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COVID-19 outbreak impacts on animal's health and food production

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ABSTRACT

The SARS-CoV-2 virus has spread swiftly over the world since the first cases of COVID-19 were discovered in Wuhan, Hubei, China, in December 2019. The World Health Organization (WHO) classified COVID-19 a global pandemic in March 2020. SARS-CoV-2 is now known to harm not only humans but also pets and other domestic wild and aquatic animals, making it a global health issue. To stop the disease transmission many animals were killed brutally. It is thought that various animals have got COVID from their infected owners. Due to lockdown, farming and fishing activity is reduced. Many animals faced shortage of food, loss of home. This pandemic also affects the economic growth of dairy farms and livestock production. Fish prices raises during first lockdown but gradually decline due to poor demand. This pandemic also affects the livestock supply by imposing shortage of animal's machinery and shortage of labors and professional services. As animals and humans depend on one another for various purposes so, the animals health is of our great concern. So, the people with suspected or confirmed COVID-19 should avoid contact with animals. To reduce the food safety risks appropriate slaughter techniques should be used. The impact of covid-19 and animals is summarized in this review.

Keywords: *Animals, COVID-19, Dietary sources, Domestic, Intermediate host, Wildlife*

1. INTRODUCTION

The World Health Organization (WHO) proclaimed COVID-19 a global pandemic on March 11, 2020 and by of July 2021, the epidemic has spread to over 190 million people worldwide, resulting in more than 4.0 million deaths. It is thought that the novel coronavirus known as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2, a highly transmissible and pathogenic coronavirus that has caused a pandemic of acute respiratory disease and is known as COVID-19) crossed the species barrier and infected humans via an intermediate host, which could have been domestic (e.g., pigs, poultry, dogs, cats) or wild (e.g., tigers, bats, macaques, lions) [1]. In 2020, the COVID-19 pandemic disrupted human lives worldwide, through contraction of the virus and potential loss of life to the restrictions

imposed by governments, beyond the direct cost on the lives of the human population, the lives of domestic, captive and wild animals were also affected in a myriad of ways [2]. The SARS-CoV-2 is an enveloped, spherical shape, single-stranded plus sense RNA virus with helical symmetry belonging to beta coronaviruses of Coronaviridae20. The virus has peplomers proteins, these spike proteins help in binding with receptors present in the body of animals (bats, rodents, civets, cats, Malayan pangolins, among other potentially competent hosts) and humans [3]. Outbreak of COVID-19, the biggest pandemic in world is likely to be spread from Huanan Seafood Market, Wuhan, China [4]. The COVID-19 pandemic is a systemic shock that affected all areas of the global food system. A growing range of impacts on aquatic food1 producers, value chain actors, and consumers is obvious [5]. During the COVID-19 epidemic, the dairy and meat industries, the poultry sector, as well as animal and animal product processing businesses such as slaughterhouses were all badly affected. The destruction of eggs, the dumping of milk, the brutal culling of animals, and the disruption of the animal feed supply chain has all contributed to a global economic disaster [6].

2. IMPACT OF COVID-19 ON DOMESTIC ANIMALS

The economic crisis, as well as the sudden restriction of human activities, is expected to have an influence on animal health. Some farmers had to cull their animals or adopt practices that are incompatible with animal welfare, such as inducing abortion and slaughtering, to reduce the population of animals on their farms and limit the surplus production of animal products (meat and milk). Due to the short breeding marketing cycle of these animals and the drop-in customer demand, several pig farmers have been compelled to abort their piglets. Thousands of pigs have been slaughtered by some farmers using inhumane tactics such as ventilation shutdown. This method relies on shutting down ventilation sources as barn temperatures rise, lowering oxygen levels and causing suffocation [7].

SARS-CoV-2 infection has been found in two Hong Kong-based dogs. A 17-year-old Pomeranian dog with positive RTPCR results in both oral and nasal samples was the first case [8]. Despite the fact, that the initial serological test was negative, blood samples taken later in the protocol yielded weak positive results. It's possible that this is due to the fact that antibody synthesis takes up to 14 days. According to a report, seroconversion in dogs suggests the animal has produced antibodies against SARS-CoV-2. This means the dog had a small infection that triggered an immunological reaction. As a result of

Table 1. Impacts of covid19 outbreak on Mammals

Context	Mammals	Location/ Country	Impacts
Attractions	Black bears	USA	In danger of losing home
	Apes	Africa	Shortage of food
	Buffalo	Thailand	Spatial expansion
	Boars	Thailand	Lack of enrichment
	Donkey	Canada	Disease transmission
	Elephant	Thailand, Sri Lanka	Reprieved of being hunted
Commodities	African rhinos	Africa, South Africa	Poaching
	Bamboo rat	China	Meat consumption
Threats	Rats	USA	Spatial expansion
	Animals	Global	Animals as a reservoir for the virus
Unusual sighting	Boars	Israel, Spain	Venture into cities
	Coyotes	USA	Return to un disturbed space

human-to-animal transfer, the findings point to a true infection in dogs. Another case of SARS-CoV-2 infection in a German Shepherd Dog has been reported in Hong Kong [8]. Both cases of canine SARS-CoV2 infection were found in dogs who resided near SARS-CoV-2 positive owners. There is currently no convincing evidence that dogs can contract SARS-CoV-2 or spread the virus to people [9].

In dogs, pigs, chickens, and ducks, SARS-CoV-2 replication is modest, but it thrives in ferrets and cats. Cats are also susceptible to airborne transmission. 1–3 days and 3–7 days after exposure, SARS-CoV-2 is found to be efficiently spread between ferrets, both directly and through the air [10]. A small number of pet cats and dogs who came into close contact with COVID-19 patients were infected with SARS-CoV-2 [10]. The existence of SARS-CoV-2 neutralizing antibodies was discovered in a serological analysis among Wuhan cats. This suggests that cats can become infected with SARS-CoV-2 in the wild and develop an antibody response. However, among the cats that tested positive, those who lived in close proximity to SARS-CoV-2 positive owners had a higher titer of neutralizing antibodies [9].

3. IMPACT OF COVID ON WILD ANIMALS

The (COVID-19) has sparked an immediate debate about wildlife trade, with numerous requests to ban or severely restrict it. This is due to the origin of COVID-19's causative component, SARS-CoV-2, which is most likely linked to a bat host, with one study showing 96 percent whole-genome identity to beta coronavirus BatCoV RaTG13 found in Rhinolophus affine [8]. However, it's possible that an intermediary host was involved in transmission to humans, and some researches have shown that this strain developed in pangolins. Nonetheless, wild mammalian and avian species, which are frequently hunted, can host coronavirus strains from many genera, with varying levels of risk of cross-species transmission. In addition, a variety of additional viral infections that pose a public health danger have been discovered in wild animals [9].

SARS-CoV2 was also found in many lions and tigers at a New York zoo, as well as mink (which are closely related to ferrets) on multiple farms in the Netherlands, Denmark, Spain, and the United States [10]. The lions, tigers, and mink became ill after being exposed to SARS-CoV-2-infected staff, according to public health officials. These observations from public health officials must be carefully analyzed so that SARS-CoV-2 transmission between humans and animals can be prevented to safeguard both humans and wildlife [11]. SARS-CoV-2 was also detected in a Malayan tiger kept at the Bronx Zoo in New York City, USA. A SARS-CoV-2 positive asymptomatic zookeeper is suspected of infecting the "Big cat." When these carnivores began to show signs of minor respiratory sickness, they were tested for SARS-CoV-2 [9]. The COVID-19 outbreak is having an unprecedented impact on human society. Nonhuman mammals are linked to human society through a variety of processes, including tourism and nature-based activities. The majority of reports of mammals as attractions are intended for viewing and engagement. The environments in which these mammals live vary from wild to confinement, and the setting has an impact on how the COVID-19 epidemic affects the mammals. Several impacts are: food scarcity, homelessness, and geographical expansion, enriched/relaxed, lack of enrichment, disease transmission, and reprieve from being persecuted [14].

4. IMPACT OF COVID-19 ON AQUATIC ANIMALS

Outbreak of COVID-19, the biggest pandemic in world is likely to be spread from Huanan Seafood Market, Wuhan, China [4]. The relationships between marine living organisms, including humans, and their shared physical environment lie at the core of the discipline of marine ecology, which seeks to understand the vital connections between organisms and the world around them [15].

None of the coronaviruses found in aquatic animals are zoonotic, and they are not closely related to those found in humans. Because the receptor proteins for coronaviruses on the cell membrane of humans and fish have such little genetic resemblance, fish are exceedingly unlikely to be infected by SARS-CoV-2. The possibility for transmission may vary based on the virus's survival duration, although there is currently no data on the virus's survivability on the surface of seafood. Infection of coronavirus to fish might seem impossible, but this virus has been detected in Pacific harbor seals, beluga whales, and Indo-Pacific bottlenose dolphins [16]. The virus was also detected in the seal that genetically close to feline, canine, and ferret's virus, suggesting the transfer of the virus from terrestrial animal to marine mammals. The early reports suggested that the seafood market's exceptionally wide contamination, such as seafood tanks, air contamination by live animals from various sources for sale, or rodent infestation, might explain the initiation of the SARS-CoV-2outbreak, but this virus is characteristically not foodborne [17]. The fisheries and aquaculture sectors operate in an increasingly globalized environment. Reductions in farming and fishing activity also reduced demand for harvesting labor, transport, and other services, with significant negative outcomes for the many workers who depend on these activities [5]. The fisheries and aquaculture sectors operate in an increasingly globalized environment. Global fisheries provide livelihoods to millions of coastal inhabitants and contribute to national economies [18]. Due to a rigorous lockdown imposed by the local authorities, all of the fishermen (100%) stated that they were not allowed to fish in the first phase. Fishermen lost a significant amount of money as a result of the sudden closure and restriction of fishing in wetlands [19]. Reductions in farming and fishing activity also reduced demand for harvesting labor, transport, and other services, with significant negative outcomes for the many workers who depend on these activities [5]. Fish production in most countries declined by 40 to 80 percent, according to estimates. Small-scale fishermen and their villages were the hardest hit, followed by fleets fishing for export. Fish prices soared during the initial lockout, but then dropped due to poor demand. As a result of the restriction of motorboat traffic during Italy's shutdown time, the purity of the water has increased significantly, and seaweed can now be seen in clean water in Venice [4]. During the COVID-19 epidemic, an increase in single-use plastics is unavoidable. Frontline personnel wear plastic as protective gear, and takeout food is delivered in plastic containers. To avoid cross contamination, many grocery stores and restaurants have made it illegal for customers to carry their own shopping bags. Given the uncertainty surrounding the pandemic's longevity, it is believed that plastic pollution will continue to be a big concern and have a long-term impact. Plastics will break down into smaller pieces called microplastics and due to their tiny scale, microplastics may be eaten by several marine species that perceive them as a food supply and may thus have harmful impact [20].

5. IMPACT OF COVID -19 ON DIETRY SOURCES OF ANIMALS

The impact of the COVID-19 pandemic on animal production systems and food items such as meat, dairy, eggs, and processed food, as well as the pandemic's impact on animal health and welfare, food chain sustainability, and the global economy, is explored and analyzed in this study [21]. Other concerns threatening the livestock sector's long-term viability include a labor shortage and restrictions on animal mobility due to lockdowns or curfews [7]. Dietary habits are influenced by food shortages and poorer earnings. Poor families spend over half of their income on non-processed non-essential foods including fruits, vegetables, and animal-derived goods. As earnings fall, many impoverished

families will be forced to cut back on these non-essential items [22].

The COVID-19 epidemic has also had alarming consequences for food security, famine, and poverty [6]. The increased supply interruptions of fruits, vegetables, milk, and meat products, compared to less interrupted staple foods, are exacerbating the income-related drop in intake of these foods, particularly among poor households. This diminishes dietary variety, micronutrient consumption, and nutritional status, raising the risk of negative health effects [22]. Some of the consumer effects are already recognized in part. Consumer behavior has been substantially altered as a result of social alienation. Food purchases by consumers have switched drastically from "food consumed away from home [23]. The substantial drop in sales of numerous animal-derived foodstuff categories at the nation's top retail chains as a result of the pandemic, including pig chops (ham, shoulder, and neck), drinking milk, yoghurts (white and flavored), butter, poultry, and eggs. Year-over-year sales increased by 2% (flavored yoghurt) to 15% (pork shoulder) in the first quarter of 2020, Pork ham and neck sales decreased by 25% and 35%, respectively, while yoghurt sales decreased somewhat [24]. COVID-19 has also harmed the economic

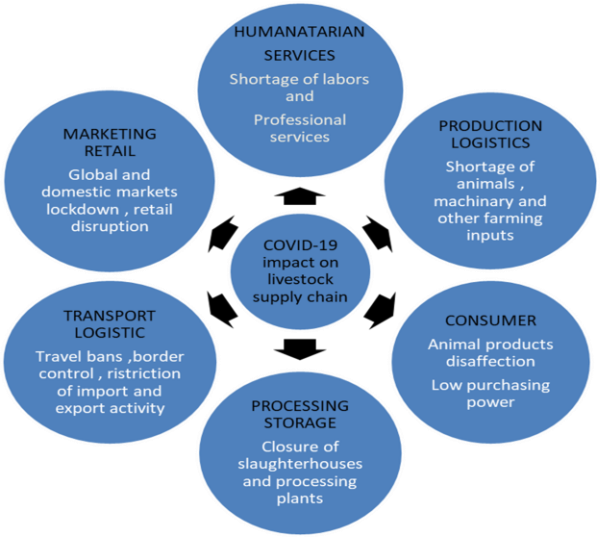

Figure 1: Impact of covid19 on livestock supply chain

growth of dairy farms all over the world. During COVID-19, milk processing units shuttered, creating a gap between demand and supply networks. In the first week of April, dairy farmers were compelled to dump 4 million gallons of milk in the United States due to this issue [25]. In May and June, the proportion was expected to be higher [26]. Low milk prices also hurt the dairy industry, which fell by 4.6 percent on average across seven nations, reaching 19 percent in the United States and India, respectively [7]. The quarantine caused labor shortages on a number of major farms, with milking and feeding being particularly hard hit [24]. Due to animal sickness and market disruption, global total meat production (including bovine, ovine, and poultry) is predicted to drop by 1.7 percent (338.9 million tons in 2019 versus 333.0 million tons in 2020) [7]. Pork production is the most important sector within meat production, with an average predicted reduction of around 8.0 percent (109.8 million tons in 2019 versus 101.0 million tons in 2020), while beef output is expected to reduce by about 1%. (72.6 million tons in 2019 VS 72.0 million tons in 2020) [7].The closure of restaurants and schools had an influence on food and semi-finished goods demand. When the limits went into effect, sales between beef cow breeders and restaurants and other outlets were quickly disrupted, forcing breeders to find new consumers. Not only did demand fall, but slaughterhouses also began to offer lower prices than they had before the recession [24]. Also, international meat prices have dropped by 8.6%, with the biggest drops seen in ovine, hog, and beef [7]. To help limit the pandemic's impact on livestock farming and production systems, we also provide practical advice to animal producers, veterinarians, workers in the animal products industry [21]. COVID-19 exposure and transmission by contact with domestic food-producing animals such as chickens, ducks, other fowl, pigs, cattle, horses, or sheep, or through eating of contaminated food or exposure to food packaging is currently regarded as

low. The virus cannot develop or multiply on the surface of food stored in a cabinet, fridge, or freezer, according to current scientific findings. However, food animals and their products, as well as other surfaces, may get infected with SARS-CoV-2 when touched by infected persons who may sweat the virus [27].

6. PREVENTIONS

- Biosecurity and cleanliness are critical in preventing SARS-CoV-2 transmission [28].
- Limit the number of employees who handle members of sensitive species and avoid unnecessary touching or other interaction with them [29].
- When travelling between each shed/barn, put on new or disinfected PPE such as masks, aprons, gloves, and boots [30].
- During their illness, those who are suspected or proven to be infected with SARS-CoV-2 should limit their contact with mammalian animals, including pets, just as they would with people [27].
- The virus can be spread by faeces, ensure that faeces are removed on a regular basis and properly disposed of according to state/local regulations [28].
- Vehicles of workers and guests should be parked in specified places away from animal housing [30].
- Isolate animals with respiratory or gastrointestinal symptoms (coughing, sneezing, nasal discharge, diarrhea, vomiting) [27].

7. CONCLUSION

This review has covered the major impacts of COVID-19 on animals. It is concluded that this pandemic also affects the animals just like the humans. Many animals got infection through infected humans. Many animals faced scarcity of food, loss of home, spatial expansion due to lockdown. Due to restrictions fishing is affected badly. This pandemic affects the farms, livestock sector and causes labor shortage and also the animal health and animal production all over the world. Restrictions on movement, national and international trade have disturbed the animal's market and contact to consumers. This resulted in substantial crises for animal producers and major distraction of global economy. The following sections include some of the recommended measures regarding animals and animal production:

8. RECOMMENDATIONS

- People with suspected or confirmed COVID-19 should avoid contact with animals, including pets, livestock and wildlife.
- Animal farms should be provided with essentials services for high quality animal health care and animal welfare.
- When working on a vast farm, stagger the entrance of laborer.
- While using tools, make sure to disinfect them after use and before use in any other part of farm.
- Practice basic personal hygiene measures, in particular regular hand-washing before and after handling animals.
- Appropriate slaughter techniques are necessary to minimize food safety risks.
- Centralized water treatment methods that use filtration and disinfection should inactivate the COVID-19 virus.
- To reduce the vulnerability of fisheries and aquaculture industries to global pandemic shock effective governance should be in place to minimize its impacts.
- Cook meat and other animal products thoroughly. Avoid eating raw and undercooked foods of animal origin.
- Educate farm workers on how SARS-CoV-2 spreads and how to prevent becoming infected and remind them about biosafety and biosecurity measures to

defend against COVID-19 on the farm on a regular basis.

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10. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

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NA

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