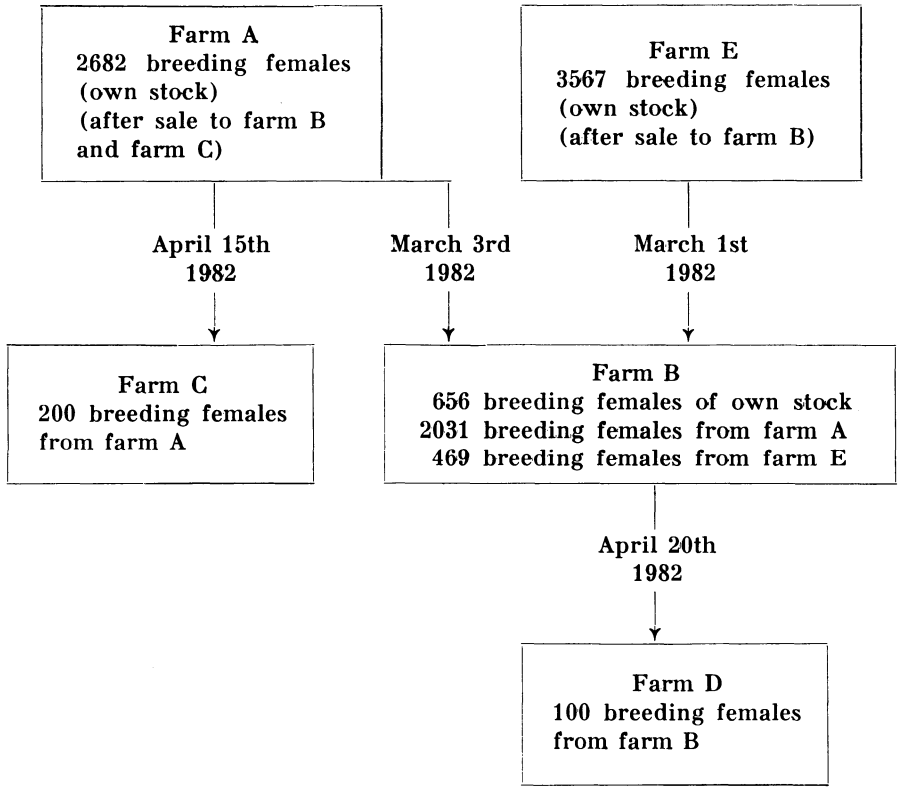

Figure 1. Farms and number of animals (breeding females) after the transfers in the spring of 1982. Date and direction of movements is indicated. Females delivered in the month of March were mated at the receiving farm, while females delivered in the month of April were mated at the farm of origin.

Table 1. Composition of the female breeding population of farm A and farm B. Scanbrown producing females included.

Type	Year of birth					total
	1978	1979	1980	1981	unknown	
Farm A						
Scanblack	135	213	289	570	—	1207
Pastel	180	205	443	458	—	1286
Pearl	5	30	51	78	—	164
Mogul	0	0	0	25	—	25
Total	320	448	783	1131	—	2682
Farm B						
Scanblack	—	—	50	1054	1	1105
Pastel	68	137	241	1584	5	2035
Mogul	—	—	2	2	—	4
Unknown	—	—	—	12	—	12
Total	68	137	293	2652	6	3156

In order to reduce a high prevalence of Aleutian Disease (AD) in farm B a relatively large percentage of its former population was replaced by females from farm A and farm E (Fig. 1). Most of these females were born in 1981. As a result of these efforts, the population of farm B was composed of animals of different origin. Tables 1 and 2 show the composition of the female breeding populations of farm A and B after these transfers had been completed.

On farm C, a population was established in the spring of 1982 by introducing 200 mated females from farm A. Furthermore, the population was supplied with 300 breeding females from France, but these animals have not been included in this report

Table 2. Composition of the breeding females at farm B according to origin of animals. Scanbrown producing females included.

Type	Origin			total
	farm A	farm B	farm E	
Scanblack	934	50	121	1105
Pastel	1097	597	341	2035
Mogul	0	4	0	4
Unknown	0	5	7	12
Total	2031	656	469	3156

because of poor registration of mortality in this group. Also, no disease problems were apparent in these animals at the time of the investigation.

On farm D, which is a small farm, the total female breeding population in 1982 was 100 animals all born in 1981. There were 50 each of Scanblacks and Pastels. The former population (100 breeding females) of this farm was destroyed in 1981 because of high prevalence of AD.

Clearly, Scanblack, Pearl and Pastel are the dominant types in all 4 farms. Four farms, designated E, F, G and H were selected as comparison farms on the basis of their similarity to the affected farms, with regard to geographic situation, size and composition (with respect to types of mink) (Table 3). These farms were supplied with feed from the same feed manufacturers as farm A-D. Farm E (see Fig. 1) had delivered 469 females to farm B in March 1982.

T a b l e 3. Types of the breeding females at the non-affected farms.

Type	Farm E	Farm F	Farm G	Farm H
Scanblack	2092	206	1000	538
Pastel	597	25	120	931
Pearl	200	29	10	198
Others	678	28	—	555
Total	3567	288	1130	2222

Apparently there was no furter connection among the farms A-H through staff, machinery or otherwise. Problems with the water supply at farm H in June and July caused an abnormally high mortality rate in the kits and therefore only data obtained until 1st of June have been included from this farm.

Aleutian Disease

The Danish Fur Breeders Association has instituted an AD eradication programme in which farms participate voluntarily. The programme is based on a counter — current immunoelectrophoresis test of blood samples taken 2—3 times per year in different groups of animals at the farms. According to the results of this programme, farm A had been AD-free for 2—3 years until June 1982, when suddenly a large number of positive reactors emerged.

Farm B has for several years made efforts to obtain status as AD-free by eradicating suspected AD-positive animals (test positive, sterile females etc.), but some positive reactors still remained in the population.

Farm C bought 200 mated females from farm A in the spring 1982. These animals were supposed to be AD-free because of the former status of farm A, but tests in June/July 1982 revealed a prevalence of about 33 % AD-positive animals.

Farm E has a very low prevalence of AD according to the results in the AD programme and is soon expected to obtain status as AD-free. Farms F-H are all registered as AD-free farms.

Description of data

This report deals with the time period from birth of the kits, which is ultimo April/primo May, until ultimo June 1982 as reliable registration of mortality seems to cease here. The particular disease problems emerged in the middle of May. The investigation is therefore primarily concerned with the period from 15th of May to 30th of June (the investigation period). For farm C the investigation period ceased already on the 8th of June 1982.

Data used in this report were obtained by different means. Farm A and farm B participate in a breeding system, "Minksystemet", operated by The Danish Fur Breeders Association. This system is based on data collected by the mink farmers. The data are reported several times per year to a central data base where they are compiled. From the system the farmers receive information concerning their own farm. Also, the system supplies farm records and identification cards for the animals. Additional data were collected by hand at the farms. Data from farm A and B were stored as computerized SAS-data sets (Statistical Analysis System) for further processing.

At farm A a comparison between the farmers registration of deaths of kits (for monitoring) and the loss figure on the basis of "Minksystemet" showed that the farmer had recorded an additional 105 dead kits. The inconsistency proved to be due to an accidential loss of 105 identification cards from "Minksystemet". For calculations where the AD status of the females must be known, the restricted data from "Minksystemet" had to be used. These results thus underestimate the number of deaths in the investigation period. For other purpose the data from "Minksystemet" have been adjusted according to the counts of the

farmer. Scanbrown producing females at farm A and B have been excluded because of poor mortality registration in these groups. This exclusion reduces the investigated female populations of farm A from 2682 to 2468 and of farm B from 3156 to 1907.

Data from farms C, D and from the 4 non-affected farms were collected and analyzed by hand.

This registration only deals with crude mortality statistics, i.e. no attempts were made to differentiate among causes of death.

RESULTS

Mortality of kits

In the period May 15th to May 17th a sudden increase in the mortality of the kits was registered in the 4 farms A-D. This high mortality remained, with some variation, for the rest of the investigation period. The registered and calculated number of deaths among kits are presented in Table 4.

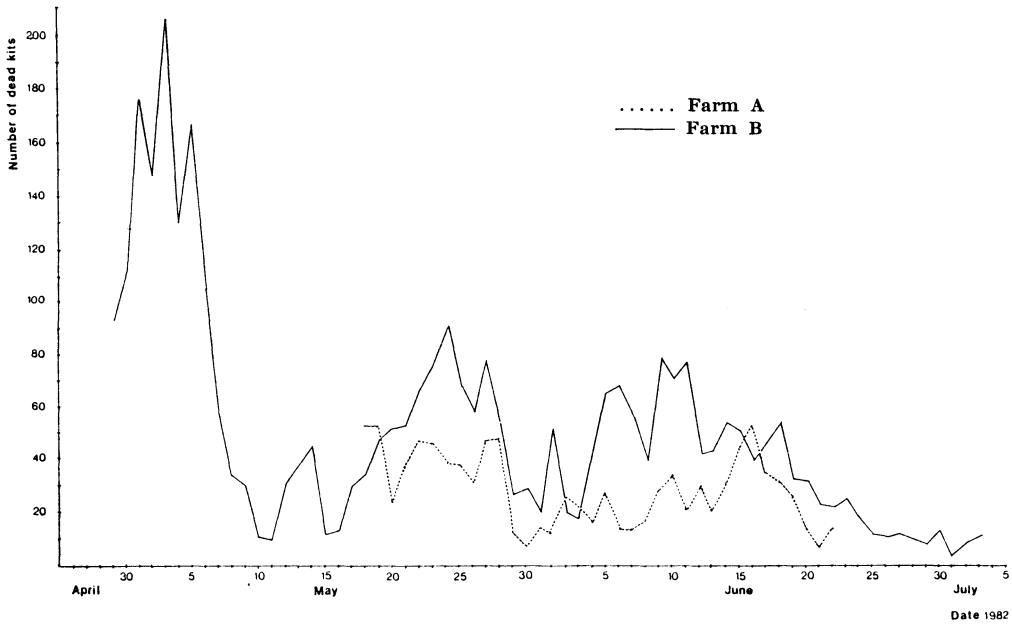

Figure 2. Mortality in farm A and farm B, based on the farmers registration. Therapy was instituted on the 26—27th of May. It must be noted that the figure pictures the number of dead kits, and that the populations at risk were of different size on the two farms (see Table 4).

Table 4. Farm A-D, number of liveborn kits and kits alive on the 15th of May and the percentage of dead kits in the early neonatal period and the investigation period (late neonatal period). Scanbrown excluded.

	Number of kits			
Type	liveborn	dead birth — May 15th % (ENMR)	alive on May 15th	dead in inv. period % (LNMR)
Farm A				
Scanblack	5404	7.2	5013	14.6
Pastel	4961	1.5	4886	4.7
Pearl	605	12.7	528	14.4
Mogul	126	9.5	114	1.8
Total	11096	5.0	10541	9.9
Farm B				
Scanblack	4373	17.8	3593	30.4
Pastel	4233	8.6	3870	14.1
Total	8606	13.3	7463	22.0
Farm C				
Scanblack			376	11.4
Pastel			216	2.3
Pearl			227	0.9
Total			819	6.1
Farm D				
Scanblack	163			40.5*
Pastel	217			14.3*
Total	380			25.5*

* The mortality rates at farm D are based on the number of dead kits in the period from birth to June the 30th.

Figure 2 shows the number of dead kits related to the date. This figure is based on the farmers registrations. The decrease in mortality of kits in the period May 27th to 31st is presumed to be an effect of the treatment.

Clinical and pathological findings

The symptoms were severe dyspnoe combined with contractions of the abdominal musculature. Death followed usually 3—5 h after manifestation of the symptoms. Convalescence from ad-

vanced stages of illness has not been observed (*M. Hansen*, personal communication). Postmortal examination of affected kits revealed macroscopic lesions only in the lungs. These lesions were characterized by diffuse or focal red-brownish discolored areas of fleshy consistence.

Histological lesions in the lungs were mainly restricted to the macroscopically affected areas. Bacteriological examinations did not indicate a bacterial etiology of the disease. Presence of AD-virus was detected in an immunofluorescence technique by immunospecific rabbit serum in CRFK cell cultures inoculated with material from the lungs of affected kits (*P. Have*, personal communication). The various pathological and other findings will be published in details elsewhere.

Therapy

In order to prevent further loss of animals, all kits at farm A and farm B were treated shortly after the onset of the outbreak with each 0.2 ml benzylpenicillineprocaine (200.000 i.e./ml) and 0.2 ml Prednisolone acetate vet. (crystal susp. 10 mg/ml, Hoechst) intramuscularly. This failed to yield the desired effect, though the mortality decreased for a short period following the treatment (Fig. 2).

Comparison between affected and non-affected farms

The severity of the outbreak in the 4 affected farms are compared to the non-affected farms using 2 parameters: *early neonatal mortality rate* (*ENMR*), i.e. the percentage of kits dying between birth and May 15th out of the number of liveborn kits; *late neonatal mortality rate* (*LNMR*), i.e. the rate of kits dying throughout the investigation period out of the number of kits alive on May 15th.

There is an obvious difference in LNMR between the affected farms and the non-affected farms (Table 5), with a much higher LNMR for the former group. The relatively low LNMR for farm C is partly due to a shorter investigation period.

The ENMR is evidently higher for farm B than for the non-affected farms, which indicates that already during the early neonatal period there had been an excessive mortality in this population. This had surprisingly not been reported by the farmer.

Table 5. Early neonatal mortality rate (ENMR) and late neonatal mortality rate (LNMR) in the 4 affected farms and in the 4 non-affected farms.

	Farm							
Mortality rate	A	B	C	D	E	F	G	H
ENMR (%)	5.0	13.3	—	25.5*	3.0	8.3	4.5	4.7
LNMR (%)	9.9	22.0	6.1		2.3	1.7	5.2	0.1

* At farm D the mortality rate is based on the period from parturition to June the 30th as the available data did not make distinction between ENMR and LNMR possible.

DISCUSSION

Comparison between the affected farms and the non-affected farms shows a pronounced difference in late neonatal mortality rate and, in the case of farm B, also in the early neonatal mortality rate.

Homogenety in the pathogenesis and in the pathology indicate that a specific disease caused the excessive mortality of mink kits at the 4 farms in the period from May 15th to June 30th 1982, and to some degree, especially at farm B, before that period. ENMR could not, however, be estimated for farm C and farm D.

Some mortality of mink kits is accepted as normal in the early neonatal period, but such mortality normally declines during the first 7 days post partum. This fact, combined with the inaccurate recording of the number of dead kits and with the lack of comparison for mortality in the neonatal period from previous years might have led to the relatively late recognition of the problems. The dominance of pulmonary lesions differs from what is normally reported in connection with AD (*Helmboldt & Jungherr* 1958), but *Bazeley* (1976) described pathological lesions in kits with AD similar to those seen in dead kits from the outbreak described here. The critical period for this particular manifestation in *Bazeley's* study was the first 2 months after birth and acute lesions occurred during the first month.

The extensive transfer of breeding females has highly influenced the composition of the 4 populations, and on farm C and farm D the affected populations consisted exclusively of animals imported from farm A and farm B. On farm B the population was

composed of animals of own stock besides animals from farm A and farm E. On the other hand the population of farm A was solely of own stock. This might indicate that the disease was transmitted from farm A to the other farms. Feed associated etiology of disease can be excluded, because no other farms receiving mink feed from the involved feeed manufacturers experienced problems in the spring of 1982.

Apparently AD was introduced to farm A during the winter and spring of 1982, but it is not possible to state the exact time of this event. The AD test results from farm C indicate a date before April 15th and the elevated mortality of kits at farm B indicates a date before March 3rd, but it must be borne in mind, that farm B was not free from AD when it received breeding females from farm A.

Unfortunately the knowledge about the AD status of the females is based on tests performed during the month of June. Tests performed immediately before and after the time of parturition would have been much more informative. The uniform therapy for the entire population of kits precludes evaluation concerning specific drug response. Randomly assigned treatment with either benzylpenicillineprocaine or Prednisolone acetate vet. (Hoechst) and non-treated kits would have enabled such conclusions.

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SAMMENDRAG

Et udbrud af excessiv neonatal mortalitet i fire danske minkfarme. I. Deskriptive epidemiologiske undersøgelser.

Udbrud af excessiv neonatal hvalpedødelighed i 4 danske minkfarme i 1982 beskrives. Sammenlignet med 4 ikke afficerede farme udviste de angrebne farme øget hvalpedødelighed i perioden fra fødsel til 30. juni. Populationerne karakteriseres med hensyn til alder, oprindelse og minktype, samt med hensyn til udveksling af avlstæver mellem farmene. Der fandtes overensstemmende patologisk anatomiske fund ved sektion af naturligt døde og aflivede, syge hvalpe. Lidelsens etiologi er indtil videre ukendt, men hvalpedødeligheden faldt tidsmæssigt sammen med stigninger i Aleutian Disease positive reagenter i de 4 populationer.

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