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Why is bird flu making cows sick?

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Abstract

Did you know bird flu can affect animals other than birds? Bird flu usually affects wild birds like geese and farm birds like chickens. But sometimes it can "jump" to other animals. This includes cats, cows, and even humans. We wanted to understand this process better.

When cows started getting sick from bird flu and stopped producing milk, we examined how this happened. We looked at the amount of virus and where it was present in the cows. We sampled their milk and several other tissues. We found that the virus mainly infected the mammary glands, which produce milk. We studied the genetic changes in the virus' genetic code. This helped us better understand how it spreads. We discovered that the bird flu virus moved between cows and from cows to other animals in the farms easily. We also learned that the virus moved between farms. It is important to track outbreaks and reduce activities that could spread the bird flu virus. This can help us prevent more animals and humans from getting sick.

Introduction

Have you ever had the flu? If so, you might remember coughing, being tired, and feeling achy. Other animals get the flu, too! It is caused by a **virus**. There are lots of different forms of the flu virus that infect different animals. In certain cases the flu virus that infects one type of animal can also "jump" across species and infect other animals.

This jump from one type of animal to another is called **spillover**. This can happen due to the virus' ability to change its genetic code (its **RNA**). The changes in the viral RNA are called **mutations**. RNA can mutate when viruses replicate. Flu viruses can also get mutations by swapping pieces of RNA with other flu viruses – usually when they meet in the same infected animal.

It is important to keep track of how viruses like the flu spill over from one animal species into another. One way to track the spread of viruses is to compare how closely their RNA matches. We can create a family tree of the virus RNA. In this tree, viruses that are closely related appear near each other, just like siblings in a family. The sibling viruses likely come from the same source. Distantly related viruses come from different sources.

In early 2024, American farmers noticed strange flu-like symptoms in their dairy cows. Plus, their milk was sometimes thick and yellow. Several of the sick cows even stopped producing milk. This was worrying. A new version of the bird flu virus had already spilled over into wild mammals like cats, foxes, and seals.

We wanted to investigate the possibility that bird flu spilled over into dairy cows. We also wanted to understand how it spread. This important information can help protect farm animals from getting sick in the future.

Methods

We studied animals from nine farms that reported sick dairy cows in early 2024. We collected over 300 samples from dairy cows. These included nose swabs, blood, urine, feces, and milk (Fig. 1). We also took samples from wild animals found dead on the farms.

In the lab, we confirmed that the animals had bird flu. Then we examined three questions:

1. How much virus was in each sample? We did this by **extracting** viral RNA. Then we used specific methods to detect the quantity of RNA in the samples. We also used a microscope and virus-specific **staining techniques** to see where the virus was in different tissues. We looked at the lungs, intestines, and **mammary glands**.
2. How long had the animals been making/producing viral particles that could infect other animals? We collected extra samples for testing 3, 16, and 31 days later.
3. What was the RNA sequence (the genetic fingerprint) of the viruses in the sick animals? We used this information to help us understand how the virus spread.

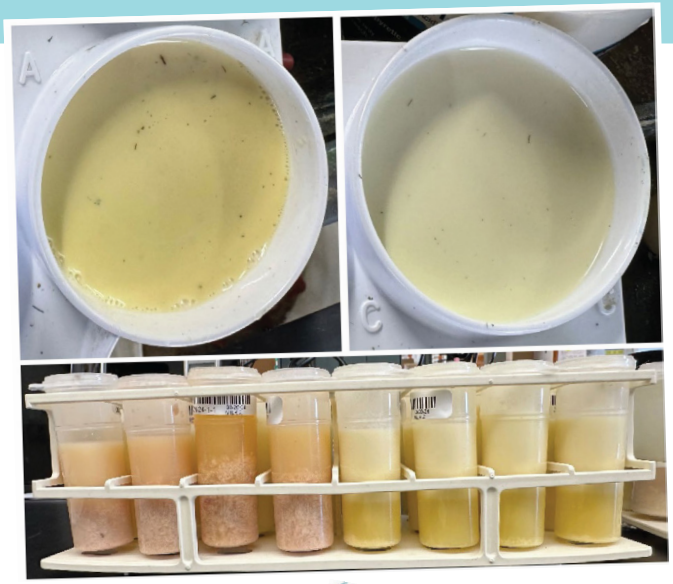

Figure 1: Milk samples from infected cows. The coloration varied from yellowish to a pink/brown color. Curdling is also visible in some samples.

Results

We found that milk from sick dairy cows had the highest level of bird flu virus (Fig. 2). Their mammary gland tissue, which produces milk, had similarly high levels. We detected the bird flu virus RNA for up to 31 days. Luckily, the virus was no longer infectious after the third day.

When we looked at the virus's RNA in samples from sick cows, the sequence was different from other versions of bird flu that we know about. The virus's RNA had accumulated mutations.

We also tracked apparently healthy dairy cows from one farm to another. They infected dairy cows at the second farm. So, they were actually carrying the virus.

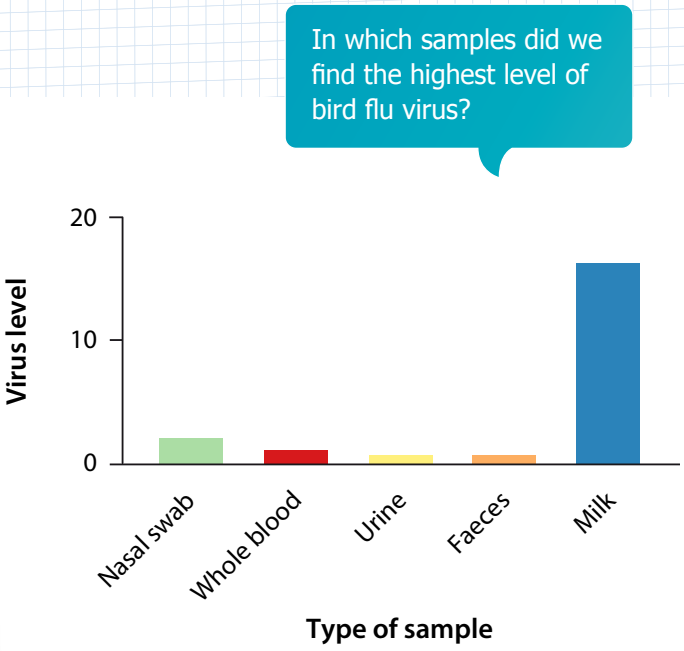

Figure 2: The average level of bird flu virus we measured in the 300 samples of bodily fluids we collected from dairy cows.

Finally, we discovered that some of the wild mammals (raccoons) and cats on the farms were infected. They had the same version of the bird flu virus as the dairy cows and were probably infected after swallowing raw milk from the sick cows.

Discussion

Our results show that dairy cows can get bird flu. The virus infects and replicates in the mammary glands. This causes high quantities of virus in the milk. Some of the farm animals may have been infected by drinking raw milk. Luckily, **pasteurizing** milk can kill the bird flu virus.

Many of the sick cows live on farms along a major bird migration route. So, wild birds may have infected them.

Even more concerning is that an infected cow could pass the virus on to other cows and animals on the farm. This is the first time we have seen transmission of the bird flu virus from one mammal to another and, most importantly, from one cow to another. If the bird flu virus gets mutations that help it infect mammals, it could start to infect humans as well.

Conclusion

You might think that cows, wild birds, and humans live in very different environments. But our lives are all connected. As humans build more farms, towns, and cities, we are moving into spaces where wild animals live. This makes it easier for diseases, like bird flu, to spread between animals. And even to us!

Fortunately, drinking only pasteurized milk can protect us from many infections. Farmers, vets, and researchers should continue to work together to fight off the spread of diseases.

Glossary of Key Terms

Extracting - separating a substance from a complex mixture using physical or chemical methods.

Mammary gland - a special part of the body in mammals that makes milk to feed babies. Female cows, humans, and dogs are all examples of animals that have mammary glands.

Mutation - a change in the genetic code. Mutations make individuals different from each other. But they can also cause dangerous changes, like making a virus more infectious.

Pasteurizing - a heating process in food production that kills harmful germs so it's safe to eat or drink. Most of the milk you can buy in the grocery store has been pasteurized so that people don't get sick.

RNA (Ribonucleic acid) - a very important molecule found in all living things. In lots of organisms it acts as a messenger carrying instructions from the "control center" (DNA) to the "protein factories" (ribosomes) in the cell. In some viruses, like the flu virus, RNA actually acts like the "control center" and the virus does not have any DNA.

Spillover - when a virus "jumps" from one animal to another.

Staining techniques - methods used to color microorganisms and their structures, making them visible under a microscope.

Virus - a tiny germ that can make people, plants, or animals sick. Viruses need to be inside living things to grow and spread.

Check your understanding

1. What are two major ways that flu viruses can change as they infect different animals?

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2. In which samples did we find the highest levels of the virus, and why might this be concerning for humans? What can humans do to avoid getting sick?

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3. Why is it important to understand how a virus has spread from one animal to another?

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4. Have you ever gotten a cold or the flu from a friend or someone in your family? What can you do to avoid getting sick or to avoid infecting others?

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