ACTA SCIENTIARUM POLONORUM

Acta Sci. Pol. Zootechnica 21(3) 2022, 19–24

www.asp.zut.edu.pl pISSN 1644-0714 eISSN 2300-6145 DOI:10.21005/asp.2022.21.3.03

ORIGINAL PAPER

Received: 23.07.2022
Accepted: 28.09.2022

NURSING OF MINK IN NEST BOXES INSULATED WITH DIFFERENT MATERIALS

Lidia Felska-Błaszczyk, Natalia Ławrów

Department of Animal Anatomy and Zoology, West Pomeranian University of Technology in Szczecin, Klemensa Janickiego 33, 71-270 Szczecin, Poland

ABSTRACT

The aim of this study was to compare the rearing of mink in nests insulated with different materials. The study was conducted on a large-scale mink farm located in northwestern Poland. The results of rearing mink from 144 females of the pearl variety, aged one and two years, were analyzed. Four groups were created, taking into account the type of nest lining material and the age of the females. Two weeks prior to the scheduled birth, the nesting houses were lined with two types of insulating material – sawdust from deciduous trees and a mixture of barley straw and hay from meadow vegetation. Data were collected on: the number of born and live-born cubs per litter, the number of reared mink per litter, and the mortality of mink during the rearing period at the mothers. It was found that the material with which mink nests are insulated has an effect on the number of born, live-born and weaned mink. Better reproductive results were reported for females whose nests were insulated with barley straw mixed with meadow hay. They gave birth to larger litters, with more live mink, and raised more young. The mortality rate of young mink was lower in nests insulated with a mixture of straw and hay. The results showed that the use of sawdust as a nest insulating material is associated with a lower survival rate of reared mink. The study shows that the choice of a suitable nest insulating material can favorably affect the number of reared young mink.

Key words: mink, insulating material, reproductive performance, perinatal mortality

INTRODUCTION

Of the fur-bearing animals farmed in Poland, the American mink is the most important species. The intensification of production has entailed the need to intensify work related to improving welfare for this animal, in order to obtain healthy animals with beautiful and dense fur. As Brzozowski [2018] points out, issues related to improving the welfare conditions of livestock are currently one of the most important topics of discussion in various EU member states, in order to develop the best regulations for the husbandry of livestock.

Selection of the best animals for the breeding stock has led to an increase in the fertility of the farmed mink. Females often give birth to litters of more than 7 young. The farmers have noticed that obtaining large litters is no longer a problem; the difficulty is to create such conditions that the whole litter may survive until weaning.

Mink belong to the typical nesters (atricial species), which means that the kits stay in the nesting boxes (nests) after birth, and the conditions there have a significant impact on their health [Brzozowski 2018]. The mortality rate of young mink during the period of maternal nursing ranges from 13 to as much as 27% [Lagerkvist et al. 1994], and the highest mortality is recorded in the first week after birth [Felska-Błaszczyk 2021]. The survival rate of the young is determined by many factors, including color variety, age of the mother, and litter size [Socha and Kołodziejczyk 2006, Kołodziejczyk and Socha 2012]. Schou and Malmkvist [2017] and Seremak et al. [2013] found that litters that were too numerous had a higher mortality rate than litters that were less numerous, which was due to the fact that pups in larger litters (more than 9 young) are much smaller and the mother has limited feeding capacity. Due to the fact that mink are born naked, blind and deaf, weighing about

lidia.felska-blaszczyk@zut.edu.pl

9–12 grams, especially during the early stages of mink rearing, maintaining an adequate nest temperature is a problem, as mink do not have a developed thermoregulatory mechanism and are prone to rapid hypothermia due to their relatively large body surface area relative to volume [Brown and Lasiewski 1972, Harri et al. 1991, Castella and Malmkvist 2008]. According to Tauson et al. [2006] the thermal comfort zone in a mink nest during the first days of life should be in the range of 25 to 30°C. Therefore, when the nest is poorly protected from the cold, large losses of the offspring can occur.

The thermoregulation of baby minks develops gradually and depends primarily on their body weight, nest isolation and maternal behavior [Rouvinen-Watt and Harri 2001]. Their survival strategy is based on their ability to withstand hypothermia and adequate nutrition and heat provided by their mother. Functional homeopathy is not developed by young mink until they are about 6 weeks old [Tauson et al. 2006]. Until then, maternal care plays a key role in mink survival. If the female is away from the nest for too long, the young are unable to maintain a high temperature, increasing their risk of death from hypothermia and starvation [Martino and Villar 1990, Harjunpää and Rouvinen-Watt 2004, Tauson et al. 2006].

The American mink is a monoestrous species, and their mating period is in March; the parturition period is late April and early May. The female gives birth to the mink in brooding houses, in which special wire inserts are installed before the mating period, and the whole is insulated with various insulating materials. Under the climatic conditions of Poland, very cold nights, with temperatures below 3°C in both April and May, occur frequently, resulting in large losses of the offspring, especially in the first days of the mink's life [Malmkvist et al. 2007]. Therefore, in order to ensure optimal conditions for the birth and rearing of young mink, the animals are provided with properly constructed and protected cages. Female breeding mink begin nest-building from January until the birthing season begins in April [Malmkvist and Palme 2015, Schou and Malmkvist 2018, Schou et al. 2018]. Nest-building by females before parturition largely depends on the temperature outside. During winter and early spring, when it is cold outside, females are more motivated to build. As the temperature rises (up to about 25°C), mink become less engaged in nest building, moreover, they stay in the nest with their young for a shorter period of time. This suggests that temperature is an important factor influencing maternal instinct and female behavior [Schou and Malmkvist 2018, Schou et al. 2018].

Mink breeders use, among other things, straw (e.g., barley straw, oat straw), wood shavings (sawdust), hay, and even sheep and rabbit wool for nest box padding. A common criterion for choosing an insulating material is not quality but price, which means that the chosen material does not always adequately fulfill its role. Adequate insulating material in nests during rearing of young is crucial for litter survival [Malmkvist and Palme 2008, Malmkvist et al. 2016].

The purpose of this study was to evaluate the effect of insulating materials on litter size and weaning rates of mink in the first days after birth.

MATERIAL AND METHODS

Description of animal housing conditions

The study was conducted on a large-scale mink farm located in northwestern Poland in 2020. The mink of the core stock were kept in double-row universal pavilions, which were positioned with the longitudinal axis in the north-south direction. The animals were fed ready-made feed supplied by an external company. The feed mainly consisted of chicken and fish waste, and had a semi-liquid consistency. This allowed it to be applied directly to the top of the cages. Thanks to nipple drinkers installed in the animal cages, access to fresh water was possible without restriction.

The experiment

The reproductive results of 144 pearl variety females aged one and two years were analyzed, and they were divided into 4 groups, taking into account the type of nest lining material and the age of the females. Two weeks before the scheduled mating, the nest houses were lined with two types of insulating material: sawdust from deciduous trees and a mixture of barley straw and hay from meadow vegetation. The females were divided into the following groups:

Group 1 40 female breeding mink aged 1 year, whose nests were lined with sawdust from deciduous trees,

Group 2 30 female breeding mink aged 2 years, whose nests were littered with sawdust from deciduous trees,

Group 3 35 female breeding mink aged 1 year, whose insulating material in the nests was a mixture of barley straw and hay from meadow vegetation,

Group 4 39 females aged 2 years, whose insulating material in the nests was a mixture of barley straw and hay from meadow vegetation.

On the second day after parturition, litter sizes were determined during the the first nest inspection. Throughout the period of the maternal nursing, litters were inspected daily to document the mortality of young mink. The following parameters were analyzed:

(a) litter size,
(b) the number of live-born mink per litter,

(c) number of reared mink per litter,

(d) mortality of young mink during the rearing period.

The sets of collected data were statistically analyzed using STATISTICA 13.3. Arithmetic mean (m), standard deviation (SD) were used for statistical analysis. Tukey's parametric RIR test for unequal group sizes and two-factor analysis of variance (ANOVA) were used to determine the significance of differences between the means of individual reproductive indices. This analysis was based on the following linear model:

$$Y_{jk} = \mu + o_j + p_k + e_{jk}$$

where:

Y_{jk} – trait level,
μ – overall mean number of the trait,
o_j – effect of female's age,
p_k – effect of the nest insulating material,
e_{jk} – random error.

RESULTS AND DISCUSSION

Table 1 shows the obtained numbers of born, live-born and the number of reared mink in nests insulated with sawdust from deciduous trees or a mixture of barley straw and meadow hay. Statistically significant differences at $P \leq 0.05$ were recorded between groups of animals from nests insulated with a mixture of straw and hay and those insulated with sawdust, and in both one-year-old and two-year-old females. The results in Table 1 clearly show that nests insulated with a mixture of straw and meadow hay had a positive effect on the analyzed indicators – litter size, the number of live-born young per litter, as well as the number of reared young per litter were higher in nests insulated with a mixture of straw and hay compared to nests insulated with sawdust. Two-year-old females had better reproductive performance than one-year-old females, but this was not statistically confirmed.

Malmkvist and Palme [2008] also compared different materials used to insulate mink nests – barley straw, plastic artificial nests and a combination of a plastic artificial nest with access to barley straw. They found that it was this combination that was most effective, increasing cub survival and reducing maternal stress after birth. They also noted that access to straw for nesting resulted in less variability in the timing of births of the mink, that is, individual young in a litter were born at similar intervals.

The mortality rate of young mink during the rearing period (Table 2) was significantly lower when using barley straw and hay as insulating material (10.86%), while the use of sawdust resulted in a mortality rate of 16.26%. It was also found that young from two-year-old females had a lower mortality rate than those from one-year-old females, and by more than 5% regardless of the nest insulating material used. Śliwińska [2017] also observed that biennial females had higher reproductive efficiency regardless of the type of bedding material. However, in our study, we found that when a mixture of barley straw and meadow hay was used, mortality of young was reduced by more than half in young from two-year-old females, compared to young born to one-year-old females. When nests were isolated with sawdust, mortality of young was equally high in one-year-old and two-year-old females.

Sønderup et al. [2009] found that wheat straw was superior to barley straw and wood shavings when it came to increasing the survival rate of young in nests. Slightly different results were obtained by Cambell et al. [2017], who used oat straw and wood sawdust as nest warming material. These authors found no differences in the survival of young voles depending on the nest insulating material used. However, they noted that wood sawdust influenced higher dusting in the nest box compared to straw.

Table 1. Statistical characteristics of the number of born, live-born and weaned mink from nest boxes insulated with different materials

Trait	Material	Female age					
		1 year		2 years		total	
		Mean	SD	Mean	SD	Mean	SD
Litter size	sawdust	6.94[a]	2.03	6.61[a]	1.72	6.86	1.95
	straw and hay	7.56[a]	1.79	7.72[a]	2.75	7.65	2.35
	total	7.19	1.95	7.38	2.52	7.26	2.19
Live-born young per litter	sawdust	6.31[b]	2.30	6.39[b]	1.72	6.33	2.15
	straw and hay	7.16[b]	1.90	7.07[b]	2.07	7.16	1.97
	total	6.69	2.19	6.86	1.98	6.76	2.10
Weaned young per litter	sawdust	5.42[c]	2.15	5.50[c]	2.18	5.44	2.14
	straw and hay	6.36[c]	2.45	6.57[c]	2.25	6.48	2.33
	total	5.79	2.30	6.24	2.27	5.97	2.29

a, b, c… means in columns marked with the same letters are significantly different at $P \leq 0.05$.

Table 2. Statistical characteristics of mortality of young from nests insulated with different materials

Material	Female age		total
	1 year	2 years	
Sawdust	16.24	16.31	16.26
Straw and hay	15.04	7.30	10.86
Total	15.77	10.09	13.48

Slightly different conclusions were drawn by Lund and Malmkvist [2012], who found that the mortality of young in the first week after parturition is influenced not so much by the type of material used to insulate nests, but by the availability of several types of material. The authors found that mink that had a greater number of building materials to choose from during the prepartum period had a lower rate of cub mortality than females with access to only one material, which was barley straw. They also collected data on nest microclimate and observed that females with access to three materials had slightly higher nest temperatures and lower relative humidity than females with access to only one insulating material.

Schou and Malmkvist [2017], on the other hand, believe that it is not only the type of nest insulation material used that is important, but also its texture, most importantly its length, as females do not transfer materials too finely cut from the cage to the nest. In another study, Malmkvist and Palme [2015] observed that it is the composition of the litter that has a significant impact on the development and survival of the young, and found that females with large litters were less successful at caring than females with small litters. This was confirmed in another study by Schou and Malmkvist [2017], who noted that success in rearing young is primarily influenced by litter size.

The first period of a mink's life is the most difficult, and its mortality rate during this time is the highest. The cubs need adequate nest temperature and maternal care during this period. Lack of hair cover, an immature thermoregulatory system and insufficient maternal care affect the onset of hypothermia in the young, which can eventually lead to their death. A good and warm nest, is an essential element when the mother is away from the nest. Therefore, the choice of suitable nest bedding material can favorably increase the efficiency of survival of mink on breeding farms and reduce the economic losses incurred in the purchase of bedding. Straw is a readily available and inexpensive material, and its use has a positive effect on the rearing of mink, as confirmed by the above studies.

CONCLUSION

The analysis revealed that the material with which mink nests are insulated has an effect on the number of mink born, live-born and weaned. Better reproductive results were recorded in females whose nests were insulated with barley straw mixed with meadow hay. They gave birth to larger litters, with more live mink, and reared more young. The mortality rate of young mink was lower in nests insulated with a mixture of straw and hay. The results showed that the use of sawdust as a nest insulating material is associated with a lower survival rate of reared mink, The study shows that the choice of an appropriate nest insulating material and its size can favorably affect the number of reared young mink.

ACKNOWLEDGEMENT

The study was financed from the funds allocated to maintenance of the research potential of the research units.

REFERENCES

Brown, J.H., Lasiewski, R.C. (1972). Metabolism of weasels: the cost of being long and thin. Ecology, 53(5), 939–943. DOI: 10.2307/1934312.

Brzozowski, M. (2018). The conditions of housing young mink with their mothers as a crucial contributing factor influencing the results of reproductive efficiency in relations to the requirements of the fur animal welfare assessment protocol. Pol. J. Natur. Sc., 33(3), 355–367.

Cambell, D.L.M., Lester-Seanz, A.H., Link, J.E., Bursian, S.J. (2017). Comparison of wood shavings and chopped straw as bedding material for fur-farmed American mink (*Neovison vison*). Can. J. Anim. Sci., 97(1), 10–13. DOI: 10.1139/CJAS-2016-0098.

Castella, A., Malmkvist, J. (2008). The effect of heat incubators on chilled mink kits. App. Anim. Behav. Sci., 113, 265–269. DOI: 10.1016/j.applanim.2007.11.009.

Felska-Błaszczyk, L. (2021). Environmental and genetic factors influencing the rearing performance in mink (*Neovison vison*). Acta Sci. Pol. Zootechnica, 20(3), 5–14. DOI: 10.21005/asp.2021.20.3.01.

Harjunpää, S., Rouvinen-Watt, K. (2004). The development of homeothermy in mink (*Mustela vison*). Comp. Biochem. Physiol. A Mol. Integr. Physiol., 137(2), 339–348. DOI: 10.1016/j.cbpb.2003.10.015.

Harri, M., Mononen, J., Haapanen, K., Korhonen, H. (1991). Postnatal changes in hypothermic response in farmborn blue foxes and raccoon dogs. J. Therm. Biol., 16, 71–76. DOI: 10.1016/0306-4565(91)90001-I.

Kołodziejczyk, D., Socha, S. (2012). Mink fertility of palomino colour type and its crossbreeds with different percentages

of standard mink genes. Acta Sci. Pol. Zootechnica, 11(4), 53–60.

Lagerkvist, G., Johansson, K., Lundeheim, N. (1994). Selection for litter size, body weight and pelt quality in mink (*Mustela vison*): correlated responses. J. Anim. Sci., 72, 1126- 1137. DOI: 10.2527/1994.7251126x.

Lund, V.H., Malmkvist, J. (2012). Influence of nest box environment on tits survival. Scientifur, 36, 78–83. DOI: 10.3920/978-90-8686-760-8_9.

Malmkvist, J., Palme, R. (2008). Periparturient nest building: implications for parturition, kit survival, maternal stress and behaviour in farmed mink (*Mustela vison*). Appl. Anim. Behav. Sci., 114, 270–283. DOI: 10.1016/j.applanim.2008.01.018.

Malmkvist, J., Palme, R. (2015). Early transfer of mated females into the maternity unit reduces stress and increases maternal care in farm mink. Appl. Anim. Behav. Sci., 167, 56–64. DOI: 10.1016/j.applanim.2015.03.009.

Malmkvist, J., Gade, M., Damm, B.I. (2007). Parturient behaviour in farmed mink (*Mustela vison*) in relation to early kit mortality. Appl. Anim. Behav. Sci., 107 (1–2), 120–132. DOI: 10.1016/j.applanim.2006.09.018.

Malmkvist, J., Schou, T.M., Møller, S.H., Hansen, S.W. (2016). Mink behaviour, reproduction and welfare is influenced by nest box material and access to additional drinking nipples in the maternity unit. Proceedings of the Xth International Congress in fur animal production. Scientifur, 40(3/4), 351–354.

Martino, P.E., Villar, J.A. (1990). A survey on perinatal mortality in young mink. Vet. Res. Commun., 14, 199–205. DOI: 10.1007/BF00347738.

Rouvinen-Watt, K., Harri, M. (2001). Observations on thermoregulatory ontogeny of mink (*Mustela vison*). J. Therm. Biol., 26, 9–14. DOI: 10.1016/S0306-4565(00)00018-8.

Schou, T.M., Malmkvist, J. (2017). Early kit mortality and growth in farmed mink are affected by litter size rather than nest climate. Animal, 11(9), 1581–1589. DOI: 10.1017/S1751731117000234.

Schou, T.M., Malmkvist, J. (2018). Maternal nest building and choice of nest site are temperature dependent in mink: Parent-offspring temperature conflict? Appl. Anim. Behav. Sci., 209, 88–98. DOI: 10.1016/j.applanim.2018.09.002.

Schou, T.M., Palme, R., Malmkvist, J. (2018). Prolonged nest building increase the reproductive outcome in American female mink. Appl. Anim. Behav. Sci., 207, 98–107. DOI: 10.1016/j.applanim.2018.07.005.

Seremak, B., Felska-Błaszczyk, L., Dworecka, M., Dziadosz-Styś, M., Lasota, B. (2013). Analysis of litter sizes at birth and at 7 days of nursing in mink (*Neovison vison*) of black velvet, Hedlung white, and silverblue color types. Acta Sci. Pol., Zootechnica, 12(2), 39–48.

Socha, S., Kołodziejczyk, D. (2006). Analiza czynników wpływających na plenność samic norek standardowych i palomino [Analysis of factors affecting the fertility of female standard and palomino minks]. Ann. Univ. Mariae Curie-Skłodowska, Ser. EE: Zootechnica, 24, 403–408 [in Polish].

Sønderup, M., Bækgaard, H., Larsen, P.F., Clausen, T. (2009). Importance of nest box size and material, for litter size – a pilot study. NJF-Seminar No. 427, Vaasa, Finland, 13–15 October 2009. Scientifur, 33, 103.

Śliwińska, D. (2017). Wpływ materiału wyścielającego na wyniki rozrodu norki amerykańskiej [Effect of bedding material on reproductive performance of American mink]. MA Thesis, SGGW [in Polish].

Tauson, A.H., Chwalibog, A., Tygesen, M.P. (2006). Late development of homoeothermy in mink (*Mustela vison*) kits – a strategy for maximum survival rate. J. Anim. Physiol. Anim. Nutr., 90, 38–45. DOI: 10.1111/j.1439-0396.2005.00617.x.

Felska-Błaszczyk, L., Ławrów, N. (2022). Nursing of mink in nest boxes insulated with different materials. Acta Sci. Pol. Zootechnica, 21(3), 19–24. DOI: 10.21005/asp.2022.21.3.03

ODCHÓW NORCZĄT POCHODZĄCYCH Z GNIAZD OCIEPLANYCH RÓŻNYM MATERIAŁEM

STRESZCZENIE

Celem pracy było porównanie odchowu norcząt w gniazdach ocieplanych różnym materiałem izolacyjnym. Badania prowadzono na wielkotowarowej fermie norek położonej w północno-zachodniej Polsce. Analizie poddano wyniki odchowu norcząt pochodzących od 144 samice odmiany perła w wieku 1 roku i dwóch lat. Zostały stworzone 4 grupy, uwzględniające rodzaj materiału wyścielającego gniazdo i wiek samic. Na dwa tygodnie przed planowanym porodem domki wykotowe wyścielono dwoma rodzajami materiału izolującego – trocinami z drzew liściastych oraz mieszaniną słomy jęczmiennej i siana z roślinności łąkowej. Zebrano dane dotyczące: liczby urodzonych i żywo urodzonych młodych w miocie, liczby odchowanych norek z miotu oraz śmiertelności norcząt w okresie odchowu przy matkach. Stwierdzono, że materiał, którym ociepla się gniazda norek ma wpływ na liczbę urodzonych, żywo urodzonych oraz odchowanych norek. Zanotowano lepsze wyniki rozrodu u samic, których gniazda ocieplane były słomą jęczmienną zmieszaną z sianem łąkowym. Urodziły one większe mioty, z większą liczbą żywych norcząt oraz odchowały więcej młodych. Śmiertelność młodych norek była niższa w gniazdach ocieplanych mieszanką słomy z sianem. Uzyskane wyniki pokazały, że zastosowanie trocin jako materiału izolującego gniazdo, wiąże się z niższą przeżywalnością odchowanych norcząt. Przeprowadzone badania ukazują, że wybór odpowiedniego materiału izolującego gniazdo może korzystnie wpłynąć na liczbę odchowanych młodych norcząt.

Słowa kluczowe: norki, materiał wyściółkowy, wyniki rozrodu, śmiertelność okołoporodowa

Lidia Felska-Błaszczyk https://orcid.org/0000-0002-3765-5954