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Notes from the Group of Editors

Happy New Year to all readers and contributors of Scientifur.

This electronic version of Scientifur is the second issue of volume 25. The first two issues of this volume will be published as a paper issue.

In 1999 the EFBA proposed that Scientifur should be upgraded in order for it to become a 'real' scientific journal. By clearly classifying the texts of Scientifur as either reviewed articles or short communications, abstracts, letters etc. we hope to succeed in this upgrading.

During 2001 we have received some articles for reviewing. These articles will all be published as scientific reviewed articles in a coming issue of the journal.

In 2002, we hope to receive a large number of articles for reviewing as well as short communications, abstracts, letters etc. When submitting their manuscripts, we kindly ask the authors to indicate whether an original article should be published as a reviewed article or as a short communication.

We hope that we have now passed our 'teething troubles', and we and all the people involved in the publishing of the journal assure you that we will do our best to make sure that Scientifur will be published regularly and without any delays.

On behalf of the
Group of Editors

Birthe Damgaard

Effect of space and floor material on the behaviour of farmed blue foxes

H.T. Korhonen, P. Niemelä, L. Jauhiainen

Effects of space and floor material on the behaviour of blue foxes were evaluated in the following groups: (1) small wire-mesh cages (50cm long x 105 wide cm x 70cm high; W50); (2) medium wire-mesh cages (120 cm long x 105 cm wide x 70cm high; W120); (3) wire-mesh floored pens (5 m long x 3m wide>< 1.8 m high:W500); and (4) earthen floored pens (5 m long x 3 m wide x 1.8 rn high; ESOG). Activity and locomotion were lowest in WSO foxes and tended to increase with increasing cage size. Floor material had only a slight effect on activity and stereotypies. Locomotion was higher in ESOO than in W500 foxes. Locomotor stereotypy increased with increasing cage size, and was higher in W500 than in ESOC foxes. Significant periodic changes were found in several behavioural variables. Activity was concentrated most and least frequently between S and 16 hand 0 and S h, respectively. The same tendency was found for sitting, standing, locomotion and activity. Digging was noted only in ESOC foxes, averaging 15 min/24 h, and being most common between 16 and 24 h.

Can. J. Anim. Sci., 2001: 81, 189-197, 1 fig., 5 tables, 35 refs.

Extent of digging and its possible underlying causal factors in penned blue foxes

H. Korhonen, P. Niemelä, I. Wikman

A recent European animal welfare recommendation stresses the importance of studying digging behaviour in farm-born blue foxes (*Alopex lagopus*). The current study was conducted (1) to clarify the extent of digging and (2) to evaluate factors that motivate digging. In experiment 1, six juvenile male blue foxes were housed together from August to the following June in an earthen enclosure. Experiment 2 was conducted from July to December, using ten enclosures each containing two juvenile male blue foxes. Behaviour was monitored by 24-h video recordings and visual observations. Progress of digging was also followed by making scale drawings of all digging marks on paper. As early as the first study day, clear signs of digging were observed. Digging sites were concentrated below and close to nest-boxes and pen walls. Maximally about 20% of the total enclosure area was affected. The total surface area of digging sites did not increase from late summer onwards because foxes tended simultaneously to cover part of the old sites when digging new ones. Motivational tendency to dig varied with time. Digging activity decreased during autumn and almost totally ceased during winter In May, foxes resumed digging activity. Digging motivation was evaluated by two means: (1) by analyzing digging purpose (experiments 1 and 2). and (2) by the damming-up test (experiment 1), that is, after 10 months foxes that had been exposed to the earthen floor were transferred for 12 days into wire-mesh cages with no possibility to dig in the ground. Thereafter, foxes were transferred back into the earthen enclosure to measure the rebound of digging following deprivation. Foxes were observed to dig for the following reasons. (1) to make a hole or a resting site. (2) to locate an escape route, (3) to cache food, faeces, or sticks. (4) in response to a novel object (new nestbox, replacement of nesthox), and (5) displacement without any clear goal. Daily time spent digging averaged 7 mm and 17 mm per fox in Exps. 1 and 2, respectively. A clear rebound effect for digging was not identified. It can be concluded that digging is a complex behavioural pattern caused by a variety of motivations that can vary over time. The present study was unable to show unambiguously that digging is an important need for farmed foxes.

Acta ethol, 2001: 3, 127-133, 5 figs, 1 table, 26 refs.

Physiological and behavioural responses in blue foxes (Alopex lagopus): comparisons between space quantity and floor material

H. Korhonen, L. Jauhiainen, P. Niemelä, M. Harri, R. Sauna-aho

Welfare-related physiological and behavioural responses were studied in farmbred blue foxes (Alopex lagopus). Comparisons in space quantity were made between two different-sized shed cages (50 cm long (W50) and 120 cm long (W120); each 105 cm wide x 70 cm high) and for one out-of-shed pen (5 m long x 3 m wide x 1.8 m high; W500). Each option had a wire-mesh floor. Furthermore, we tested how floor material affects responses by comparing the W500 foxes in wire-mesh floor pens

with foxes housed in earthen floor pens (E500: 5 m long x 3 m wide x 1.8 m high). Each test group comprised 20 juvenile males maintained in pairs. The experiments lasted from weaning in July to pelting in December. Final body weights of the W500 foxes were significantly lower than those of the W50 or W120 foxes. Claw length of back foot was longer for E500 than for W500 foxes. Posture of front feet was the most folded for W50 and the least folded for E500 foxes. Breaking strength of tibia was highest for foxes housed on the earthen floor (E500). Gastrocnemius muscle succinate dehydrogenase activity tended to decrease and the number of leucocytes tended to increase with cage size. Alanine-aminotransferase and aspartate-amino transferase activities were significantly higher in foxes housed in shed cages (W50, W120) than in enclosures (W500, E500). Creatine-kinase activity tended to decline with increasing cage size. Highest and lowest open field activity was found for E500 and W50 foxes in both wire-mesh and earthen floor test arenas. Some difference were found in body weight-related organ sizes between groups. Heart weight was significantly higher in W500 than in W50 or W120 foxes. Brain weight was significantly lower in W50 than in W500 foxes. Liver weight increased with increasing cage size. Capture time was significantly lower for W50 and W120 foxes than for W500 or E500 foxes. Cortisol levels after capture were significantly higher in foxes from enclosures (W500, E500) than in those from shed cages (W50, W120), but after ACTH stimulation the levels were similar in each group. Rectal temperatures after restraint were highest in foxes from W500. Fur properties of W500 and E500 foxes were poorer than those of W50 or W120 foxes.

Animal Science, 2001: 72, 375-387, 6 tables, 60 refs.

Temperament and reproductive performance in farmed sable

H. Korhonen, P. Niemelä, P. Siirilä

The present study sought to evaluate the relationship between temperament and reproductive success in farmed sable (*Martes zibellina*). Experimental material comprised altogether 58 males and 236 females. Temperament was measured by using a stick test. About 85% of matings occured in July. Most whelpings were in April. Over 80% of young and old males were classified as curious. Number of fearful and aggressive males was small. Among females, the amount of curious animals was much lower compared to males. Every third female was fearful. Temperament did not affect length of the gestation period which ageraged 268 ± 14 days. Gestation period was longest for early breeding females ($r=-0.629$; $P<0.001$). Aggressive females tended to be less willing to mate than fearful or curious ones. Whelping started latest in aggressive females. Whelping result was poorer in aggressive (0.2 ± 0.2 kits per breeding female; 2.5 ± 0.5 kits per whelped female) than in curious (1.2 ± 0.2; 3.1 ± 0.2) and fearful females (1.0 ± 0.3; 3.5 ± 0.4). Percentage of whelped females was lowest (7.7%) and kit losses highest (28.6%) for aggressive females).

Agricultural and food science in Finland, 2001: 10, 91-98, 5 tables, 19 refs.

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NJF RAPPORTER

Ethology and welfare

Assessment of mink welfare at farm level

S.H. Møller, S.W. Hansen

The objective of this paper is to describe an operational "Welfare Assessment System" for use on private mink farms. The aim of the welfare assessment is to provide information to the farmer in order to identify welfare problems on the farm and facilitate the inclusion of this information in farm management. Animal welfare cannot be measured directly, and therefore a number of indicators has been examined and implemented in the welfare assessment system. These are: 1) Behavioural data like the temperament and stereotypy. 2) Health data in the form of mortality, physical damages and weight changes. 3) Management data like manpower, watering and feeding strategies, weaning and vaccination procedures and use of nesting material. 4) Housing data like number and type of sheds and cages and watering system. The welfare during one year has been assessed using the system on six mink farms and the resulting report has been discussed with the farmers. Mainly behaviour and management in terms of temperament and feeding strategy indicated reduced welfare. By use of this information the farmer may choose if and how the welfare may be improved by management changes. The facilitation of decision support and inclusion of behaviour, health and management indicators distinguishes the "Welfare Assessment System" from other systems for welfare assessment like the "Animal Needs Index".

Proceedings from NJF-seminar No. 331. 8 pp, 4 tables, 1 fig, 7 refs. Authors' abstract.

Water requirement in farmed mink

R. Oppermann Moe, L. Lønne Dille, M. Bakken

The present study was the first in a series of experiments that attempted to investigate water requirement in mink during the winter season. The objective was to study water intake during the winter season during non-frost periods, and effects of water deprivation on osmolality, urea, Na and K in urine and serum in farmed mink.

Initially, daily water consumption, feed intake and urinary excretion recorded, and urinary osmolality and solute excretions were measured in 16 female mink (8 experimental, 8 controls). Then, experimental animals were water deprived for 48h. Water consumption (in controls), feed intake and urinary excretion were recorded, and urinary osmolality and solute excretions were measured, and blood samples for analyses of serum osmolality, urea, Na and K were drawn.
Following onset of water deprivation, significant increases were found in urinary osmolality, Na, and K. Increases were significant after 24h. The increase in urinary urea was significant after 48h. Urinary volume decreased. Daily feed intake decreased in the experimental animals. Water deprivation did not affect serum osmolality or serum levels of Na, K or urea.
The results show that the mink made a physiological adjustment in response to water deprivation and concentrated urine and reduced urinary volume in order to compensate the water loss. The self-induced fasting in the present study may have been an additional means to stabilise osmolality in serum.

Proceedings from NJF-seminar No. 331. 5 pp, 12 refs. Authors' abstract.

Action plan for welfare improvement in fur animals

L. Lønne Dille, R. Oppermann Moe, S. Gil Westersjø

In order to implement scientific recommendations concerning welfare improvements into practical farm conditions and recommendations, an Animal Welfare Group was initiated by the Norwegian Fur Breeders Association in 1995. The basis for field trials and recommendations from this group were various approaches to welfare issues defined in "Tiltaksstrategi for velferdsforbedringer for farmrev innenfor rammen av et økonomisk og etisk akseptabelt produksjonsopplegg " (1994). In 1999, the Animal Welfare Group prepared their "Plan for welfare improvement in fur animals" which was largely a continuation of previous work in the group. The "Action plan for welfare improvement in fur animals" was approved by the Board of the Norwegian Fur Breeders Association May 2001. Many of the recommendations in this plan proceed

Norwegian and international legislation.
Important issues are welfare improvements by means of developing educational programmes related to basic management and a welfare certificate, further develop the Quality System as a tool to follow up the "Action plan for welfare improvement in fur animals" on farm scale, develop stimulating farm environments, improve water and feed supply, develop a health record system, and improve man-animal relationship by means of imprinting and the breeding programme. To achieve welfare on an international basis, inter-Nordic co-operation will be initiated.

Proceedings from NJF-seminar No. 331. 3 pp. Authors' abstract.

Stress-related behavioural and physiological responses in blue foxes housed in cage and pen environment

H. Korhonen, L. Jauhiainen, P. Niemelä, M. Harri, R. Sauna-aho

Welfare-related physiological and behavioural responses were studied in farmbred blue foxes (Alopex lagopus). Comparisons in space quantity were made between two different-sized shed cages (50 cm long (W50) and 120 cm long (W120); each 105 cm wide x 70 cm high) and for one out-of-shed pen (5 m long x 3 m wide x 1.8 m high; W500). Each option had a wire-mesh floor. Furthermore, we tested how floor material affects responses in foxes housed in wire-mesh (W500) and earthen floor pens (E500: 5 m long x 3 m wide x 1.8 m high). Each test group comprised 20 juvenile males maintained in pairs. The experiments lasted from weaning in July to pelting in December. Final body weights of the W500 foxes were significantly lower than those of the W50 or W120 foxes. Claw length of back foot was longer for E500 than for W500 foxes. Posture of front feet was the most folded for W50 and the least folded for E500 foxes. Breaking strength of tibia was highest for foxes housed on the earthen floor (E500). Gastrocnemius muscle SDH activity tended to decrease and the amount of leucocytes tended to increase with cage size. ALAT and ASAT activities were significantly higher in foxes housed in shed cages (W50,W120) than in enclosures (W500,E500). CK activity tended to decline with increasing cage size. Highest and lowest open field activity was found for E500 and W50 foxes in both wire-mesh and earthen floor test arenas. Some differences were found in body weight-related organ sizes between groups. Heart weight was significantly higher in W500 than in W50 or W120 foxes. Brain weight was significantly lower in W50 than in W500 foxes. Liver weight increased with increasing cage size. Capture time was significantly lower for W50 and W120 foxes than for W500 or E500 foxes. Cortisol levels after capture were significantly higher in foxes from enclosures (W500,E500) than in those from shed cages (W50, W120), but after ACTH stimulation the levels were similar in each group. Rectal temperatures after restraint were highest in foxes from W500. Fur properties of W500 and E500 foxes were poorer than those of W50 or W120 foxes.

Proceedings from NJF-seminar No. 331. 13 pp, 25 refs. Authors' abstract.

Nutrition and feeding

Plasma concentrations of leptin mirror changes in body weight but do not influence the pattern of the pre-ovulatory luteinizing hormone (LH) surge in mink (Mustela vison)

A.-H. Tauson, M. Forsberg, A. Chwalibog

The discovery of leptin, the protein product of the obesity gene (1), has generated a vast amount of research into leptin's different roles in metabolism. One area of special interest is reproduction: from empirical research it is well-known that nutritional status is important for the reproductive processes, but still there is no complete understanding of how nutrition regulates reproduction. Leptin has been suggested to play an important role in the nutrition – reproduction interaction, possibly by acting as a metabolic gate (2, 3, 4). Nutrient supply is reflected in LH secretion: when insufficient, LH pulse frequency is suppressed, but rapidly restored in response to refeeding (5). The objective of this study was to evaluate whether plane of nutrient supply prior to breeding did influence plasma concentrations of leptin and other metabolic hormones and LH during the pre-ovulatory surge in the mink. The mink is a reflex ovulator and the pre-ovulatory LH surge is hence induced by mating.

In conclusion, the present data suggest that plasma

leptin concentrations in mink are very responsive to changes in food supply and body weight within the range of body weight of the animals in this investigation. However, it could not be shown that plasma leptin concentrations were reflected in plasma LH concentrations during the LH surge.

Proceedings from NJF-seminar No. 331. 6 pp, 1 table, 3 figs, 11 refs.

Dietary protein, fat and carbohydrate supply to lactating mink (Mustela vison) - Effect on glucose homeostasis, energy metabolism and milk production

R. Fink, A.-H. Tauson, C. Friis Børsting

The objective of the present investigations was to study the effects of different dietary protein, fat and carbohydrate supply on glucose homeostasis, energy metabolism and milk production of the lactating mink. Glucose homeostasis was measured in 18 catheterised dams nursing 6 kits four weeks post partum by means of blood samples drawn 5 and 10 min. before feeding and 30, 60, 90, 120, 125, 130, 140, 150, 165 and 180 min. postprandially. The dams were fed ad libitum from parturition on diets with different ratios (%) of metabolisable energy (ME) derived from protein:fat:carbohydrate (61:37:2, 46:37:17 and 31:37:32). Energy metabolism and milk production were measured in 12 dams nursing 6 kits, and fed ad libitum from parturition with different ratios of ME derived from protein:fat:carbohydrates (58:34:8, 47:38:15 and 39:35:26). Energy metabolism was measured by means of balance and respiration experiments, and milk production by means of the water isotope dilution technique. The main findings were the following: 1) Lactating mink are capable of utilising high amounts of digestible dietary carbohydrates, and 32% of ME derived from carbohydrates does not result in critically elevated plasma glucose levels. 2) Dams fed the low protein diet (39:35:26) had lower heat production, oxidised less protein and had a higher milk production during weeks three and four of lactation, and a higher kit live weight four weeks post partum, than dams fed the high protein diet (58:34:8). It was concluded that there is a considerable potential to reduce the protein and increase the carbohydrate supply to lactating mink with positive effects on animal performance, energy utilisation and with beneficial effects for the environment.

Proceedings from NJF-seminar No. 331. 9 pp, 3 figs, 1 table, 17 refs. Authors' abstract.

The functionality of the intestine in mink (Mustela vison) kits

J. Elnif, R.K. Buddington, C. Malo, P.T. Sangild, N. Enggaard Hansen

The importance of a well functioning gastro-intestinal tract (GIT) in neonatal mammals is particularly well illustrated in mink kits who within there first 3 weeks of life increase their body weight more than 10 times. This can only be achieved with a high efficiency in the GIT regarding both the activity of the digestive enzymes as well as the absorptive capacity of the small intestine. In the recent years we have obtained data regarding the development of the digestive enzymes in the stomach, pancreas and small intestine in mink kits from birth to adulthood and as the mink is a strict carnivore with a high demand of protein it is important to focus on the development of the mink kits' ability not only to brake down protein into amino acids and oligopeptides but also to study the development of the absorptive capacity of these nutrients.

Proceedings from NJF-seminar No. 331. 5 pp, 5 figs, 9 refs. Authors' abstract.

Substrate oxidation in male blue foxes (Alopex lagopus) during feeding, fasting and realimentation

A.-H. Tauson, A. Chwalibog, Ø. Ahlstrøm

When living in the wild the blue fox may experience extended periods without access to food during the winter. As a survival strategy it accretes large amounts of fat during the autumn, a body reserve that has dual purposes: it can serve as insulation of the body during periods of extreme cold, and as energy reserve during periods of food scarcity. The animals are strictly seasonal, and the process of fat accretion is regulated by photo-period. The objective of this study was to evaluate how the fox

economizes with its body reserves during a period of fasting, and how reserves are restored during realimentation.

In conclusion, our results suggest that well fed blue foxes are able to withstand a prolonged period of fasting without deleterious effects, because they are able to mobilize substantial amounts of body fat which is used as main metabolic fuel supported by amino acid gluconeogenesis as a glucose source. The level of UN excretion during fasting indicated that the foxes had not started to mobilize excessive amounts of body protein, and the continuous decrease in HE suggested that HE had not reached its minimum level by the end of the fasting period. The realimentation period used here was, however, not sufficiently long to induce a complete recovery of metabolism.

Proceedings from NJF-seminar No. 331. 7 pp, 1 table, 3 figs, 7 refs.

Farm trial on fish-free diet with low protein content in blue foxes (Alopex lagopus)

T. Dahlman, I. Pölönen, H. Jäykkä, K. Valkosalo, T. Jalava

A large-scale field study was conducted on growing-furring blue foxes (Alopex lagopus) fed a low protein and high energy diet. The experimental diet was completely fish-free, reflecting the changes in blue fox feed composition that have taken place during the past decade. The protein sources were slaughterhouse by-products and soy bean cross. Methionine was added to bring the methionine content of the experimental diet up to the same level as that of the control diet. The control group was fed normal feed kitchen feed for blue foxes. No differences between the diets were found in weight gain, recorded from late September to pelting. The feed consumption of the animals on the high energy experimental diet was lower and, accordingly, their feed efficiency ratio (kg feed/kg weight gain) better than that of the control animals. There were no differences in skin length or fur quality parameters between the groups. However, whether the methionine level in the diets studied here was sufficient for the development of optimal fur quality in blue foxes needs further investigation.

Proceedings from NJF-seminar No. 331. 10 pp, 3 tables, 1 fig, 7 refs. Authors' abstract.

Use of rapeseed and lupin products in mink feed

C.L. Bagger, C. Bjergegaard, T.N. Clausen, H. Sørensen

The aim of this study has been to examine the value of different biorefined products from rapeseed and lupin as protein source for mink feed in the growing period. Cold-pressed and water-extracted rapeseed (PRM) was tested alone and in combination with 2 different lupin products isolated as the insoluble and soluble fraction after dehulling and aqueous extraction. The results obtained showed that rapeseed and lupin could be included in feed to mink with unchanged or slightly better fur quality as a result, except for the highest level of PRM (7,5% of feed). The weight gain of animals was unchanged for the groups at the lowest inclusion level of plant proteins, but significant reduced for the other groups. The results of pelt length corresponded hereto. The level of antinutritional compounds (glucosinolates and sinapine) in rapeseed and oligosaccharides in lupin and rapeseed products was generally low. The dietary fibre fraction may be one of the reasons for the reduced weight gain observed.

Proceedings from NJF-seminar No. 331. 10 pp, 7 figs, 4 tables, 15 refs. Authors' abstract.

Meat-and-bone meal as feed for blue fox and mink in the reproduction period

Ø. Ahlstrøm, A. Skrede

Since January 1, 2001, when a ban on feeding meat-and-bone meal to animals intended for production of human food, use of meat-and-bone meal has been limited to feed for fur animals and pets. Meat-and-bone meal is often made raw materials of dubious origin and hygienic quality, and may have low protein quality and digestibility due to raw material and processing at high temperatures. Nevertheless, large volumes are available at a low price, and recent experience with meat-and-bone meal in feed for fur animals in Norway has shown that meat-and-

bone meal can be safely used as an alternative protein source.
The present experiment comprised three groups of 23 blue foxes females, 29 standard brown females and 27 standard dark females given 0, 8.3 and 16.6 % of meat-and-bone meal in the diet during the reproduction period (January-July). The meat-and-bone meal was made from carcasses of farm animals, and replaced fishmeal protein in the control diet. The meat- and- bone meal contained 50.2 % crude protein with a true mink digestibility of 60.2 %. In the two experimental diets, meat-and-bone meal accounted for 22.5 and 45 % of digestible protein.

The reproduction results of blue foxes and mink, including mating performance, litter size, kit weight at birth, mortality rate and average litter size at weaning was not affected by diet. However, the body weight of the young at weaning was significantly lowered by the highest level (16.6 % of the feed, 45 % of digestible protein) of meat-and-bone meal, but not by the lowest level (8.3 % of diet, 22.5 % of digestible protein). The experiment shows that blue fox and mink can tolerate up to 8.3 % meat-and-bone meal in the diet during the reproduction period without any negative effects.

Proceedings from NJF-seminar No 331. 6 pp, 4 tables, 6 refs. Authors' abstract.

Growth and development of mink (fur animals) in relation to type and quality of dietary lipids

H. Sørensen

The aim of the present work is to obtain more detailed information on type and quality of lipids in relation to growth and development of mink. Focus has been placed on composition of lipids in mink feed and the effects this may have on the lipids in the animals' organs, tissue, milk, blood and membranes. The majority of feed lipids are used for energy purposes and only some few percent are essential lipids, where lipid quality is highly important. This is the case for some long chain polyunsaturated fatty acids (LCPUFA) in blood- and milk lipids, in membranes, in neurolipids, as well as for vitamins and natural antioxidants. Other types of lipids as phytosterols in the feed are also considered to be important factors for the quality of mink milk and the effect this has on growth and development of mink kits. Milk of carnivores as mink and other fur animals has a high content of dry matter, of proteins and a low content of lactose. Thereby, milk from these animals is noticeably different from milk of other animals. This holds good for colostrum, where mink colostrum has a very special composition of oligosaccharides. The relatively high content of lipids in mink feed, especially LCPUFA, and the appreciable amounts of such lipids from fish give a need for more detailed analyses and knowledge to type and quality of intact lipids in mink feed and mink milk, in relation to effects on growth and development of the animals. New methods based on supercritical fluid techniques (SFT) have now been developed to these purposes. These SFT based methods have the potential to give wanted, improved and reliable determinations of lipid types, lipid quality including determination of rancidity.

Proceedings from NJF-seminar No 331. 1 pp. Author's abstract.

Health and diseases

MinkAstrovirus - epidemiology and possible prophylaxis

C. Mittelholzer, L. Englund, M. Chriél, H.H. Dietz, K.O. Hedlund, L. Svensson

Sticky kits (fedtede hvalpe), is a well known problem in mink kits prior to weaning. The kits become covered in exsudate and develop varying degrees of diarrhoea. The morbidity varies within farms, between farms, and between seasons. Different causalities have been discussed, i.e. feed composition, feed energy contents, hygiene and infectious agents. To investigate if enteric viruses may influence the disease syndrome we conducted a modified case control study of 180 mink kits in Swedish and Danish farms. Samples from all kits were analyzed using EM and RT-PCR. The results show that a previously unknown astrovirus significantly increased the risk of development of sticky kits. Comparative studies show that this astrovirus is different from other astroviruses and may be unique to mink. Diagnostic tests are developed to allow further studies of patogenesis,

transmission and immune response.

Proceedings from NJF-seminar No. 331. 3 pp, 8 refs. Authors' abstract.

Fur properties

Blue fox pelt characteristics in relation to pelting date

L. Blomstedt, M. Miettinen, I. Pölönen

The purpose of this study was to investigate blue fox skins with regard to pelt characteristics in relation to different pelting dates. 125 young male blue foxes, born during the last three weeks in May, were pelted between October 20 and February 1. The animals originated from five different farms and on each farm from four to six litters. From every litter one blue fox was pelted every two weeks. The raw skins, dried on board, were graded as done for skin auction. On skin samples from the hip region leather thickness and weight of hair mass were measured, and, with light microscopy, mature hair percentage judged. Six different pelting dates bore no significant visually detectable differences in fur characteristics (quality of guard hairs, density of under fur hairs, colour, overall impression). However, until mid-December the leather part became significantly thinner and its weight declined, whereas the weight of the hair mass increased. After this these parameters were stable until the end of the trial. The degree of fur maturity increased significantly, being almost 90% in mid-December. Our study shows that until mid-December considerable changes affecting pelt quality take place in blue fox leather and fur. Yet, these changes go unnoticed to the naked eye. Hence, pelting at a later date than now is customary is highly recommended.

Proceedings from NJF-seminar No. 331. 7 pp, 1 table, 4 figs, 5 refs. Authors' abstract.

Length and quality of mink skins from early or late pelting season

S.H. Møller

The effect of pelting at the normal time (mid November) or two weeks later on skin length and quality was studied in two groups of 25 young male mink of the brown colour type on each of 6 private farms. The skin length and quality was closely related to body weight but the regression of skin length and quality on body weight differed between farms. Within the two weeks from mid November to the beginning of December, the time of pelting did not affect the skin length. The effect of body weight at pelting on skin length was 10.2 cm per kg. On average the skin quality was 0.2 grades better at late then at normal time of pelting but the effect of pelting time differed between farms. The effect of body weight at pelting on skin quality was 0.77 grades down per kg (almost from e.g. saga selected down to saga).

Proceedings from NJF-seminar No. 331. 1 pp. Author's abstract.

Genetics and breeding

Testing standard worksheets and e-mail in "Pelsdyrkontrollen". Live grading depends on fast communication to the central database

K.-R. Johannessen, E. Børsting, H. Kristiansen

The Norwegian Fur Breeders Association developed in 1994/95 in cooperation with Mr. Ejner Børsting, Scanbrid Int. A/S a system for calculating selection indexes (breeding values) on the basis of data from the live grading of young animals at pelting time. The data for body size and fur quality are corrected for sex-differences, and selection indexes are calculated within farm. This is done by the SAS-System for Information Delivery from SAS Institute and the indexes are standard matrix indexes based on information from the animal itself, fullsibs' and halfsibs' means.

The indexes are meant as guidance in the selection of new young animals for the breeding stock. At the same time the central database in Pelsdyrkontrollen is updated with the new information from the grading and the indexes on each animal.

The system with two-way communication by e-mail between the farmers and Pelsdyrkontrollen in the grading season was tested in full scale the season of 2000. Approx. 50 farms were included in this test. Farmers who used the system have reported to be satisfied with it. Especially regarding the extended possibility to adjust the selection criteria and simultaneously seeing the consequences of the choices. It was possible to use the Excel-file without much professional help, and there were only small problems getting the farmers to use the e-mail system.

The principle of using standard software and the e-mail system to distribute and handling data files can be developed at low costs and can be tested very quickly by the farmers. One major advantage with the Excel system from Microsoft is that active macros, which are connected to a certain worksheet, are linked to the worksheet. They stay with it even when it is sent by e-mail. This means that it's not necessary for the recipient to install or create macros separately.

The handling routines regarding the worksheet are possible to adjust and to fit in to the ordinary routines in Pelsdyrkontrollen. The very fast response that the farmer can get from sending in his data and then receiving them back into his computer, is a big advantage. This makes it much easier for the farmer to actually take the indexes into the selection work, thus increasing the effect of the selection.
As long as one can use standard, common software to develop new facilities in the breeding programmes, it can be done cost efficient, it's easy to test and many farmers can be expected to use the new possibilities without much help.

Proceedings from NJF-seminar No. 331. 6 pp, 5 tables, 1 fig, 2 refs.

Heritability for birth date and effect of mating date in mink (Mustela vison)

M. Fredberg, U. Lund Rasmussen, P. Berg, P. Sandbøl

The objective of the present study was to estimate the heritability for time of birth and to investigate whether the time of birth depended on time of mating.
540 dams and 108 sires were selected for the experiment, consisting of groups of full sibs with either 3 full sisters or 3 full brothers. The dams were divided into three lines with a full sister in each line. The time of mating for the three lines was different but all dams were mated according to the 1 + 9 mating system. A group of 3 full sib brothers should mate 15 dams, 5 from each line.
Heritability for time of birth of the litter was 0.53. Time of birth was effected of remating and age of the dams at first mating. Remated dams gave birth four days earlier (on average) than single mated dams. A 1-day increase in dam age at first mating resulted in time of birth being 0.11 to 0.16 days earlier. In general each day the last mating was postponed, resulted in the time of birth being postponed by 0.7 days. Time of mating effected time of birth and length of pregnancy. Late remated dams gave birth later but had a shorter pregnancy than their full sisters remated earlier.
The heritability for time of birth shows that it is possible to change the time of birth by selection. Furthermore this experiments show that time of mating effects the time of birth, late mating can postpone time of birth and reduce the length of pregnancy. The age of the dam at first mating and remating were also factors that influenced the time of birth.

Proceedings from NJF-seminar No. 331. 8 pp, 3 figs, 3 tables, 8 refs. Authors' abstract

Alternative measures for prediction of maternal and kit effects on early kit growth in mink

B. Krogh Hansen, P. Berg

The objective of this study is to evaluate the value of alternative information of kit weight (average kit body weight in each litter or litter average for males

and females) as a source for predicting the genetic effects on early kit growth. Data were obtained from The Danish Fur Breeders Research Farm 'SYD' in Lindknud, DK-6650 Brørup, and included records from 7956 kits, 3994 female and 3962 male kits born in 1530 litters by 1245 dams and 488 sires. No crossfostering was performed. The following traits were analysed in a univariate Animal Model: Individual body weight at 4 weeks and at weaning. The average kit body weight and the average weight of male and female kits per litter were used in a Sire Model and in a Sire model using population parameters from Animal Model. Selection was based on maternal or direct genetic effects or the sum of maternal and direct genetic effects. The expected response of selected animals (150& and 30%) were compared using Breeding values from the Animal Model. The average kit body weight in the litter can not be used, while the mean body weight of male and female kits in each litter may be used in selection for maternal traits at 4 weeks. But the expected genetic response is 6 to 55 % lower than when selection is based on individual body weight using Animal Model.

Proceedings from NJF-seminar No. 331. 9 pp, 5 tables, 6 refs. Authors' abstract.

Information

The use of stable isotopes to determine the origin of American mink (Mustela vison) caught in the wild – preliminary results

M. Hammershøj, T. Asferg, B. Buchardt Westergaard

This paper presents the preliminary results of a test of a method of determining whether free-ranging American mink (*Mustela vison*) have originally escaped from fur farms, or whether they have been born and raised in the wild. The method is based on three facts: 1) there is a different balance between the stable carbon isotopes 12C and 13C in the terrestrial (including freshwater) versus marine food chain; 2) the carbon isotope balance in the food is reflected and stored as a permanent "signal of origin" in certain hard body tissues, e.g. the teeth; 3) the "standard" food fed to most farm mink in Denmark has a high marine fish content. The hypothesis is therefore, that mink born and raised in fur farms will carry a "marine" signal, whilst mink born and raised in nature away from coastal areas will carry a "terrestrial" signal.

In a pilot study we analysed the isotope balance in canine teeth and claws from four mink taken directly from a mink farm, and from seven free-ranging mink caught in a control campaign in north-western Jutland. The teeth from the farmed mink carried a typical marine signal with very little variation between individuals. Five of the seven mink caught in nature had signals in the marine end of the spectrum, while two had signals in the terrestrial end. This suggests that five of the free-ranging individuals originated from farms and two were "wild". This was supported by the isotope balance of the (continuously growing) claws, covering the full interval from marine to terrestrial, suggesting that the five escaped animals had been on the loose and feeding on terrestrial food for differing lengths of time. The claws of the two "wild" animals carried a distinctly terrestrial signal. Our interpretation was further supported by analysis of teeth and claws from two European polecats (M. putorius) taken in the mink control campaign area.

Proceedings from NJF-seminar No. 331. 4 pp, 1 fig, 4 refs. Authors' abstract.

E-mail groups as a communication tool in fur science and fur business

E. Børsting

Communication via Internet has been part of daily routine for many involved in fur science and fur business. An international e-mail group for fur people was set up in July 1999 and it has now 28 members from 10 countries. Total numbers of e-mails in the group are 146 until May 2001.

Proceedings from NJF-seminar No. 331. 5 pp, 2 figs. Author's abstract.

Posters

Digestibility of feed with different ash content from meat-and-bone meal in mink

O. Sylte Heggset, Ø. Ahlstrøm, A. Skrede

The ash content of fur animal feed has increased during the last years. Fish filleting industry and meat processing industries, which are the main suppliers of by-products for fur animal feed, have developed efficient equipment for separating muscle from bone, leaving by-products with a high ash level. Use of meat-and-bone meal as feed for fur animals because of the low price has also contributed to higher ash content in fur animal diets. Among likely negative effects associated with high ash content are poor protein quality and lowered protein and fat digestibility.

The study included six diets; four of them with increasing ash content, and two of them with an intermediate ash level and different pH. Adjustments of dietary ash were done by varying the level of meat-and-bone meal. The results of the digestibility experiment showed that ash content affected digestibility, especially for protein and fat. The pH level did not influence digestibility. In conclusion, to ensure satisfactory nutrient digestibility, dietary ash content should be monitored and kept on a moderate level, especially if meat-and-bone meal is used in large amounts.

Proceedings from NJF-seminar No. 331. 5 pp, 3 tables, 3 refs. Authors' abstract.

New mutants of American mink (Mustela vison) (Names for new mink mutants confirmed)

U. Lund Rasmussen, K.-R. Johannessen, K. Smeds, M.B. Jonsson, G. Lagerkvist, O. Lohi

The phenotype and the inheritance of three new colour mutants of American mink (Mustela vison) and one single gene effect causing a curly hair type are described. The official Nordic names for all and gene symbol for one of the colour types are presented. Telemark cross (ST) is proved to be an allele for black cross. The genes for stardust colour and for the curly hair type are dominant, whereas the gene for cinnamon colour is recessive.

Proceedings from NJF-seminar No. 331. 6 pp, 7 figs, 6 refs. Authors' abstract.

Effects of different activity objects on dental health in silver foxes

L. Lønne Dille, R. Oppermann Moe, M. Bakken, G. Sanson

Disease prevention and thereby maintaining a good health status is strongly determining for welfare in all farm animals. The objective of the present study was to investigate possible effects on dental health by supplying silver foxes with different chewing objects. 102 silver foxes were included in the study: 34 foxes were supplied with a large bone, 34 with a wooden chewing stick, and 34 were not offered any chewing object.
Foxes with access to different chewing objects had less plaque than controls. Although not significant, animals with access to chewing objects tended to have fewer teeth- and enamel lesions than controls. Differences in plaque incidence between the two experimental groups having a wooden chewing stick vs. a chewing bone was found, where chewing bones were the best objects. Gum condition (inflammation) differed between groups, where foxes not having access to any chewing object had redder gums. Foxes with chewing bones showed fewer bleeding lesions than the others, but no differences were found between foxes with chewing sticks vs. controls.
In conclusion, offering foxes various chewing objects will enable the animals to keep the gum and teeth in good condition and, in the long term, prevent severe inflammatory and painful conditions. Maintaining a good dental health status by offering the animals good chewing objects, and preferably bones, is a simple means to increase welfare in silver foxes during every-day farming conditions.

Proceedings from NJF-seminar No. 331. 3 pp, 1 table. Authors' abstract.

A new system to record behaviour around birth: Observations on deliveries of mink kits

J. Malmkvist, B. Houbak

Many aspects of the early behaviour of the mink female and her kits are presently unknown. Therefore studies of the period around birth are needed, for example in order to understand factors involved in early kit mortality. We have therefore evaluated behaviour using a new recording system, able to follow the female, before, during and after the delivery of kits. Preliminary results from the first observations in the birth season May 2001 are presented.

The movement of a mink in the cage area were detected via a passive infrared detector, switching the input for the video recorder from the nest camera to the out-camera via a relay station. A special adapted mini camera was integrated in the cover of the nest. Eight complete, transportable recording units were used. In the birth season of 2001, a total of 11 mink females were recorded in their home environment. The pregnant females were recorded three days before expected delivery using time-lapse video. In case of delivery, four hour recordings were made in real time. After delivery, the female and her litter were recorded the following four days using time-lapse (factor 1:8).

Overall the recording system gives us the possibility to obtain new information on mink behaviour during the birth period. The system was not always able to successfully detect the position of the females, and alternatives to passive infrared detection are under development.

Proceedings from NJF-seminar No. 331. 1 pp.

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CONTENTS

Seasonal rearrangements in the isoenzymatic profile of lactate dehidrogenase in the organs of mink and polar foxes

N.N. Tyutyunnik, L.K. Kozhevnikova, A.R. Unzhakov, H.I. Meldo

The separation of izoenzymes of lactate dehydrogenase (EC 1.1.1.27) in the extracts of liver, heart and skeletal muscles of minks and polar foxes by agar gel electrophoresis reveal seasonal variations in the ratio of electrophoretic fractions of the enzyme. It has been shown that in winter the rearrangements of the isoenzymatic spectrum of LDH is manifested in the increased relative content of the B-subunits of the enzyme in the total lactate dehydrogenase activity, decreased anaerobiosis coefficient in the tissues of liver and skeletal muscles. The aerobic pathways of glycolysis were concluded to become more important in cold adaptation of fur animals.

Comparative study of lactate dehydrogenase enzymes in tissues of minks and polecats

A.R. Unzhakov

LDH isoenzymes present in heart liver, lung, kidney and spleen of farm-bred animals were revealed by agar gel electrophoresis according to Wieme's procedure. Species specifity character isoenzymic LDH distribution in tissues inherent to fur-bearing animals with various ecogeneses reflect the animals adaptation to environmental conditions. Thus, in mink, adapted to life in two types environment (water and land), M-subunits LDH, responsible for anaerobic pathway of glycolysis became dominant presumably due to the long-tern evolution conditioned by frequent diving causing forced hypoxia.

Specific indices of thiamine profile of minks during acute oxythiamine deficiency.

G.G. Petrova, T.N. Ilyina, N.N. Tyutyunnik, I.P. Chernikevich

The following aspects have been studied: the influence of B_1-vitamin antagonist, oxythiamine, on specific indices of thiamine profile in the organism of minks (the transketolase activity, the value of the thiamine diphosphate effect (ThDP effect), the level of total tniamine and its phosphate esthers: thiamine diphosphate and thiamine triphosphate: the activities of thiamine biotransformation enzymes: thiamine kinase. thiamine diphosphate kinase and thiamine diphosphatase) with different background vitamin provision. The OT injection at the doze of 1,5 mg/kg has caused an acute form of thiamine deficiency with considerable biochemical changes in specific indices of thiamine metabolism and characteristic neurological symptoms independently of background provision.

Thiamine status in minks during modelling B_1-deficiency in reproductive period

T.N. Ilyina, G.G. Petrova, I.P. Chernikevich

The specific indices of vitamin B_1 (thiamine) were studied in the mink females' blood during reproduction period in condition alimentary deficiency. This was achieved by feeding raw fish containing thiaminase - thiamine inactivated enzyme. The researches have shown, that the moderate vitamin deficiency was detected in the experimental mink group and the level of physiologically active forms of thiamine essentially decreased. The pregnancy period in both groups was characterized by the change of thiamine metabolism as a level of vitamin phosphorylated form and enzymes of biotransformation as the reaction of the organism to the pressure connected with reproduction.

Vitamin B_1 metabolism in mink cubs in different biological periods and growth phases

R.V. Trebukhina, I.P. Chernikevich, L.K. Lashak, V.G. Petushok, T.A. Lychko, O.V. Krivehya

Dynamics of thiamine metabolism indices; the level of thiamindiphosphate, activities of thiamine pyrophosphokinase, transketolase and ThDP-effect in mink cubs at different growth phases were studied. It was estimated that vitamin B_1 metabolism depends on physiological processes in organism of fur-bearing animals and full of value of nutritional components.

Leukocytes alkaline phosphatase in mink reproduction period

L.B. Uzenbayeva

Using cytochemical methods activity of leukocytes alkaline phosphatase, structure of leukoformula and content of leukocytes in blood of standard minks female in different period - mating, pregnancy, lactation and post-lactation - were investigated The data about activity and localization of the enzymes in different leukocytes populations and specificity of cytochemical reaction on AP in mink on comparison with other species of animals are represented. The changes of researched indexes in dependence from reproductive cycle period are shown. The examples of high sensitivity of the AP activity to environmental factors influences are demonstrated and in connection with this fact the problem AP measuring for monitoring of organism status is considered. The problem on the reasons of observable changes and role of hormonal status in regulation of cellular metabolism is discussed.

Genetic polymorphism in marmots

E.A. Tinaeva, L.G. Markovich, T.I. Kazakova, G.A. Fedoseeva, V.N. Pomytko

The genetic features were determined by 4 polymorphic serum proteins and blood haemoglobin of marmots (Marmota bobak) expressed both in spectrum and concentration of alleles and genotypes. The albumin synthesis is determined by 2 allelic genes, the postalbumin? Transferrin and posttransferrin synthesis - by 3, and the hemoglobin one - by 4 alleles. The level of observed homozygosis of an investigated marmot population, determined by albumin, postalbumin. transferrin, posttransferrin and haemoglobin loci, is equal 54,8%, what is in correspondence with its expected level of 42,8% ($P>0.05$, chi-square test).

Testing of interferon status in fur-bearing animals

L. Ye. Boyarintsev, N.N. Tyutyunnik, K.N. Gruzdev

Detailed study of interferon status of fur-bearing animals under the normal physiological state, sharp (pestilence of carnivore) and chronic (Aleutian disease of minks) virus infections was conducted. Values of these factors and borders of fluctuations in the norm, under different physiological states and some pathology were established.

Evaluation of immune status in adult mink

L. Ye. Boyarintsev, N.N. Tyutyunnik, V.V. Klimenko, A.G. Schahov

Different indexes of cell and humoral immunity, factors of non-specific resistance in standard paint adult mink were investigated. A big dispersion (fluctuations in the selection) of indexes was noted. The dispersion is stipulated by the study of the separate specimens, having or mountain-high, or very low values in contrast with average values.

The use of biologically active substances for raising of efficiency in farmed minks

N.A. Balakirev, T.M. Demina, O.V. Rastimeshina

Biological active substance (BAS): vitamin preparations – Vitgarant M#B, synthetic antioxidant – Kormolan, ferment – Jizorecifin ГЗх, preparation of stimulate action – Purivetin, complex organic acids – Baliz B, source of minerals – Bishofit and adsordent – Ceolit may be using in the nutrition of minks for raising their productivity.

Digestive hydrolases level in the blood of predatory fur-bearing animals at different periods of year

V.M. Oleinik, E.B. Svetchkina

Trypsin and α-amylase activities were estimated in the blood of mink and blue fox females during 6 years in period of proestrus (December), the beginning of the rut (February), pregnancy (April), lactation (May) and in cubs – at a period of the second phase of growing (September). Average activity of amylase is little changed during the annual cycle. In minks it is maximum at a February, and in polar foxes – at a May. Seasonal fluctuations in amylase activity have no regular disposition. Activity of trypsin in both species of animals is noticeably above in April, than in other periods of observation. The obtained results show that fluctuations of digestive enzymes in blood of predators hardly not connected with the season of a year.

The reaction of enzyme spectrum of digestive tract in herbivorous fur-bearing animals under the changing of qualitative composition of ration

B. Barabasz, V.M. Oleinik

Proteolytic and amylolytic activity in different parts of digestive tract in two herbivorous species (nutria and chinchilla was investigated. Five experimental groups of nutrias and four groups of chinchillas were given feeds with different protein, fat and carbohydrates level during 10 days. Conducted studies have shown that the reaction of digestive system in nutrias and chinchillas in response to changing a diet is not identical. However, the reactions of both types of herbivorous animals have general particularities, distinguishing them from omnivorous. In both investigated animals, the level of digestive enzyme activity changes more in small intestine mucosa, and to a lesser extent, in the pancreas, when changing a qualitative composition of diet.

The hormonal status in fur animals in the postnatal ontogenesis period and reproductive season

L.N. Sirotkina, N.N. Tyutyunnik

Complex research of endocrine thyroid gland, adrenal cortex and gonadal functions in dark brown and coloured mink, polar fox and silver fox in relation to physiological condition (mating period, pregnancy and lactation), stage in the postnatal ontogenesis period, influence of the season and species was carried out. Radio-immunological method was used to investigate the hormonal status (thyroxine, thriiodothyronine, cortisol, testosterone, progesterone and oestradiol) in the serum of peripheral blood of the animals on various fur farms. High thyroid, cortisol and oestradiol hormone levels were recorded in the kit aged two – four months. The peak of triiodothyronine, cortisol and testosterone activity coincided with the beginning of mating period. The animals with impared reproductive system showed reduced levels of thyroid and sexual hormones. High correlation coefficients between the intensity of growth and contents of triiodothyronine, thyroxine, cortisol and testosterone were recorded in mink aged 2 and 4 months which can be used as a criterion to evaluate

physiological condition of the herd when selecting kits for breeding.

The analysis of genetic and environmental factors' influence on reproduction indexes of American mink

A.V. Kharlamova, O.V. Trapezov

The comparison of reproduction indexes of homo- and heterozygous by halfdominant autosomal mutation "Black crystal" (Cr) American minks with minks of standard dark brown colouring, and also analysis of an effectiveness degree of reproduction in varying environmental conditions is carried out.

Fodder stress and conflict between animals of different behaviour types

O.V. Trapezov, O.V. Antonenko, I.N. Oskina, R.G. Gulevich

The researches of behaviour role in conflict development in conditions of forage shortage are carried out at pair placed breeding of young minks, selected during 15 generations for manual and aggressive behaviour regarding the man. It was revealed that in conditions of competitive struggle for forage, body mass of manual males, in difference from aggressive ones, does not essentially influence on cortisol and transcortin levels. Apparently, aggressive males, being not as massive as their partners, experience the greatest stressing action, because they have not only the maximum cortisol concentration in blood, but also the minimum transcortin level. These animals appear to be less stress-resistant in competitive struggle for forage in comparison with manual males.

Embryonic mortality in American mink: Morphological analysis of preimplantation embryonic loss

E.A. Kizilova, A.N. Golubitsa, A.I. Zhelezova, S.I. Baiborodin

It was found that the main reasons for preimplantation loss are disturbances of the fertilization process, selective blastocyst elimination owing to selective damage of trophoblast and damaging effect of spermatozoa of the second mating. In some cases damaging and embryotoxic effects of a reproductive tract bacteria are possible.

Influence of vitamin E on physiological state, milk composition and productivity of blue fox (Alopex lagopus)

V. Ilukha, L. Kozhevnikova, M. Valtonen, S. Kasanen, H. Meldo, N. Tyutyunnik

The influences of extra vitamin E on Polar fox vixens during the two last weeks of pregnancy and the whole period of lactation up to weaning were investigated. Additional vitamin E did not have statistically significant effects on reproduction vixens or their posterities. The haematological and clinicochemical values were within normal range and no differences between the groups could be seen except the higher vitamin E concentration in the blood of females getting extra vitamin E compared to the controls. The experimental group had higher concentration of vitamin E both in their blood and milk and decreased level of fat in milk. It has been concluded that vitamin E supplementation is not necessary under quality and good feed condition.

Reproduction disturbances in female blue foxes

O. Szeleszczuk, P. Niedbala, G. Maloszyc, V. Ilukha

One of the important factors influencing profitability of monstrous breeding fur-bearing animals is the number of born and weaned cubs. Besides barrenness of females, abortions and puerperal complications, reduced breeding efficiency results from embryo mortality and cub mortality at birth. The aim of the present study was to evaluate fertility and fecundity of female blue foxes at the selected farms in southern Poland and in Karelia. The following parameters were considered: total number of females, number of covered and whelping females, litter size at birth, cubs mortality in the period from birth to weaning and pelting. The multiparous vixens had more born and weaned cubs

than primiparous ones. Coproscopic examination allowed to detect eggs and larvae of Toxocara canis, Toxoscaris leonina, Uncmaria stenocephala Teama sp., Triphocephalus vulpis and Echinochasmus perforiatus on farms with bad breeding results. Fertility and fecundity decrease on the farms under examination was caused, besides genetic factors, by environmental conditions such as poor feeding or inadequate care for cubs, etc. Another parameter of environment (i.e. feeding) plays an important role in Karelia.

Attempts to improve reproductive performance of farmed foxes

M. Harri, J. Mononen, T. Rekilä, L. Ahola, T. Pyykönen

The review analysed changes in fox breeding technology according to Council of Europe recommendation. It was shown that this document does not take into account the species nature. Based into literature and own data the influences of different factors on kit mortality were analysed. In all experiments in which silver or blue foxes have been raised in a semi-natural environment, their reproductive performance has been inferior to farm situations. Attempts to improve reproductive performance on farms have been focused on improving a nest box configuration, social organisation of breeding vixens before and after breeding season and on selection for more confident breeding animals. Information on the effect of social hierarchy of breeding vixens on their reproductive success is too fragmentary to draw any conclusive evidence. However, statistical analyses provide evidence that on a population level confident vixens have better reproductive success than fearful ones.

Effect of the enlarged breeding nest box on reproductive success of blue foxes (Alopex lagopus)

T. Rekilä, M. Harri, L. Jalkanen

The effect of enlarged breeding nest box on reproductive success of primiparous blue foxes was studied. Enlarged breeding boxes (45x45x45 cm, LxWxH) were provided for females smaller than average (n=41) and for females bigger than average (n=68). the size of the standard breeding boxes provided for 36 small and 79 big females were 40x40x40 cm (LxWxH). The number of cubs born tended to vary between the farms but not between the experimental groups. The number of cubs at weaning tended to be lower and the number of cubs that died between birth and weaning was higher in females having large breeding boxes in comparison to females with standard breeding boxes. The present results indicate that the standard breeding box is large enough for the biggest blue fox females to give birth normally and enlargement of the box with 5 cm in each direction may lead to increased cub mortality.

The effect of genotype and physiological condition on the content of some minerals in the fur of coypu females

D. Mertin, K. Süvegova, P. Fl'ak, P. Sviatko, I. Tocka

This work is a contribution to the study of mineral element concentration in the organism of herbivorous fur animals. The concentration of some minerals in the fur of coypu females in relation to their genotype and physiological condition was studied. The experimental observations were performed at the Experimental Farm of Fur-bearing Animals of the Research Institute of Animal Production in Nitra. Six female coypus of different mutations – standard (St), Greenland (Gr), silver (S) and white (W) – were included in a trial. The objective of the trial was to determine Ca, K, Na, Mg, Fe, Zn, Cu, Mn, Co concentrations in the fur of female coypus in certain body regions, in the central dorsal and ventral regions, and in relation to the physiological condition (stage): 1. Primiparas, age of 8 months – fur maturing stage, 2. females on the day of delivery, 3. females on the day of young weaning. The analyses showed that the content of Ca, Mg (in the ventral region), Zn (in the dorsal region) in the fur of coypu females varies depending on genotype. The content of Ca, K, Na, Mg, Fe, Cu, Mn, Co (in the dorsal region) in the fur of coypu females varies depending on physiological condition (stage).

Digestibility of nitrogen and fats from feed rations for minks at various proportions of poultry by-products

D. Mertin, K. Süvegova, I. Tocka, P. Fl'ak, Z. Ceresnakova, E. Podolanova, B. Barabasz

The digestibility of nitrogen and fats from the feed ration for minks was studied at various percentual proportions of poultry by-products (heads). The digestibility of nitrogen and fats from the tested feed was studied as well. The experiment was performed on the Experimental Farm of Fur Animals at the Research Institute of Animal Production in Nitra. Five unrelated males of standard mink at the age of four months were studied in the experiment, they were housed in special balance cages. The animals were fed basic feed ration in the first stage, the content of the tested feed in the feed ration represented 33.0% out of the original matter in the second stage, 43.6% in the third and 55.3% in the fourth stage. Digestibility of nitrogen in feed rations for minks was approximately on the same level (80.77-81.25%), and it decreased significantly to 76.94% with 55.3% representation of the tested feed in the feed ration. The digestibility of fats in feed rations for minks rose significantly in dependence on percentual representation of poultry heads in feed rations from 89.88% to 94.22%. The digestibility of nitrogen from the tested feed decreases significantly with 55.3% proportion of poultry heads (81.45-73.58%) and digestibility of fats is approximately on the same level (97.73-94.15%).

Meeting at the Danish Institute of Agricultural Sciences, Research Centre Foulum, on 26 September, 2001 on the subject:

The effect of the diet on mink performance and environment

The meeting hosted then presentations on the topics:

- Feed quality, feed requirement and mink performance
- Feeding routines and environmental effects

The proceedings from the seminar are written in Danish. For more information please contact Birthe M. Damgaard, e-mail: BirtheM.Damgaard@agrsci.dk

Prediction of the nutritive value of feedstuffs and feeds for mink by a new in vitro method

H. Nygaard Lærke, S. Boisen, C. Hejlesen

For screening and control purposes a method for prediction of the nutritive value of feedstuffs and diets for mink is under development.
The method focuses primarily on the digestibility of protein and carbohydrates, and aim to include dietary factors that contribute to endogenous losses of protein. In the early phase of the development, enzyme activities of pancreatic enzymes from the mink pancreas and from commercially available porcine pancreatin were compared. The activities of the two main proteases trypsin and chymotrypsin were equivalent after activation of the proenzymes in the mink pancreas homogenate. However, the activity of α-amylase was, as expected, much higher (about 30 fold) in the porcine pancreatin than in the mink pancreas homogenate. The developed in vitro method involves an initial incubation with porcine pepsin for one hour followed by incubation with porcine pancreatin, where the incubation time for determination of hydrolysed starch and protein are different based on the differences in capability between mink and pigs to digest starch and protein, respectively. A large number of different batches of various feedstuffs are tested by the developed in vitro method and correlated to their in vivo digestibility. Based on these results, an equation between chemical composition, in vitro digestibility and in vivo mink digestibility, respectively, will be determined for the final method.

The influence of the biological and hygienic quality of raw-materials and mink feed on the health status of the mink

M. Lassén

The quality of feed has a great influence on the health condition of the mink. It is known, that fur animal feed of a poor microbiological quality results in a poorer health condition. The main ingredients in Danish fur animal feed are primarily by-products from the production of food ingredients. These by-products must be treated and handled correctly in each stage of the production otherwise they will be spoiled. Decomposition or putrefaction of feed can be caused by micro-organisms (bacteria and fungi) or by enzymes. Both the micro-organisms and the enzymes mainly come from the natural content in the animals yielding the raw material and thus are necessary elements in living organisms, that simply continue to function after the animals death. They have adapted to the conditions in the raw material and consequently have the best conditions for their activity, when the external environment, temperature, water activity, pH, redox potential, etc. lies close to that to which they are accustomed. Raw materials are often heavily contaminated with spoilage bacteria. Many of these spoilage bacteria in fishery by-products have both proteolytic and lipolytic activity at very low temperatures (between 0°C and +10°C).

When fat is broken down, triglycerides first split into glycerine and free fatty acids. The most important change of the fat molecule is the chemical oxidation of unsaturated fatty acids, also called fat rancidity. Rancid fat is characterised by a yellow colour and a characteristic smell and taste. Fur

animals are very susceptible for rancid fat, and rancid fat should never be feed to fur animals. Adding large amounts of vitamin-E cannot prevent the negative effects of rancid fat. When proteins decompose, the first breakdown products are amino acids, subsequently these can be broken down into other nitrogenous compounds, that, at best, cannot be used by the mink, and, at worst, have a harmful effect. The protein quality is measured by determining the total content of free nitrogen (TVN). Thus the TVN-content tells us how much of the protein has been degraded to compounds, that the mink cannot use as free amino acids, it does not tell us anything about its chemical form. A very large TVN will result in a reduced palatability of the feed, resulting in a reduced feed intake and a reduced growth and a poorer fur quality.
It would, however, be much more useful to analyse the content of biogenic amines in the feed in relation to determination of protein quality. The analysis of biogenic amines tells us a lot more about the compounds created during degradation of protein and amino acids.

Occasionally the feed may also be contaminated with pathogenic bacteria. While spoilage bacteria do not cause other symptoms of disease, than diarrhoea and reduced growth, pathogenic bacteria often causes haemorrhaging diarrhoea and death. A feed related poisoning is often characterised by a sporadically high mortality, while a feed disturbance caused by spoiled feed is characterised by a reduced feed intake and reduced growth. On a long termed basis spoilage bacteria will eventually also cause deaths among the animals. Pathogenic bacteria that occasionally occur in fur animal feed is primarily Salmonella spp., Clostridium botulinum, Staphylococcus aureus, E. coli and Camphylobacter jejunum. Finally, toxins, produced by bacteria or fungi can also cause deaths among fur animals.

The biological quality of the raw material is also very important. In protein rich raw materials, the nutritional value is influenced by the amino acid content and the relationship between the amino acids. Also the ash content is important for the nutritional value. Some of the proteins derived from vegetable products, like peas and soybeans contain antitrypsines, which also lower the biological value of the raw material. These products need to be heat treated, which also may lower the digestibility of the product. Many slaughterhouse by-products also have to be autoclaved, because of the high content of micro-organisms. This will prevent outbreaks of sickness among the animals, but it will also reduce the digestibility of the raw material. Finally, the palatability of the raw material and the feed is important for the animal.

Energy consumption in the lactation period

B. Krogh Hansen

Consumption of metabolizable energy (ME) was studied in lactating scanblack mink in the period from 1991 to 1994. The objectives were to describe the daily ME consumption and to evaluate the factors that influence it. The factors included were dam age, dam body weight, litter size and litter weight. The daily consumption was recorded from 72 dams in 85 lactations. Dam body weights were recorded every week and for each dam exactly on days 14, 28 and 42 post partum. Kit body weights were recorded at parturition, and at days 14, 28 and 42 post partum. Between the first and the third week (day 23 post partum), there was a steady increase in daily ME consumption of 33 kJ per day. From day 23 to 42 post partum the increase in daily ME consumption was 73 kJ per day. ME consumption of adult dams was lower than that of yearlings. Litter weight had more influence on dam ME consumption than the number of kits. The results imply that in the lactation period heavy demand is put on the mink dam. Despite the increase in ME consumption during lactation, the dams lose weight, which indicates that they mobilize body reserves, especially in the late part of lactation.

Reduce protein to lactating mink!

R. Fink, A.-H. Tauson, C. F. Børsting

The objective of the present investigations was to study the effects of different dietary protein, fat and carbohydrate supply on glucose homeostasis, energy metabolism and milk production of the lactating mink. Glucose homeostasis was measured in 18 catheterised dams nursing 6 kits four weeks post partum by means of blood samples drawn 5 and 10 min. before feeding and 30, 60, 90, 120, 125, 130, 140, 150, 165 and 180 min. postprandially. The dams were fed ad libitum from parturition on diets

with different ratios of metabolisable energy (ME) derived from protein:fat:carbohydrate (61:37:2, 46:37:17 and 31:37:32). Energy metabolism and milk production were measured in 12 dams nursing 6 kits, and fed ad libitum with different ratios of ME derived from protein:fat:carbohydrates (58:34:8, 47:38:15 and 39:35:26). Energy metabolism was measured by means of balance and respiration experiments, and milk production by means of the water isotope dilution technique. The main findings were the following: 1) Lactating mink are capable of utilising high amounts of digestible dietary carbohydrates, and 32% of ME derived from carbohydrates does not result in critically elevated plasma glucose levels. 2) Dams fed the low protein diet (39:35:26) had lower heat production, oxidised less protein and had a higher milk production during weeks three and four of lactation, and a higher kit live weight four weeks post partum, than dams fed the high protein diet (58:34:8). It was concluded that there is a considerable potential to reduce the protein and increase the carbohydrate supply to lactating mink with positive effects on animal performance, energy utilisation, milk production and preweaning kit growth, and with beneficial effects for the environment.

Protein requirement to mink kits in the growing-furring period

B. M. Damgaard, T. N. Clausen

The mink is a carnivorous animal and has a relative high protein requirement. In nature, the mink prefers fresh carcasses and a typical commercial mink diet has a high content of protein, a variable content of fat and a low content of carbohydrates. The mink has a simple digestive tract and anatomical and physiological development of the digestive tract take place from birth until 10-11 weeks of age. The digestibility of protein is lower for mink kits in the early growth phases compared to adult mink. During recent decades there has been a general desire to minimise the nitrogen emission from animal production systems. Investigations have shown that the protein requirement of mink kits is higher in the early growth phases than in the later growth phases. Therefore, it has been possible to reduce the dietary protein content to mink kits in September - October without effects on growth performance and fur quality. The interaction between protein, fat and carbohydrates in growing mink kits are very complex. Investigations including protein quality, digestibility and amino acid composition are needed in estimating the protein requirement in growing mink kits. In the years to come research including the effects of the dietary composition and the feeding strategies on mink kit performance and health as well as on the environment are needed in optimising the mink production.

Variations in dietary protein levels influence hair growth and pelt quality in mink

P. V. Rasmussen, C. F. Børsting

The effect of different and shifting dietary protein levels on hair growth and the resulting pelt quality in mink was studied. Two groups of pastel female mink were fed either 59% (high protein, HP) or 40% (low protein, LP) of metabolisable energy (ME) from protein during pregnancy and lactation. Shortly after weaning, kits from females fed the LP diet were put on a new LP diet (21% protein of ME). Kits from females fed HP were randomly distributed to four experimental groups fed a new HP diet (34% protein of ME) and three of these groups were shifted to diets with 21% protein at different moments during June until September. Histological techniques and computer-assisted light microscopy were used to determine the ratio of activity (ROA) of wool hairs and guard hairs, respectively, defined as the number of growing hairs in per cent of the total number of hairs. Skin samples represented kits 4, 6, 23, and 29 weeks of age. The hair fibre length and thickness in pelts were determined by morphometric methods.

It was found that 40% of ME from protein during pregnancy and lactation was sufficient for mink kits to express their genetic capacity to produce hair follicles. In males, a reduced protein level from the age of 15 weeks or 22 weeks and until pelting disturbed moulting, indicated by a low ROA of underfur hairs at 23 weeks, and consequently reduced the growth and development of the winter coat. A constantly low protein level from conception until the age of 29 weeks did not disturb moulting, but led to a reduction of primeness and especially of length and thickness of wool hairs in the winter coat. Hair growth, final fur volume, and general quality of the winter coat of males were influenced

negatively and to the same degree in all groups fed the LP diet in the whole part or in various parts of the growth period. The number of wool hairs per area (hair density) of the winter coat was not influenced by the dietary treatment meaning that the protein content of 21% of ME in the LP diet was high enough for the mink to express its genetic capacity to develop hair follicles. However, this low protein content led to a reduction of length and thickness of the wool hairs.

Overall, this study demonstrated that hair growth and hair properties in pelts are very dependent on the dietary protein supply in the period from 22 weeks of age until pelting, irrespective of the supply in the preceding periods.

Feeding and drinking behaviour in mink: correlations between feed intake and stereotypies and activity parameters

S. W. Hansen, E. L. Decker

When fed ad libitum, no distinct circadian rhythm as regards the mink's feeding behaviour can be observed; the animal feeds at all hours. Each meal lasts on average just under 4 minutes, and the mean interval between each meal is two-three hours with wide individual variations. In contrast to the mink's feeding behaviour, its drinking behaviour clearly has a circadian rhythm. After midnight, the time spent at the drinking nipple increases, peaks at approximately 8 a.m. when the animal is fed, and decreases during the morning. At hours of increased drinking activity, there are marked variations in the time spent drinking, indicating that some – but not all – animals increase their drinking activity. The fact that previous studies have demonstrated that the animals' locomotive activity is at a maximum at night may be a reason for this increase in the time spent drinking.
When fed restrictively, the locomotive activity is synchronised at the time of feeding, and the incidence of stereotypies is increased markedly. The increased incidence of stereotypies results in increased energy demands, and thus a vicious circle develops. Stereotypies may possibly be of compensatory importance to the individual animal. Thus, they may indicate that the housing or the management routines are not optimal.

Feeding routines and feeding management in relation to energy requirement of the mink

S. H. Møller

Abstract
The mink production is characterised by an annual production cycle that all mink follow within a few weeks' variation in e.g. mating, gestation, weaning and pelting. The periods differ in relation to feeding routines and the minks energy demand and thus in need for control of the feed allowance.
In the winter period from December to February the control includes the choice of strategy for weight development and the fulfilment of the strategy in terms of feeding, weighing and evaluation of body condition. Many farmers apply a flushing strategy where females are fed a restricted amount of energy prior to the mating period. From approximately 5 days before mating and during the mating period, the mink are flushed by ad libitum feeding. Without becoming obese during pregnancy the minks need for nutrients for building of foster and mammary gland tissue should be fulfilled. In the lactation period the females are fed almost ad libitum but the variation in their need is larger than usual, due to variation in date of birth as well as litter size. When the kits begin to eat at four weeks of age, the feed should be placed within reach of the kits. During the growth period from weaning to pelting the mink kits are feed almost ad libitum. During the annual production cycle feeding management is alternating between restrictive and ad libitum feeding combined with handling of different levels of individual variation between the animals. The need for, the scope of as well as the methods used in feeding management differ between the different production periods. The same is true regarding the consequences for the production result, health and welfare of the mink if feeding management is not optimal. The aim of the presentation is to discuss the aim, the means and the consequences of management of the energy allowance in relation to production result, animal welfare and the environment.

Ammonia emission and nitrogen balances in mink houses

S. Pedersen

Due to a high protein content in mink feed and heavy natural ventilation in open mink houses, the potential for ammonia emission is high. In respect to getting more information on ammonia emission, experiments were therefore initiated in the early summer of 1999 in a two-row house and carried out during the growing seasons of 1999 and 2000 for different manure handling methods. In respect to measurement of ammonia emissions, which are the product of ammonia concentration and ventilation flow, a "tent" was placed around the experimental house. The emission was measured for a house with 385 mm wide slurry gutters placed below cages opposite the nest. The first year, the floor below the cages consisted of a layer of sand, and the second year, it consisted of a layer of straw. The examined parameters were the days between the slurry gutter emptyings and the intervals between the manure and straw removals from the floor beside the slurry gutters.

For slurry removed daily in houses with slurry gutters and sand floors, the ammonia emission rates were 0.44 g N/animal/24 hours at 6oC and 0.62 g N/animal/24 hours at 16oC. For slurry removed weekly in houses with slurry gutters and sand floors, the ammonia emission rates were 0.59 g N/animal/24 hours at 6oC and 1.15 g N/animal/24 hours at 16oC. By covering the ground below the cages with a layer of chopped barley straw, the nitrogen loss increased with the time since the latest renewal of straw. After one week where the slurry gutters were emptied weekly, the emission amounted to 0.70 g N/animal/24 hours at 6oC and 1.44 g N/animal/24 hours at 16oC.

Nitrogen balance measurements were carried out over nine weeks in three sections. Where a layer of chopped barley straw on the floor below the cages was renewed once a week, about 45% of the nitrogen in the consumed feed was collected from the slurry gutter by emptying the gutter twice a week. About 19% was collected from straw beneath the cages, about 5.5% was deposited in the carcass, about 20% evaporated, and the rest, about 11%, was assumed to be collected from the sand floor below the cages.

Excretion of nutrients from mink and effects on the environment

C. F. Børsting, S. H. Møller

The normative for nutrient excretion from mink ex. animal have been revised based on information about feed intake and feed composition for the total Danish production of mink. However, the revised values for N intake based on this exact information showed that N excretion ex. animal per breeding female mink and per skin did not deviate from previous values, even if those values were calculated from only a small sub sample of the Danish production. Contrary, the excretion ex. storage of N, P and K were all changed due to changes in the values for losses from the mink sheds. Compared to the previous standards, the production of N and P ex. storage is higher for mink kept in sheds with manure gutters under the cages, whereas the new standards are lower than before for sheds without manure gutters.

The ammonia losses from all mink sheds is estimated at 3.600 tonnes for year 1999 equivalent to 6% of the annual ammonia losses from the total Danish animal production. However, these losses from mink sheds are estimated with a large uncertainty. Mink slurry collected in manure gutters has a very high content of P per animal unit (1 animal unit is equal to the number of animals yielding 100 kg N in manure ex. storage), which due to future legislation, may lead to a demand for larger areas for spreading the manure.

In order to reduce the environmental impact of mink production it is important to develop tools to reduce dietary content of protein and P in the feed. Furthermore, it is important to develop better systems for faeces and especially for urine collection in mink sheds, and these systems must be able to reduce both nutrient leakage under the sheds and evaporation of ammonia.

Nutrient content ex. storage per breeding female mink (including 5.36 kits produced) in sheds with and without manure gutters.

		Nutrients ex. storage		
Type of shed	Type of manure	Kg N	Kg P	Kg K
With manure gutters	Slurry	2,27	1,03	0,61
Without manure gutters	Solid manure	0,88	0,58	0,16

Environmental restrictions! - possible adjustments?

P. Sandbøl

There is an increasing public interest and concern for nutrient loads of the environment. Two action plans concerning the water reservoir have been introduced and the government has initiated plans for reduction of the ammonia load from the agricultural production.

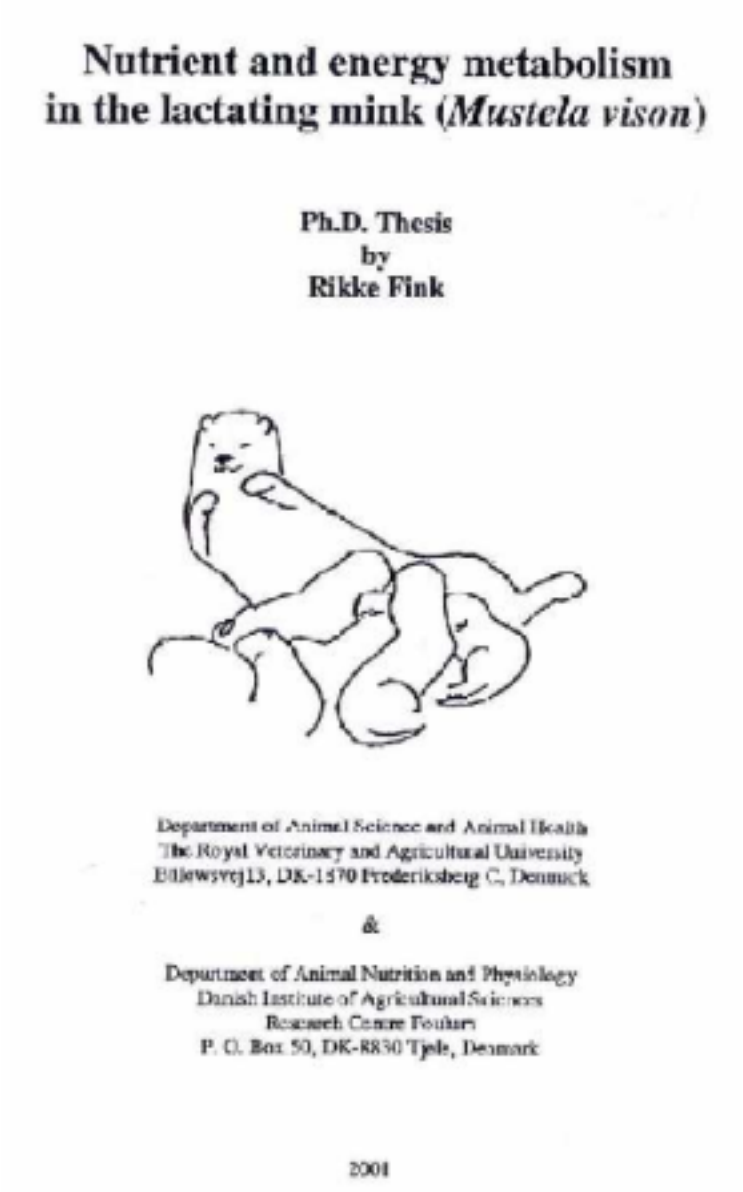
The total nitrogen load from the Danish mink production has been calculated to be 7.000 tons, of which 2.400 - 4.700 tons is ammonia. By use of slurry gutter the load should be reduced to 5.400 tons and ammonia 2.500 - 3.400 tons. By daily cleaning of the slurry gutter, the total load should be reduce to 4.300 - 4.700 tons and that of ammonia 1.800 - 2.400.

The mink is a carnivore and basically uses a certain amount of amino acids for energy production via the gluconeogenesis. About 80 % of of the nitrogen excretion from mink is via the urine. The most important nitrogen compound of mink urine is urea, which is easily converted to ammonia. Various trials with different protein contents in mink diets, during the production cycle, have shown that it should be possible to lower the protein content of the feed. This requires and optimal amino acid balance of the feed and a good biological value of the protein. If these criteria can be met, it should be possible to reduce the nitrogen load from the Danish minkroduction with about 2.000 tons annually.

Detailed research into the minks' requirement for protein/amino acids will be needed, if a further reduction shall be reached.

New doctor in fur animal nutrition

Rikke Fink has defended her Ph.D. thesis at the Royal Veterinary and Agricultural University, Copenhagen, Denmark on July 6th 2001



Nutrient and energy metabolism in the lactating mink (*Mustela vison*)

Ph.D. Thesis
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2001

The objective of the present investigations was to study the effects of different dietary protein, fat and carbohydrate supply on glucose metabolism, energy metabolism and milk production of the lactating mink. Glucose homeostasis and metabolism were measured in a total of 36 catheterised dams nursing 6 kits four weeks post partum by means of frequent blood sampling, and by administration of a single dose of U-'4C and 2-~ labelled glucose two hours postprandially. The blood samples were drawn 5 and 10 mm. before feeding and 30, 60, 90, 120, 125, 130, 140, 150, 165 and ISO miii. postprandially. The dams were fed ad libitum from parturition on diets with different ratios of urtabolisable energy (ME) derived from protein:fat:carbohydrate (61:37:2, 46:37:17, 31:37:32, 61:38:1, 47:52:1, 33:66:1). Energy metabolism and milk production were measured in 12 dams nursing 3, 6 or 9 kits, fed ad libitum on a conventional wet Danish lactation period diet (55:33:12). and in 12 darns nursing 6 kits, and fed ad libitum with different ratios of ME derived from protein:fat:carbohydrates (58:34:8,47:38:15,39:35:26). Energy metabolism was measured by means of balance and respiration experiments, and milk production by means of the water isotope dilution technique. The main findings were the following: 1) Lactating mink are capable of utiisung high amounts of digestible dietary carbohydrates, and 30% of ME derived from carbohydrates does not result in critically elevated plasma glucose levels. 2) Lactating mink are capable of synthesising sufficient amount of glucose even when fed carbohydrate free diets, however, then they are depending on the availability of sufficient gluconeogenic precursors in the form of amino acids. 3) Four weeks post partum dams nursing 9 kits did not produce more milk than dams nursing 6 kits, indicating a maximum capacity for milk production in mink dams and that milk production limits the growth rate of kits raised in large litters. 4) Dams fed the low protein diet (39:35:26) had lower heat production, oxidised less protein and had a higher milk production during weeks three and four of lactation, and a higher kit live weight four weeks post partum, than dams fed the high protein diet (58:34:8).

It was concluded that there is a considerable potential to reduce the protein and increase the carbohydrate supply to lactating mink dams with positive effects on animal performance, energy utilisation and with beneficial effects for the environment.

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