



ISSN: 2456-2912
VET 2020; 5(4): 89-92
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www.veterinarypaper.com
Received: 22-05-2020
Accepted: 24-06-2020

Oluwafemi RA
Risk Assessment Center on Food
Chain, Sofia, Bulgaria

Public health risk analysis due to the spread of the Covid-19 virus from the free living minks and mink farms in Bulgaria

Iliyan Kostov

Abstract

The people is currently facing a pandemic of a new coronavirus - severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes Covid-19 disease. The virus spreads effectively among humans, causing mainly respiratory diseases of varying severity. In April 2020, the Dutch government reported the occurrence of respiratory disease and increased mortality on two mink farms in the Netherlands, with interstitial pneumonia and the presence of SARS-CoV-2 RNA in organ samples and nasopharyngeal swabs. With this work we aim to analyze the health risk to public due to the spread of the virus Covid-19 from breeding mink farms in Bulgaria.

Based on the analysis, we can conclude that if Covid-19 infection enters minks in Bulgaria (both in farms and in the wild population), the probability that these animals will become a reservoir for the virus and thus present a permanent source of infection for humans is large.

Keywords: Minks, public health risk, infection with Covid 19, surveillance of infection

Introduction

The people is currently facing a pandemic of a new coronavirus - severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes Covid-19 disease. The virus spreads effectively among humans, causing mainly respiratory diseases of varying severity. The virus has also been shown to infect a number of animal species under experimental conditions. Macaques, ferrets, cats, and golden Syrian hamsters support viral replication in the airways, and some of these species (rhesus macaques, young cats, and hamsters) show mild to moderate clinical signs of the disease. In addition to experimental infections, periodic transmission from humans to domestic animals or captive animals has been reported ^[1]. In several isolated cases, cats and dogs owned by infected individuals tested positive for SARS-CoV-2 RNA, and sometimes cats showed clinical disease ^[2].

In April 2020, the Dutch government reported the occurrence of respiratory disease and increased mortality on two mink farms in the Netherlands, with interstitial pneumonia and the presence of SARS-CoV-2 RNA in organ samples and nasopharyngeal swabs. In both farms, at least one worker had coronavirus-related symptoms before the onset of the disease among the minks. Analysis of viral sequences isolated from minks shows humans as the probable source of the initial infection and demonstrates transmission between minks and no infection between farms. In addition, the presence of viral RNA in inhalation dust collected from farms indicates possible exposure of workers to the virus excreted by minks ^[3]. The epidemiological study concluded that the virus was transmitted by infectious droplets, food or litter, or by dust contaminated with animal feces. Like humans, an infected mink may show no symptoms or develop severe problems, including pneumonia. Mortality is insignificant on one farm and almost 10% on the other. Initially, the infection (in April 2020) was transmitted to minks by their keepers (the first two infected farms in the Netherlands). In all affected farms, the destruction of the animals was ordered - depopulation of the farms (about 800,000 minks were killed in the Netherlands alone until July 6, 2020). The minks was found to have clinical and gastrointestinal symptoms and was tested for SARS-CoV-2 because the owners had Covid-19-like symptoms. The minks give a positive result for SARS-Cov-2, confirmed in WBVR-

Corresponding Author:
Oluwafemi RA
Risk Assessment Center on Food
Chain, Sofia, Bulgaria

Lelystad ^[4]. The epidemiological studies indicate that the infection is likely to be present on mink farms for more than 4 weeks and that the transmission of the virus from mink to mink is efficient. No link has been established between the infected farms. There is no association with known human isolates of SARS-CoV-2, therefore it is considered that the virus does not spread outside the farm ^[5]. Denmark has decided to depopulate all infected farms, applying the precautionary principle, as test results show that more than 50% of the herd (in infected farms) is positive for Covid-19 ^[6]. Currently, no animals are allowed to enter or leave the farms and only a limited number of authorized staff are allowed. Presence of Covid-19 outbreaks in mink farms in both countries clearly indicates that the mink is susceptible to SARS-CoV-2 virus infection, may develop a respiratory disease with typical pathological findings of viral pneumonia, and may transmit the virus to each other. The serological surveillance on mink farms that have been previously infected shows that 90% of minks have seroconversion, which shows that the minks are highly susceptible and the infection spreads very effectively on the farm. In the context of surveillance, it is important to note that clinical signs alone are not a good indication that farms are infected, as the infection is often asymptomatic or oligosymptomatic. In addition, the people working on mink farms are also at high risk of contracting the virus, which shows the need to prevent infections among workers and to impose strict biosecurity measures to prevent the spread of the virus from affected mink farms.

In Bulgaria, only minks of the American mink species (*Neovison vison*) are bred. The Bulgarian Food Safety Agency maintains a public register of all mink farms and by July 2020 there are two farms in the country intended for mink breeding. One is near the Yambol village of Chargan with a capacity of 1000 minks and their offspring, and the other is near the village of Madjerito, near the town of Stara Zagora - with a permitted capacity of 128,576 animals. In the conditions of a continuing pandemic of Covid-19, the Bulgarian Food Safety Agency (BFSA) has issued Guidelines for inspection of a livestock farm for minks under the conditions of Covid-19 ^[7]. It should be taken into account that the risk of spreading the infection by the minks in the environment is also high, due to the establishment of a free population of American minks in the nature of Bulgaria, found inconsistencies with legal requirements for breeding and feeding of minks and the disposal of animal by-products from such as farms (discussed in detail in the scientific opinion of the Risk Assessment Center on Food Chain in 2020 and on the basis of a scientific study of Bulgarian Academy of Science) ^[8, 9].

Material and methods

With the present work we set ourselves the goal to analyze the risk to public health due to the spread of the Covid-19 virus from wild minks and from the breeding sites for mink for valuable skins in Bulgaria.

In assessing the risk to public health due to the spread of the Covid-19 virus from wild minks and farms, we have reviewed foreign and Bulgarian literary and scientific sources and analyzed the measures taken in Bulgaria. To fully assess the risk of creating an outbreak of infection, we have taken into account the free mink population in the wild on the territory of Bulgaria which escaped from the farms. The evaluation should answer the following questions:

1. What does it mean for public health if SARS-CoV-2 in mink farms does not disappear quickly or if it continues

to circulate in these farms for a long period after their infection?

2. What measures can be used to mitigate or prevent these risks to public health? Is it justified to take measures to prevent the outbreak or possible reservoir of SARS-CoV-2 among minks from a public health point of view and how would this be possible?

Results and Discussion

It has already been stressed that humans pose a risk of infection in mink farms and that the virus has in several cases been transmitted from minks to humans, and in this sense Covid-19-infected mink farms pose a risk of spreading the virus to humans and in particular those working on mink farms. People who become infected with mink, in turn, can spread the virus to other people through their social contacts, as probably happened in one of the surveyed households in the Netherlands. At the same time, it is difficult to prevent people with only mild symptoms from entering mink farms. As a result, it is not possible to prevent mink from being infected with the virus by an infected person in all situations. An additional problem is that minks do not show all the symptoms, their clinical manifestation in infected animals may be asymptomatic. In other words, the infection may circulate for some time before it is detected. And while the virus circulates among minks on the farm, it poses a potential risk of introduction (or re-introduction) among humans. Furthermore, it is impossible to exclude the risk of new mutations in the case of continuous transmission of this virus in mink farms, followed by the selection of specific options that may pose an additional risk for the further spread of the virus among minks or humans. For a comprehensive assessment of the risk of creating an outbreak of infection, the free population in the wild in the territory of Bulgaria of escaped minks should be taken into account. Since then, there has been new evidence of an increase in the free mink population, but there is currently no information on the origin of the mink, namely whether they escaped from the farm and whether they are the result of a free-living self-reproducing population and whether measures have been taken to limit minks in the wild. When the Covid-19 virus enters the free and reproducing wild mink colony, this population could also become a source of infection or a reservoir for future reintroduction of the virus to animals and humans.

The experience of the Netherlands based on virological and serological tests (> 90% of female minks are seropositive) shows that in some of the infected mink farms the infection is likely to disappear within a few weeks and in others to persist for more than month, but if the farm is not depopulated, monitoring is needed, i.e. continuous monitoring to prove the absence of infection in the newborn mink generation ("vertical transmission"). The infection can last much longer if newborns are actively involved in the spread of the virus on farms. Due to the lack of knowledge about the effects and course of the mother's immunity, it is uncertain how the infection will progress in the young. Under the most unfavorable prognosis, the infection will not go away until the animals are killed for the fur production purpose. Moreover, the peak of the viral load on the mink farms may increase above the level currently observed in infected farms in the event of active spread of the virus among young, as this would lead to a significant increase in the number of animals involved in the infection (with reproductive coefficient (Ro) 5 - 6).

In many of the infected mink farms, the animals are housed in separate cages with an impermeable barrier between them, excluding direct contact as a mode of transmission. Indirect transmission between minks can be either through equipment (e.g., feed or litter material provided by humans) or through infectious droplets / aerosols generated by infected animals, or through (fecal) contaminated litter dust. Inhalation of infected dust or aerosol from air on farms presents an occupational risk of exposure of farm workers.

To date, studies on Dutch and Danish farms have not provided definitive information on the sources of infection in animals, except in a few cases where sequential analysis of the viruses showed infection of minks by humans. However, the possibility of transmitting the infection through feed imported from other establishments is not excluded.

Based on the above, it is necessary for Bulgaria to consider and discuss the following types of measures to prevent the risk of continued spread of SARS-CoV-2 in and from mink farms. These measures may be applied individually or in combination:

1. Infected mink farms: Very strict isolation of infected farms and "vertical" surveillance of infection on these farms. This measure should take into account the assumption of the presence of the virus over a long period of time (measures should not be alleviated). If the virus spreads between newborn minks, there is a possibility of a significant increase in the total viral load on an infected farm. There are doubts about compliance with the proposed measures, such as the use of personal protective equipment. Detailed protocols need to be developed to protect employees from a workplace safety perspective. In addition, training courses must be organized and conditions created for their implementation. It is also essential to reduce the number of new employees allowed access to the farm. This is a challenge in periods involving heavy work, which will happen soon when young animals are vaccinated and weaned. In addition, there should be an explicit emphasis on working conditions and the protection of workers working in the sector during peak hours.

2. Killing and depopulation of minks from infected farms: This will prevent any mink farm from becoming a permanent source of infection and reintroduction of the virus to humans and will also prevent the spread of infection among the new generation of mink, possibly accompanied by a significant increase in the total viral load on the infected farm.

3. Infection-free mink farms: It is essential for these farms to prevent the introduction of the virus into minks and to recognize the infection at an early stage. This requires a combination of some of the above measures, as well as intensive monitoring. These holdings should introduce extremely strict prevention of the introduction of viruses, combined with effective hygiene recommendations and intensive monitoring (early warning system, virological and serological surveillance) until only as a final measure of preventive killing. Strict adherence to occupational safety and hygiene protocols is also essential and should be accompanied by symptom-based employee triage and easy access to testing. Special attention should be paid to monitoring - it cannot be limited to clinical manifestations, as the infection in infected minks may be asymptomatic, i.e. there should be active and passive supervision.

Conclusions

As the infection in the human population will develop in the longer term, it is essential to prevent the infection of mink by humans. If Covid-19 infection enters minks in Bulgaria (both on farms and in the wild population), it is not known whether these animals can become a reservoir for the virus and thus be a permanent source of infection for humans. The reintroducing the virus into the human population, moreover, minks may be positive for the virus when tested without prior clinical manifestation, as the animals show little or no symptoms.

Due to the lack of knowledge about the effects and course of the mother's immunity, it is uncertain how the infection will progress in the young and subsequent generations. Under the most unfavorable prognosis, the infection will not go away until the animals are killed for the fur production purpose.

Bear in mind all these, we can summarize the measures to be taken to prevent the spread of disease:

1. In the event of entry and detection of Covid-19 infection in mink farms, animals on infected farms must be humanely killed with all subsequent cleaning and disinfection measures in order not to become a reservoir of SARS-CoV-2 and a threat to human health.
2. The lack of surveillance program and a monitoring system for communicable diseases (other than Covid-19) in minks, especially in a global coronavirus pandemic situation, increases the risk to public and animal health from American mink farming.
3. Not to create new mink farms, as well as to stop or severely limit the breeding of animals and increase the capacity of the existing farms in our country, until a permanent trend of non-proliferation of COVID-19 in the territory of P Bulgaria and until a reliable program for supervision and monitoring of infectious diseases in American minks is created, incl. and for Covid-19.
4. In view of all the scientific data based on the latest studies of the virus and of the affected Covid-19 mink farming countries, the CHRC considers that, when the virus enters farms, there is a real risk of it becoming a source of infection for humans. This should be considered, and the BFSa should propose as a realistic option for mink farmers to temporarily reduce the number of mink farmed to a minimum until the risk of spreading Covid-19 is eliminated.
5. The mink farms in our country have not yet met the requirements regarding the protection of the health of minks from transmissible spongiform encephalopathies (TSEs) and other infectious and zoonotic diseases (common to animals and humans), which is a duty to public health.

Acknowledgments

My acknowledgement goes to the colleagues of Risk Assessment Center on Food Chain. I also want to acknowledge all those who contributed in one way or the other from the beginning to the end of the analysis.

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