POLISH JOURNAL OF NATURAL SCIENCES
Abbrev.: Pol. J. Natur. Sc., Vol 33(3): 355–367, Y. 2018

THE CONDITIONS OF HOUSING YOUNG MINK WITH THEIR MOTHERS AS A CRUCIAL CONTRIBUTING FACTOR INFLUENCING THE RESULTS OF REPRODUCTIVE EFFICIENCY IN RELATION TO THE REQUIREMENTS OF THE FUR ANIMAL WELFARE ASSESSMENT PROTOCOL

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Key words: mink welfare, nest box quality, feeding mink prior to weaning.

Abstract

The aim of this paper is to juxtapose, on the one hand, the results of research held with a view to providing young mink with the best possible conditions in the period of being housed with their mothers (the nest box quality and the food and water provision conditions), and, on the other – the requirements set before fur farms in the scope of providing the animals with the best possible welfare standards contained in European recommendations (*Welfare Quality*®… 2018, WELFUR 2015). The analyzed research refers to the protective properties of the material lining the nest, as well as the availability of water and feed for young mink at the earliest stage of their life. The juxtaposition of the actions of farm managers and researchers with European requirements points to their congruence, which in the end result provides the animals with growing welfare conditions.

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WARUNKI ODCHOWU MŁODYCH NOREK PRZY SAMICACH JAKO ISTOTNY CZYNNIK WPŁYWAJĄCY NA WYNIKI ROZRODU, W ODNIESIENIU DO WYMAGAŃ PROTOKOŁU OCENY DOBROSTANU ZWIERZĄT FUTERKOWYCH

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Słowa kluczowe: dobrostan norek, jakość gniazda, żywienie norek do odsadzenia.

Abstrakt

W publikacji zestawiono wyniki badań przeprowadzonych w celu zapewnienia młodym norkom jak najlepszych warunków w okresie odchowu przy samicach (jakość gniazd oraz warunki żywienia i pojenia) z wymaganiami stawianymi fermom zwierząt futerkowych w zakresie zapewnienia zwierzętom jak najwyższego poziomu dobrostanu, a zawartych w europejskich rekomendacjach (*Welfare Quality*®... 2018, WELFUR 2015). Analizowane badania dotyczą właściwości ochronnych materiału wyściełającego gniazdo, a także dostępności wody i pokarmu dla szczeniąt norek w jak najwcześniejszym okresie ich życia. Zestawienie ze sobą działań hodowców i naukowców oraz wymagań europejskich wskazuje na ich zbieżność mającą na celu zapewnienie zwierzętom coraz lepszych warunków, w jakich są utrzymywane.

Introduction

Issues pertaining to raising the welfare conditions of livestock animals are a crucial subject area of discussions held in different EU Member States. In effect of such discussions, as well as actions held in consequence thereof, the European Union had funded a research project titled "Welfare Quality®: Science and society improving animal welfare in the food quality chain," with a view to developing the principles of improving the welfare of livestock animals (BLOKHUIS 2008, BLOKHUIS et al. 2012). The aim of the project, which has been held in 2004–2009, was to integrate knowledge from the field of livestock animal welfare within the food quality chain. The project has been coordinated by INRA (Institut National de la Recherche Agronomique, France) and encompassed the basic species of livestock animals, that is, pigs, poultry, and cattle (BRZOZOWSKI 2017). The results of the projects have become a touchstone for the introduction of legal regulations with a view to improving livestock animal welfare conditions in EU Member States. The interest of Western societies in impro-

ving the welfare conditions of livestock animals is confirmed by the Special Eurobarometer Report "Attitudes of Europeans towards Animal Welfare" (*Special Eurobarometer Report* 2016). The vast majority of consumers who participated in the Eurobarometer survey have declared that they are not opposed to pay more for food items produced with a view to providing livestock with a high level of welfare conditions.

Cognizant of such a created view on reality, the fur industry decided to actively participate in the discussion and prove to the public opinion that the term animal welfare is a priority they support as well. For the industry, this is an issue of reaching out to the society with a message of the actual state of breeding fur animals. The fact that most farms provide appropriate conditions for their animals is attested to by the high price of fur skins on the auction markets, as it is impossible to obtain high quality skins in the fur trade without providing the animals with the optimal welfare conditions (Brzozowski 2017).

The abovementioned EU project with a view to providing livestock animals with the best possible welfare conditions is congruent with the specific actions undertaken by farm managers and scientists alike, with respect to raising the conditions of breeding animals. Such issues also include the matter of nest box quality and food provision conditions for young mink.

The aim of this paper is to juxtapose, on the one hand, the results of research held with a view to providing young mink with the best possible conditions in the period of being housed with their mothers (the nest box quality and the food and water provision conditions), and, on the other – the requirements set before fur farms in the scope of providing the animals with the best possible welfare standards contained in European rules, regulations, and recommendations.The conditions of housing young mink with their mothers from the point of view of animal needs, two issues are the most crucial in the period of housing young mink with their mothers: proper housing (nest box) and proper food and water provision conditions.

Proper nest box

Multiple species of mammals instinctively build a den or nest prior to giving birth. This group of animals is collectively referred to as "altricial species," which points to the fact that in order to properly nurture their young, especially in the first period after birth, the animals require a properly prepared and protected den or nest.

The group of "altricial species" also comprises carnivorous fur animals, including mink. The breeding of mink is seasonal and delivery takes place in the end of April and in the beginning of May. In this period, the ambient temperature is variable, with warm and cold days occurring interchangeably, with temperatures dropping even below 0°C. In effect, in the first weeks of life, the offspring are completely dependent on the mother not just due to suckling, but also because the offspring are incapable of thermoregulation. For this reason, the mother also provides her offspring with heat and protects them from exposure to cold. According to Danish studies, the thermal comfort zone in a mink nest in the first years of life falls within the range of 25–30°C (TAUSSON et al. 2006). In the postnatal period, the offspring have severely limited energy reserves: a mere 1% of the body mass at birth is fat, which in the case of a mink birth mass of about 10 g translates to a mere 0.1 g of fat tissue. A long and thin body shape results in an unfavorable ratio of volume to surface area, or, in other words, considerable heat loss. Furthermore, nestlings have severely limited locomotive skills and, once they find themselves outside the nest, are unable to return. The highest mortality rate for nestlings pertains to the first days of life, and one of the main reasons behind nestling mortality immediately after birth is hypothermia (CASTELLA and MALMKVIST 2008). The American mink has an effective adaptive mechanism with a view to conserving the nestlings' limited energy reserves. Reduction in body temperature causes the young mink to enter into a hypothermal state resembling torpor, in which the pace of metabolism and the level of activity are reduced. Upon raising the body temperature, the kits are able to return to their normal metabolic state and activity level. It turns out that a strategy focused on entering a reduced state of metabolism in mink is more effective in terms of the survivability of a larger number of offspring than an attempt at thermoregulation (MALMKVIST and HOUBAK 2000). In the wild, the female must leave the nest in order to find food. During this time, her offspring remain alone in the nest. The nestlings' crowded presence in a heat-insulated nest prevents heat loss. In the case of farm mink food intake is not a factor which would require the female to abandon the nest for long enough to endanger the well-being of the offspring, but extreme weather conditions in connection with the inadequate construction of the nest box may lead to hypothermia in single nestlings or entire litters. In the case of mink, the development of a thermoregulatory mechanism manifesting itself in heightened metabolic activity during exposure to low temperatures appears after about 6 weeks (TAUSSON et al. 2006). In order to provide optimal conditions for the delivery and rearing of young mink, the animals are provided with properly constructed and protected cages,

which are further fitted with nest boxes in which the female prepares her nest. The lack of a nest or an improperly prepared nest are a severe risk with respect to the survivability of nestlings. Furthermore, as Danish studies by MALMKVIST and PALME (2008) indicate, ridding the females of the possibility of building nests leads to build-up of additional stress in the perinatal period. In the aforementioned study, the researchers divided the female mink into two groups, of which one was provided with bedding material for the nest box and the other was not. The researchers determined that the lack of bedding material raises the level of cortisol (the stress hormone) in female mink.

The standard nest-building material substrate used in mink breeding is barley straw. At the same time, a number of studies have evaluated the usability of other materials which could be used to this effect. In a study MALMKVIST and PALME (2008) have compared the quality of nests and reproductive efficiency in females which had access to either plastic bedding material, barley straw, or concurrent access to both products. The highest marks were awarded to nests created with the use of both materials: plastic and straw, but the obtained results were statistically insignificant (MALMKVIST and PALME 2008). Similar results were obtained in a study from 2012, which compared nests made of straw with the addition of rabbit wool (LUND and MALMKVIST 2012), or a 2016 study, which compared nests made of straw with the addition of sheep wool (MALMKVIST et al. 2016). In another experiment by LESTER-SAENZ et al. (2014), aspen sawdust was compared with straw. The researchers came to the conclusion that while sawdust nests rated higher on a 5-point scale and provided better comfort to the nestlings, this in itself did not translate into reducing nestling mortality rates. In turn, in her study ŚLIWIŃSKA (2017) compared three bedding materials: barley straw mixed with thermally processed wheat straw; thermally processed and dedusted pinewood shavings mixed with thermally processed wheat straw; as well as thermally processed and dedusted pinewood shavings alone. Nests from barley straw were evaluated as being lower in quality (less heat-insulating) in comparison with nests made from other materials, but this in itself also did not result in differences in reproductive efficiency. The study also observed that two-year-old females have a higher reproductive efficiency regardless of the type of bedding material.

The feeding and watering of young mink prior to weaning

Aside from the minks' genetic makeup, feeding is the most crucial factor influencing their reproductive efficiency. Mink are typical carnivores, however, in farmed mink the gastrointestinal function and nitrogen metabolism has changed compare to wild ones: farmed animals make better use of nutrients (GUGOŁEK et al. 2013, GUGOŁEK et al. 2015). Feeding should be consistent with changing nutritional requirements in subsequent developmental periods. Mink feed components should be characterized by proper sanitary conditions, and the feed itself should be provided in a timely manner and in the right quantity (*Zalecenia żywieniowe*… 2011). Table 1 presents the general principles of the nutritional quality of mink feed in subsequent production (breeding and feeding) periods.

Table 1

The nutritional requirements in mink in subsequent production periods (*Zalecenia żywieniowe*… 2011)

Subsequent production (breeding and feeding) periods	Percentage of metabolic energy from [%]		
	proteins	fats	carbohydrates
From December to mating	45–55	30–40	12–20
From mating to July 15	40–45	38–45	12–20
From July 16 to September 15	33–40	45–55	12–20
From September 15 to pelting*	28–35	42–50	15–20

* – depending on the coloration from November 15 to December 15

In order to achieve high reproductive efficiency, it is crucial to properly feed the foundation stock throughout the entire year, with the highest importance assigned to the period beginning in December, when the only animals remaining on the farm are those selected for mating. This period (from December to mating) is further divided into three distinct sub-periods: preparation for mating, when animals should have restrictive diets, the mating period proper, and the following gestation period, when females should be fed without limit (*Zalecenia żywieniowe*… 2011).

The period of restrictive feeding is intended to instill the proper mating conditions in mink. For this process to be successful, it should be performed in the long term, individualized, and tailored to the climate conditions in a given year. It is also crucial it ends before the onset of mating. One should also remember to provide the necessary higher quantity of vitamins, as well as macro- and microelements in reduced-volume doses (SŁAWOŃ 1987, ROUVINEN-WATT 2003).

In the gestation period, females should be provided feed with a view to the optimal development of the fetuses – rich in nutrients – primarily pro-

tein, vitamins, minerals, and allowing the organism to build up stores of nutrients for the lactation period. In the case of mink, nutritional demand in the first half of the gestation period is close to normal demand, as the nutritional needs prior to the implantation of the embryos are minimal. In the second half of the gestation period the nutritional needs are higher due to the development of the fetuses. In the first half of the gestation period there should be a slight rise in the body mass of the pregnant female, which in the second half of the gestation period should rise to about 10–15% in relation to initial mass at the onset of gestation. In accordance with this principle, it is advised to raise the general energy value of the feed by about 10% (Zalecenia *żywieniowe*… 2011).

It has been demonstrated that most premature mortality of mink kits, apart from mortality resulting from the behavioral disorders of the mother, is caused by bacterial infections, which may be tied to the "wet nest" syndrome (*wet kits*, *greasy kits*) and result in significant premature mortality in kits. The incidence rate is variable and depending on the year and the farm is as high as 30%, with a death rate of 1–2 kits per litter. This syndrome is not, strictly speaking, a disease, but rather, a disease symptom, which may, apart from diet, have multiple other causes. It is present in kits and manifests by stickiness and a certain greasiness of their hair coating, as well as diarrhoea. The first stages of diarrhoea are not by and large infectious, but in effect the kits become weaker and their condition worsens. In turn, this weakened state often leads to further infections of the gastrointestinal tract and the diarrhoea becomes infectious itself. While the initial causes of this syndrome are diverse, they nonetheless always remain the result of interactions between three factors: diet, imbalanced intestinal microflora, and low resistance to infectious agents in kits. The main area of contact between the young animal and pathogens, which is crucial in the development of the proper functioning of the organism's immune system, is the gastrointestinal tract. Feeding mistakes are the main factor which may influence the dysfunction of the gastrointestinal tract. This, in turn, leads to a drop in the natural resistance to bacterial infections (Clausen and Dietz 2000, Clausen and Dietz 2004, Rouvinen-Watt 2003). Health improvement can be also obtained by using probiotic and prebiotic preparations, as it was demonstrated in polar fox, another carnivorous animal (Lorek et al. 2001, Gugołek et al. 2004).

The requirement for nutrients, vitamins, minerals, and energy is much higher in the case of lactating females than during gestation itself, particularly in female mink with large litters. However, the mink feed component ratio and its nutritional and energy values should be changed gradually over time, as to prevent disorders in feed intake. When selecting

the feed components for dosages in the lactation period, as well as in the preceding period, one should take into account their freshness, high biological value, and proper microbiological state. Young mink grow very fast and the mass of the litter in the fourth week of lactation begins to equal the body mass of the female (HANSEN and BERG 1997). As is apparent from studies by WAMBERG and TAUSON (1998), the average daily mink kit milk intake is over 11 g in the first week and up to 28 g in the fourth week of life, which means that daily milk production by a female with a litter of ten kits may approach 300 g (Table 2). The above values point to the necessity of properly feeding the females, so that they will be able to meet such demands.

Table 2

Milk intake in mink kits in subsequent weeks of lactation
(after WAMBERG and TAUSON 1998)

Details	Lactation [week]			
	1	2	3	4
Number of kit per litter	7–9	7–8	7–9	7–8
Female body mass weight [g]	1095	1154	1077	1131
Mass of all kits in the litter [g]	151	274	595	807
Daily milk intake by a single kit [g]	11.1	18.0	27.0	27.7
Daily milk intake by the entire litter [g]	78–100	126–144	189–243	194–222

Another factor of fundamental significance rests in watering the females and providing them with continuous access to water during lactation, when the females are burdened with considerable water retention issues. It has been evaluated that up to 15% of the water in the mother's body is transferred with the milk to the organisms of the kits (TAUSON et al. 1998).

One of the most critical points in the development and rearing of young mink is the termination of lactation and transfer to eating solid feed. As documented by relevant scholarship in the matter (MOLLER 1991, BRINK et al. 2004, AHLSTROM 2010), the nestlings begin to take in solid feed when they are about 4 weeks old (after 30 days since birth). Since then on, they start to gain weight intensively: while after 30 days they weigh about 300 g, only three weeks later their mass amounts to 600 g (CLAUSSEN et al. 1992). The transfer to solid feed is also tied to higher water intake. Studies (BRINK et al. 2004) show that 30-to-40-day-old nestlings still prefer to remain in the nest. This is tied to the fact that their locomotive skills still remain undeveloped. Access to drinking water available in drinking nipples on the opposite side of the cage is very difficult. In effect, farm managers are faced with the problem of combating water deficiency in kits.

A good source thereof is the mother's milk, moisture contained in the feed, and the female's saliva. When searching for water, the kits lick the snouts of their mothers and attempt to suckle the mother during the entire nursing period in the nest. This, in turn, burdens the females and leads to a drop in their body mass (De Rond 2008). One solution to this problem is to insert additional water sources near the exit of the nest box itself. Literature contains information on other solutions. In his research, as a source of water for nestlings Steffensen (2007) used a watering through in the form of a bowl placed in the cage near the exit from nest boxes. This solution allowed the kits to begin to drink water 3 days earlier than the kits in the control group, which resulted in more efficient growth in the experimental group. However, this system proved to be hard to implement on a large scale due to its labor intensity and hardships in keeping the water throughs clean. De Rond and Kleyn van Willigen (2009, 2011, 2012) have performed a series of studies on watering mink kits. In the first instance, they used bottles with attached drinking nipples placed directly in nest boxes, which allowed them to determine the volume of water drank by kits between the 30th and the 50th day of rearing (De Rond and Kleyn van Willigen 2009). In the second instance, they installed typical nipple drinkers in the cages, which were connected to the farm's water supply. One negative aspect of such a solution was the risk of dampening the nest boxes, which could lead to a drop in the environmental conditions in the nests (De Rond and Kleyn van Willigen 2011). In the last instance, the authors of the studies placed watering troughs near the exits to the nest boxes (De Rond and Kleyn van Willigen 2012). This system turned out to be the most beneficial and practicable to implement in farms.

Requirements pertaining to proper mink rearing conditions in the nesting period according to the WelFur Protocol (WelFur 2015).

In order to familiarize the public with knowledge on the conditions of breeding fur animals, as well as to demonstrate that such conditions satisfy the needs thereof, in 2009 EFBA (The European Fur Breeders Association) initiated the performance of a project named WelFur, similar in its premises to the *Welfare Quality®*... (2018). At present the initiative is continued by Fur Europe, an organization comprising EFBA and IFF (The International Fur Federation).

The WelFur project rests on three principles (WelFur 2015):

– WelFur is a reliable and feasible system for animal welfare assessment based on scientifically proven measurements;

– WelFur is designed to create transparency around the animal welfare standards;

– WelFur works as ~~a~~ strategic tools for the individual fur farmer to identify and improve any areas on the fur farm where the welfare standards can potentially be improved;

The initial WelFur protocols, which were formulated in 2009–2010, have been tested in 2011 and 2012 in fur farms in Denmark, Finland, the Netherlands, Norway, and Sweden. The performed verification of the test has demonstrated that evaluation on a single farm can be completed within a single day (it takes about 5–7 hours to complete). It was also assessed that the adopted criteria and their level are sensitive enough to show differences between farms (WELFUR 2015).

One of the key indicators defining the welfare level of farm mink within the WelFur protocol is the assessment of rearing conditions when the young mink are housed with their mothers.

The criteria of assessing the conditions of rearing on the basis of the WelFur protocol are presented in Table 3.

Table 3

Criteria and indicators for the conditions of rearing for American mink in the WelFur protocol (WELFUR 2015)

Welfare criterion	Indicator
Comfort around nesting	access to nest box
Thermal comfort	protection from environmental conditions material to build nest boxes and nests
Ease of movement	space available for moving (surface area and height)

Until weaning, the young mink remain in the cage with their mother. The WelFur protocol evaluates the minks' ease of access to the nest box, as well as the possibility of the gestating female to line the nest box with bedding material (WELFUR 2015). The size of the cages and nest boxes is assessed in reference to standards set forth in the Council of Europe Recommendations during the 37th meeting of the Standing Committee of the European Convention on the Protection of Animals Kept for Farming Purposes in Strasbourg in 1999 (MONONEN et al. 2012). The quality of resting is defined as the evaluation of the construction of nest boxes (whole/destroyed) and the degree of the dampness and cleanliness of the bedding material. In the case of thermal comfort the measurements were selected in a way which guarantees the welfare of the animals by the farm manager in exceptional weather conditions by e.g. reducing the cooling influence of wind, increasing ventilation or cooling on hot days, as well as providing good thermal insulation for nests (MONONEN et al. 2012). Protection from adverse external conditions is evaluated with respect to the

location of the farm (the terrain layout, the proximity of trees) and the fence, the degree of the insulation of the sheds (open/neighboring/closed), the construction of roofs, and protection from heating (covering, paint). Farms at risk of exposure to temperatures exceeding 30°C are required to implement cooling systems such as sprinklers (WELFUR 2015). Part of the cage intended for the nest may be constructed from wood, plywood, chip--board, or plastic. Bedding material may be hay, straw (cut or intact), or other straw-like material, shredded paper, wood, or other soft shavings, wool, and similar materials. The product for building nests must be supplied in the right amount, which enables the mother to cover the entire floor and build a complete nest with a view to efficiently protecting the kits from drought and temperature loss in the nest. The material provided to the animals should have insulating qualities and be moisture-absorbent. For most of the year, the nest box functions as a sleeping and resting area. The requirements underline the exceptional significance of the nest in the perinatal period. Pregnant females have a behavioral need to prepare a nest for their offspring, which is one of the main factors conditioning their survival in the first weeks of life (WELFUR 2015).

The appearance and quality of the nest is assessed on the basis of three measurements presented in Table 4.

Table 4

Measurements for the assessment of the quality of the nest within the WelFur protocol (WELFUR 2015)

Thermal insulation properties of the nest	Access to bedding material	External insulation of the sheds
0* – high insulation of the walls of the nest box (materials: wood, plywood, chip-board with wire netting)	0 – access to a large amount of bedding material allowing for the construction of an enclosed nest	0 – coverage of nest box roofing plates with insulation material
1* – moderate insulation of the nest box (materials: woo, plywood, chip-board without wire netting/plastic with wire netting)	1 – access to an amount of bedding material allowing for the coverage of the entire floor area	1 – no coverage of nest box roofing plates
2* – low insulation of the nest box (plastic without added netting)	2 – access to an insufficient amount of bedding material to cover the entire floor area	–

* – „0" is the best score, while „2" – the worst score

In the course of a WelFur assessment randomly selected cages are evaluated, following which an average score is calculated to evaluate the quality of the nests on a farm, taking into account the percentage of nests with a given score in relation to the total number of nests.

The description provided above contains just the portion of the welfare evaluation protocol that directly pertains to the topic of the article at hand, that is, the possibility of raising the reproductive efficiency of nestlings housed with their mothers by improving breeding practices used on mink farms. By the same token, other matters associated with mink breeding are evaluated. The general result of farm assessment is primarily a crucial information for the farm manager, as it provides information on the condition of the farm, which is admittedly evaluated from the perspective of animal welfare, but which nonetheless generally encompasses all aspects of managing a farm. In effect, the results of the assessment are a valuable information for the farm manager as to what should be changed and how in order to achieve better outcomes (BRZOZOWSKI 2017).

In conclusion, it can be said that juxtaposing the actions of researchers and farm managers with a view to guaranteeing the best possible degree of efficiency of breeding in accordance with the principles of the WelFur protocol, intended to provide animals with the best possible level of welfare on farms, which in the end result provides the animals with growing welfare conditions.

Translated by MARIAN BRZOZOWSKI

Accepted for print 3.07.2018

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