What is Happening to all the Rabbits?

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Abstract

In one way or another, disease affects every living thing on the planet. One disease in particular, Rabbit Haemorrhagic Disease (RHD), has recently come to the forefront due to its ability to rapidly spread. RHD is problematic because it can wipe out an entire population of rabbits, known as Oryctolagus cuniculus, within a few hours. The decline is so drastic, that some scientists fear that this particular species of rabbits may go extinct. Scientists know that there are many factors such as climate change and agricultural choices that aggravate the transmission of RHD. The key to eradicating RHD is to eliminate the transmission of the disease from one rabbit to another. A vaccine is also in development to try and prohibit transmission for this declining species of rabbit.

Introduction

Diseases can start out as something small and can quickly turn into something big. They are known for disrupting our body structures and functions. They can enter the body through injuries, person-to-person contact, or they may even be hereditary. Humans and other animals have the ability to transmit diseases, some of which can be passed from one species to another. Other diseases are transmitted solely by individuals within the same species. One example of this transmission is Rabbit Haemorrhagic Disease (RHD). This disease has become extremely problematic. It has the ability to wipe out entire populations of rabbits within a very short period of time. RHD is concerning agriculturalists as well as others in the in similar professions, and scientists are doing everything in their power to save the rabbits.

RHD has killed almost a quarter billion free-living and domestic rabbits since it emerged in China in 1984 (Alda *et al*., 2010). RHD only affects a specific species of rabbit native to Europe, Oryctolagus cuniculus (McIntosh *et al*., 2007). Since 1984, RHD has spread to many other countries, including the United States. RHD is a highly contagious virus that can cause sudden death (within 12-36 hours of exposure) to 95% of the rabbits that it infects (McIntosh *et al*., 2007). The virus can be transmitted through close contact, contaminated fur, or contaminated cages, which makes it very easy to transmit from one rabbit to another. (McIntosh *et al*., 2007). Rabbits exhibit symptoms of RHD, but usually when they are very close to death. These symptoms include weight loss, jaundice, foamy nasal discharge, liver necrosis, and pulmonary hemorrhages (McIntosh *et al*., 2007). Scientists are trying to learn more about the composition of the virus and what causes it to take the lives of so many rabbits, hopefully putting an end to this horrible epidemic.

Scientists have analyzed this virus to understand why it is so destructive. The RHD virus (RHDV) is a member of the Caliciviridae virus family (Alda *et al*., 2010). Norwalk virus, commonly seen on cruise ships, is also a member of this family. The genome of RHDV is what allows it to replicate and spread quickly. RHDV contains RNA as its genetic material (Gall & Schirrmeier, 2006). This is important because viruses that contain RNA have a greater chance of adapting or mutating (Alda *et al*., 2010). The RNA inside the virus has a mutation that allows it to have a great deal of genetic variation and replicate quickly (Alda *et al*., 2010), making death unavoidable. The evolutionary origin and rapid succession of epidemics is unclear (Alda *et al*., 2010). This piece of information is vital, and by conducting research, clarity will hopefully be found soon.

Scientists and other researchers have discovered that climate and the season in which the outbreaks occurs factor into the aggressiveness of RHD. Like many viruses, RHDV can only withstand certain climate changes. RHD outbreaks predominantly occur in spring and dissipate as soon as the hot, dry weather arrives (Cooke, 2003). This allows the rabbits to live untroubled by the disease throughout the summer. As the rabbits grow older, however, they become more susceptible to the disease. Young rabbits receive age-specific and maternal antibodies that protect them from the disease (Cooke, 2003). They lose these antibodies around six weeks of age, making them just as susceptible to the virus as their parent (Cooke, 2003). We can hypothesize that rabbits born at the beginning of the cool and rainy seasons will survive their first outbreak. Some rabbits continue to remain immune to the virus, but scientists have yet to explain why this is only true for a small number of rabbits (Cooke, 2003). This information can lead to more research in how controlling the climate can help control the spread of the virus.

In many agricultural areas such as farms, rabbits are seen as pests because they graze on crops, which can become very destructive. Farmers have taken action to protect their crops by using poisons and warren control against the rabbits (Mutze *et al*., 2010). Measures are also taken to restrict rabbit populations to certain areas, which causes a patchy distribution (Mutze *et al*., 2010). Since the rabbits are restricted to a specific area, they do not have as much interaction with each other and the entire population which ultimately affects disease transmission. Farmers have noticed that the presence of RHD is much lower, or nonexistent, due to low population density and patchy distribution in the restricted areas (Mutze *et al*., 2010). Farmers question whether there is a need for conventional pesticides when RHD naturally decreases the rabbit population at no cost. There is also the issue of infected rabbit meat. Although pesticides are costly, letting RHD spread and infect rabbit meat creates high economic losses (Mikschofsky *et al*., 2009). Farmers and other individuals in the agricultural business are currently trying to determine if there is a cost-effective method to control rabbit populations while preventing crop destruction.

In an effort to stop the spread of RHD, scientists have developed vaccines using the livers of infected rabbits (Mikschofsky *et al*., 2009). Scientists are also working on a different approach for vaccine production due to safety concerns regarding the use of infected animal material and animal welfare (Mikschofsky *et al*., 2009). Plants have many medical uses, which is the idea behind the newest RHDV vaccine. A vaccine derived from plant material instead of infected rabbit material would eliminate many of the current safety concerns. The major capsid protein (VP60) that is found in RHDV is also found in pea plants (Mikschofsky *et al*., 2009). Mikschofsky *et al*. (2009) found that a pea-plant derived vaccine created an immune response against RHDV, but it was not enough to protect the rabbits from the virus. Thus, Mikschofsky and his team added an adjuvant to the recombinant plant vaccine to create a stronger immune

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response (Mikschofsky *et al*., 2009). They then tested this combination on experimentally infected rabbits and found that the immunogenicity was high enough to protect the rabbits from RHD (Mikschofsky *et al*, 2009). This experiment is only a baseline study, but it allows for the exploration of plant-derived vaccines. Scientists are continuing to work with this vaccine combination to ensure it is safe before releasing it to manufacturers.

Rabbits are not the only animals susceptible to haemorrhagic disease. Since 1955, there have been outbreaks of Epizootic Haemorragic Disease (EHD) in white-tailed deer and cattle (Allison *et al*., 2010). There have been outbreaks of RHD and EHD throughout the world. EHD is not as deadly as RHD, but it is able to spread quickly (Temizel *et al*., 2009). This virus can spread even faster than RHDV because of its host, Culicoides spp., more commonly known as mosquitoes (Temizel *et al*., 2009). Out of six different viral stereotypes, deer become infected with EHDV-1 and EHDV-2, which are the most deadly (Allison *et al*., 2010). Less than 12% of cattle become infected with a deadly form of this virus (Allison *et al*., 2010). The symptoms of EHD vary from those of RHD. Cattle and deer can develop a fever, anorexia, lesions on the hooves and mouth, and also have haemorrhaging (Temizel *et al*., 2009). Some symptoms are more severe than others. If the case of EHD is mild, which is more common with EHD, the animal usually recovers within a few weeks (Allison *et al*., 2009). Researchers have yet to find a direct link between RHD and EHD, but there is evidence that evolution of RHD has taken place.

Any disease has the potential to turn into an epidemic. Finding a way to control transmission is the key to stopping an epidemic. Scientists are working towards a solution to this problem every day, but there is still much that is unknown about RHD. Animals, such as rabbits, do not possess the same intelligence and reasoning skills as humans. Therefore, controlling the transmission of RHD, and many other diseases that affect animals, is much more difficult. As the overall rabbit population continues to decline, agriculturalists are concerned that this particular species of rabbit may go extinct. This would eliminate the pest-control problem, but it does not take into consideration the well-being of the rabbits that are still alive today. Every animal has the right to life, and as humans, we have the resources to give these rabbits a chance to live and to not let this disease invade and destroy an entire species. If we do not find stop this epidemic soon, the end result will be just that.

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