Fur Animal Research
Published by Mink Farmers' Research Foundation, a Committee of Fur Commission U.S.A
Volume 17, Number 1 March 2009

Dr. Jim Oldfield

Many people help me with information for these newsletters and one of he most consistent of these is Vern Peterson, the General Manager of Northwest Farm Foods, located in Burlington, Washington. In last week's mail, Vern sent me notes on what some of our prominent mink producers are doing, diet-wise, for their animals. One of those he mentioned was Ron Gengel, who himself has often been helpful to me. Vern raised questions about herring as a diet ingredient and I was able to assure him that it was an excellent food. He added questions about vitamin supplementation of mink diets: what form of thiamine (vitamin B1) to use, for example, and thiamine mononitrate seems to be becoming popular and is giving good results.

He raised a question, too, about salmon poisoning of dogs. This has been reported when dogs have eaten salmon that have died after spawning on riverbanks. There is no problem with fresh salmon or salmon products, either for dogs or for mink. As with other fish, salmon should be protected against spoilage by use of antioxidants, like vitamin E, since fish oils are highly susceptible to oxidative damage unless protected in this way. Unprotected fish can harm the animals to which it is fed, so this is a matter of some concern.

The breeding season for mink is approaching and I wish you every success in it. This is one of the most important times in the mink year and sets the stage for a productive operation.

J. E. Oldfield

ALEUTIAN DISEASE VIRUS DIPSTICK TEST

Two hundred fifty-eight natural dark mink (approximately 10 weeks of age) were tested for Aleutian Disease Virus (ADV) with the ADV dipstick test (Scintilla Development Company, Bath, PA) both before and 25 days after vaccination for distemper/MEV (Distox Plus 4-way Vaccine[1], Schering-Plough, Summitt, NJ) to check for cross-reacting antibodies that might interfere with the ADV antibody test. Results of the test (all negative) were reported to Dr. Robert Stephon for addition to Scintilla's database of testing results.

[1]Mink Distemper-Enteritis Vaccine,, Modified Live and Killed Virus-Clostridium botulinum Type C-Pseudomonas aeruginosa Bacterin-Toxoid

S. J. Bursian, J. Link and A. Napolitano
Department of Animal Science
Michigan State University
East Lansing, MI 48824

THE INFLUENCE OF BODY CONDITION ON BREEDING RESULTS AND EARLY KIT MORTALITY

Abstract

The purpose of this field investigation was to examine the connection between early kit mortality and the body condition of the females and the feed consumption from January to birth. Twelve farms with a total of 5338 first year females were included in the investigation. The females were classified by types wild type, pearl and white. The body condition of the females was scored on a 6 scale within the periods; 18 – 31 of January, 20 – 24 of February, 20 – 24 of March and as pregnant females 18 – 21 of April. Moreover, some females were evaluated immediately after birth. Dead kits were noted within the first three days after birth, whenever possible. Feed allocation was registered by means of the individual feeding system with the handheld palm pilot and divided into two periods; implantation (25 of March – 6 of April) and pregnancy (7 of April – 24 of April). We did not find any coherence between the feed consumption and number of kits in any of these periods. However, we found a good correlation between the body condition of females and the number of both living and dead kits. The body condition of the females in February, March and April and right after birth had a significant influence on the number of newborn kits. We did not find any significant influence of the female's body condition in January. Generally speaking, females that are in a medium body condition show the best results. Females that are too fat in March and April had more dead and fewer living kits. As expected, the majority of the females gain weight from February to March. Those females that stay in a similar body condition or gain 1 score in body condition, have more living kits than those who gain 2 or more grades in the score. A decrease in body condition from March to April results in fewer living kits. A decrease of 2 or more grades gives furthermore a higher number of dead kits. We conclude that a conditioning of the females in February, March and April seems to be able to help the females in having more live- and fewer dead kits per female.

Introduction

The final breeding result is a combination of the number of born kits and even more important, the number of kits that will survive until pelting in November. Most of the lost kits are lost within the first 72 hours. This is often called early kit mortality. On the basis of questionnaires Hansen (2004 and 2005) describes the considerable differences in problems with early kit mortality on the different farms. There are significant variations within color types, feed kitchens and farms. There are also variations throughout the years. It also seems as if the extent of problems with early kit mortality are slightly increasing.

In addition to the questionnaire in 2005, Hammer et al. (2005) made several autopsies of kits and females who lost their litters. Only females with no outer signs of birth complications were selected for autopsies, but anyway there were found several females with dystocia. The conclusion from this study was the fact that several of the females had a long/complicated birth and this had affected the kits by making them less viable as a consequence of lack of oxygen.

A female who has had a long and complicated birth is not capable of nursing the kits after birth. The nursing behavior of the female is nest building, protection of the kits, licking of the kits and suckling (Malmkvist & Hansen, 1999). By video recording 39 pregnant first year females Gade and Malmkvist (2004) did not find any difference in nest building

behaviour at females who have lost many kits contrary to females who have lost few kits. However, in this study they found a significant difference in length of birth between females who have lost many kits (average 10 h 7 min) and females who have lost only a few kits (average 5 h and 7 min). Another study of Malmkvist (2005) showed that the females' body condition tends to affect the birth length and the birth intervals between the kits. Tauson (1988) found that obese females who had a high feed intake during pregnancy might have an increased risk of losing the kits shortly after birth due to birth complications and/or poor milk production. There are several studies that suggest that the body condition of the females affect the birth and the survival of the kits.

Feed Amount

The amount of feed to females during the pregnancy period has been discussed for several years (Lund, 1992; Børsting and Hedegaard, 1998; Møller and Klaas, 2005). Both ad libitum feeding in the implantation period followed by restrictive feeding before birth (Børsting and Hedegaard, 1998) and a restrictive feeding throughout the pregnancy period (Møller and Klaas, Møller and Chriél, 2001) has been discussed. Møller and Chriél (2001) recommend that the energy allowance throughout the pregnancy period is between 190 and 230 kcal to ensure development of the mammary gland and to avoid the fattening of the animals in pregnancy.

In a study on the Individual feeding system, Sønderup and Clausen (2005) found large variations between animals in feed uptake in pregnancy regardless of the litter size. In another study made by Baekgaard and Sønderup (2005), also including the individual feeding system, the weight of the females at pelting time was compared to the feed amount during the pregnancy period. They also found a large variation in feed intake with no regard to the weight at pelting and litter size. There was, however, a tendency towards heavy females at pelting eating more in the pregnancy period than the lighter ones. The large variation in feed intake during the pregnancy period will most likely lead to a different body condition at birth.

Body Condition

Clausen (2005) showed a connection between the fat percent in the animal body and the body condition. The body condition was described from a scale developed by Rouvinen-Watt and Armstrong. Malmkvist (2005) also studied body condition of females on the 19 April and 9 May, respectively. There was found a connection between the body conditioning score and the weight of the females. There was also found a connection between the body conditioning score and the length of the birth, although there was only a significant difference at the scoring on the 9 May. Both females with a high body condition score and females with a low score showed the largest variations in the course of the birth.

Earlier investigations show two things: (1) The females are in a different body condition at the time of delivery, and (2) the body condition might lead to birth complications and thereby make the kits less viable.

Materials and Methods

There were 12 farms involved in the study. In a group of females on each farm there were made a registration of the body condition score was registered in each of the following periods: 18-31 of January, 20-24 of February (just before flushing – ad libitum feeding), 20-24 of March and 18-21 of April. On each farm 300-600 yearling females were random selected in the Wild colour type and Pearl and White colour types. These colour types were selected because of the differences in feed intake and behaviour. The body condition in January and February were scored on the following scale: 5 (obese), 4 (heavy), 3 (ideal), 2 (thin) and 1 (very thin) (Rouvinen-Watt and Armstrong). In the last half of March and in April there was included an extra score: 6 (very obese) to

reflect the development in the body condition of the females.

Some females were scored right after birth. The farmer made this evaluation after receiving instructions. These body condition scores were made to study the connection between the score made on the pregnant females and the body condition at birth. The objective was to evaluate the score made in late pregnancy where the females were in different state of pregnancy and with different litter sizes.

The body condition scores before delivery were all made by the same person to make sure that the evaluation was as uniform as possible.

Information on birth date and litter size was noted by the farmer on the breeding card within the first 24 hours after birth. The registered data were: birth date, the number of live kits and the number of stillborn kits. Kits that died after the first 24 hours were also registered. If kits were moved from the litter this was also noted on the breeding card. If a female had an extra kit from another litter this was not included in the litter size. Females who had all their kits removed were noted as dead kits to eliminate the influence of the farmer's ability to move the kits before they died. The kits that were moved because of too many kits in the litter were noted as live kits and were included in the study. Barren females were also registered.

This was a field study and at every farm visit the body condition of the females was discussed with the farmers. This means that the farmers in most cases tried to make the females have the right body condition.

Feed registrations were made on 7 of the 12 farms. This was made by using the individual feeding system with the handheld palm pilot. The farms had their feed delivered from four different feed kitchens. The feed kitchens were not included as a variable in this study. The connection between feed amount and the number of live-born kits and stillborn kits were studied in the periods 23 March to 6 April (Implantation) and 7 April and 24 April (pregnancy). These periods cover large variations among the females; some females give birth on 5 May and this means that the period called pregnancy only covers a small part of the pregnancy of these females.

Statistics. Statistical calculations were made in SAS for Windows ver. 8.2, using a general linear model. Factors with significant influence were included in the model as co-variate.

Results

A total of 5338 first year females from 12 farms were included in the study. There were 3137 of the wild colour type, 1282 Pearl and 919 White females.

The average body condition score of the females scored at birth is shown in Figure 1.

Table 1. Average body conditioning score, all farms and all color types. Scale 1-6. 2067 females, who were scored at delivery and during all periods.

January	February	March	April	May
3, 5	3, 4	4, 5	4, 4	4, 2

Feed amount

Data from 3475 females was available. In the periods studied (implantation and pregnancy) there was no connection between feed amount and the number of life and stillborn kits.

Body condition and the number of liveborn kits

If data from all 12 farms and from all 3 colour type was included there was a good correlation between body condition scores in February, March and at birth and the number of liveborn kits. The score in January and April there did not show any statistical significant correlation between body condition and the number of liveborn kits. However, there was a tendency towards a lower number of liveborn kits from the females who had high body condition scores.

If only females of the wild colour type were included there was no correlation between the body

condition in January and February, and the number of liveborn kits. On the other hand, the studies showed a strong connection between the body condition in March, April and at delivery and the number of liveborn kits. The females with the highest body condition scores had the lowest number of liveborn kits at birth (Table 2.)

	March		April		Birth	
Body score	Live born	N	Live born	N	Live born	N
3	6,6 AB	69	6,0 AB	59	5,9 B	44
4	6,5 A	1564	6,4 A	1537	6,6 A	852
5	6,0 B	1206	6,1 B	981	6,3 B	285
6	5,2 C	78	5,8 B	77	4,2 C	15

Table 2. Number of live born kits per litter born of wild colour type females with body condition scores, 3, 4, 5 and 6. The females are scored in March, April and right after birth. The letters A, B and C indicate the statistical significant difference between the groups. p-values are p<0,0001, p=0,02, and p=0,0008.

The Pearl colour type showed the same tendency, however, this study shows a strong correlation between the body condition score in March and the number of live born kits. Within the females at the body condition score in January. In the white colour type the correlation seemed to be opposite of the correlation of the other two colour types. Within the white colour type there was a higher number of liveborn kits with an increasing body condition score.

The increasing body condition from February to March as a consequence of flushing was studied in all colour types and on all farms. The data from both different farms and colour types was pooled. There was no statistical correlation between the change in body condition and the number of live born kits. If, however, we looked at only one type (wild colour type), there was a difference. The females who had the same score in March as in February, or had 1 more or less in score, had more liveborn kits than females that had a change in body condition score on 2 or 3 (see table 3). Within the White and Pearl colour types there was no correlation between change in body condition score from February to March and the number of live born kits.

Table 3. Correlation between change in body condition score in the Wild colour type from February to March and the number of live born kits per mated female. The letters A, B and C indicate the differences between groups. p=0.03.

Change in body condition score	Litter size (live born)	N
-1	6,78 AB	27
0	6,26 AB	464
1	6,37 A	1362
2	6,11	872
3	5,91 BC	138
4	4,22 C	9

Body condition score and the number of dead kits

When data from all 12 farms and all colour types was pooled we found a good connection between the body condition score in March , April and at birth and the number of dead kits. There was no connection to the body condition in January and February (see table 4). As shown in table 4 there were more dead kits in the litters from females who had the score 5 or 6 and fewer dead kits when the females had the score 3 or 4.

When only females of the wild colour type was

included, the study showed that the body condition in April (p=0.009) and at birth (p=0.0004) had an influence on the number of dead kits in the litters. Too fat and thin females had more dead kits in their litters, than females that were considered as ideal. There was also a tendency towards more dead kits from females that had a high or a low score in March, although this was not significant. Within the White and Pearl colour there was no correlation between body condition and the number of dead kits in the litters.

The major changes in body condition from March to April were studied on the basis of all data from the 12 farms. Females who had a lower body condition score in April than in March had significantly fewer live born kits than females who had the same or a higher score in April than in March. If the females lost two or more body condition scores from March to April, they had a significantly higher number of dead kits.

Table 4. The number of dead kits (first year – Wild, White and Pearl colour types). Females had a body condition scores 3, 4, 5 and 6 in March, April and at birth. The letters A, B and C indicate the differences between groups. p-values are p=0.003, 0.005 and <0.0001.

	March		April		Birth	
Body condition	Dead kits	N	Dead kits	N	Dead kits	N
3	0,51 A	84	0,76 AB	74	0,83 AB	115
4	0,73 A	2436	0,77 B	2403	0,69 A	1523
5	0,90 A	2268	0,95 B	1850	0,90 B	486
6	1,26 B	175	1,26 C	164	2,0 C	33

Discussion

Even if early kit mortality is often referred to "as the kits that die within the first 72 hours" this can vary. In this study both the still born kits and kits that died within the first 72 hours were regarded as dead. A strict counting of the kits was necessary due to a very large number of data on females and litters. This made the number of dead kits as reliable as possible.

As earlier studies (Baekgaard & Sønderup, 2005; Sonderup & Clausen, 2004) have shown, this study also showed large variations in the amount of feed that the females asked for and that this was regardless of litter size. The correlation that Børsting and Hedegaard (1998) saw between ad libitum feeding in the implantation period and the number of kits was not see in this study. The body condition of the female indicates if she has been in a negative or a positive energy balance, and therefore makes a better indicator of the nutritional state of the females than the feed amount because this will vary from female to female. Body condition scoring is an easy method to use in practice because it is easy to learn and it is a fast method to use on the farm.

At the visits on the farms the body condition of the females was discussed with the farmer. Therefore the farmers tried to make changes in the body condition of the females on the farm, e.g. by having a longer time without feed on the cage before the next feeding. The study showed that the body condition of the females is an important factor to the litter size. The females that were too fat seemed to have fewer live born and more dead kits in the litters than females that had an ideal body condition. The scores given by the farmers at birth showed a tendency towards females that were too thin and had fewer live born kits and more dead kits. This study shows that the body condition of the females in February, March, April and at birth has an impact on the litter size. The body condition in January did not seem to have any influence on the litter size.

The body condition in February and March was not expected to have influence on the number of dead kits because the kits were only blastocysts at this moment, but the body condition in February and

March did indirectly seem to affect the number of dead kits by the following: (1) the females that are too fat already in February and March were not possible to reduce in body condition before birth and therefore they had a more difficult birth and more dead kits; (2) The females that had a lower body condition score in April than in March had fewer live born kits. If the females had 2 or more scores lower in April than in March there was an increase in the dead kits also. A reduction in the body condition from March to April seemed to cause more dead and fewer live born kits; therefore, we have to focus on the body condition of the females already after mating. Then the females do not have to reduce their body condition during the pregnancy period to have the right condition at birth. Managing body condition of the females in February, March and April seems to reduce the number of stillborn kits and increase the number of liveborn kits. This is easy to implement into a normal farm practice where the farmer concentrates on the body condition of the males in December and January and the body condition of the females in February, March and April.

A scoring of the females in April demands a person with a routine in evaluating the pregnant females. It can be difficult to evaluate if the females are fat or they are pregnant. In April there will be females in early pregnancy and some in late pregnancy. This means that the evaluation of the body condition might also be an evaluation of the state of pregnancy according to personal observation.

This study showed a strong correlation between body condition and litter size within the Wild colour type. Females from the Pearl colour type also showed some correlation, while the White colour type females showed the poorest correlation. One of the factors involved was the number of females of the Wild colour type (3 times more) compared to the number of Pearl and White colour type females. Pearl females showed a large variation in the activity level from farm to farm (personal observation). It seemed that some breeds of Pearl were acting like the Wild colour type (active and very easy to slim in the winter) while other breeds acted more like the White colour type (calm and more difficult to slim during the winter). Whether the activity is a factor in the body condition, or not, has not been investigated, but the thought is not far away. A good physical condition of the females at delivery might lead to an easier birth.

Conclusion

There was no provable effect of the amount of feed given to the females during implantation and pregnancy on the number of live and stillborn kits. However, the body condition of the females did have an influence on birth, and thereby on the number of live born kits and dead kits. The study indicates that females who had a high body condition score had more stillborn kits or kits that died right after birth than females in an ideal body condition. Females who had an increase at 2 or more body condition scores from February to March have fewer liveborn kits and more dead kits in their litters. Females who are reduced to ??? or more body condition scores from March to April also have fewer liveborn kits and more dead in their litters.

The study indicates that the focus should be on the body condition of the females in March (after mating). This means that the females do not have to be reduced in body condition from late March to late April.

Henrik Baekgaard, Mette Ulf Hansen and Michael Sønderup

Danish Agricultural Advisory Service
National Centre for Fur Animals
Udkaersvej 15, 8200 Århus N, Denmark

RARE GENETIC DISEASES

A mink farmer called and said he had young kits that died with heads full of fluid. Since the same dams and sires had produced "water head" kits the previous year, the mink farmer rightfully figured out that he was dealing with some "bad" genes in his mink. Actually, his keen observation led to a diagnosis of hydrocephalus that is a simple recessive genetic disease.

I have been impressed with the mink farmers. They are sharp observers and notice mink with unusual symptoms or appearance among the thousands of mink on their farms. The genetic mink diseases described in this article were first observed by mink farmers.

Dwarfs. Dr. Richard Shackelford, probably the most respected fur animal geneticist of our time, described a condition in which some kits are midgets. These mink are sometimes referred to as "shorties" by mink breeders. Although the midget mink described by Shackelford had a 50% reduction in body size, the head and feet appeared to be of normal proportion. Some of these midget mink have an undershot jaw and a bulldog face.

Another type of heritable dwarfism in mink is accompanied by hairlessness. These mink are small, unthrifty and hairless; however, the hair coat of those mink that survive usually grows back. An additional entity involving dwarfism apparently occurs in sable mink. Dwarfs have been reported in these mink and a blunt, shortened nose is associated with the condition.

A string of burlap bedding sliced through the fragile skin of an Ehlers Danlos affected mink.

Fragile skin disease. If any of you are from a small town and are as old as I am, you might remember the traveling "freak shows." Do your memories include the "India Rubber Man" who could pull his elastic skin away from his body? He had to be careful or he would tear his fragile skin because he had the Ehlers Danlos Syndrome.

The same condition turned up in mink. When a pelt was pulled at pelting time, it would rip and the farmer would end up with pieces of pelt in his hand. The affected mink had loose fragile skin with a very low tensile strength compared to that of a normal mink. Fragile skin disease is a hereditary condition transmitted by dominant genes that cause a defect in the tissues that underlie the skin of the mink, making it elastic and fragile.

Scleroderma (Hard Skin)

Scleroderma (hard skin) is a disease reported primarily in man that is associated with thickened skin of the face, neck, chest, hands, and in some instances, throughout the skin and other organs. Similar conditions have been reported in swine and cattle. In 1951, we recorded a clinical case in an adult male Pastel mink that resembled scleroderma in man. This mink walked in a "dog paddle" manner and the skin over the neck and front legs was taut and thickened.

About one week before the death of the mink, the skin of the neck became so tense and hardened that it could not be elevated between the thumb and forefinger. The mink succumbed after the disease became progressively worse over a six-month period. At autopsy, tissues were examined and the skin was severely thickened over

the entire body, as thick as one-half inch in some areas. The skin over the joints was thickened and the unnatural paddling movement of the joints was believed to have resulted from the thickened skin inhibiting normal joint movement.

John R. Gorham, DVM
College of Veterinary Medicine
Washington State University
Pullman, Washington 99164

The skin of the head of a mink with fragile skin disease (Ehlers Danlos) mink is elastic and folded like an accordion. Normal skinned head below

INDEX

Mink Farmers' Research Foundation Board

Members of your Research Foundation Board of Directors invite your input into the ongoing program of research. Please contact any of the Board with suggestions or comments. You may reach them at:

Author Dr. J.E. Oldfield • Desiged by Sandra Wallace