

Ecology & Spillover

Experimental transmission studies of SARS-CoV-2 in fruit bats, ferrets, pigs and chickens

8 MAY 2020 [SSRN Schlottau et al.](#)

Our take –

In this study, available as a preprint and thus not yet peer reviewed, transmission experiments of SARS-CoV-2 in fruit bats, ferrets, pigs, and chickens confirm that pigs and chickens are not susceptible to infection; fruit bats are susceptible but show transient viral shedding and limited transmission to contact animals; and ferrets are susceptible and capable of efficient transmission to contact animals. These results could guide the development of effective infection models in bats and ferrets to study viral shedding and possible vaccines. Human-to-bat transmission is a potential risk that could complicate the management of the pandemic, so contact with wild bats by researchers and wildlife managers should be limited during this time.

Study design

Ecological; Other

Study population and setting

The study population consisted of nine fruit bats (*Rousettus aegyptiacus*), nine ferrets, nine pigs, and seventeen chickens inoculated intranasally with SARS-CoV-2 (oculo-oronasally in chickens). Three direct contact animals

per species were included 24 hours post-inoculation. The authors also tested the susceptibility of embryonated chicken eggs and three different cell lines from pigs typically used for virus isolation. All animals tested negative for SARS-CoV-2 genetic material and antibodies prior to the experiment. Viral shedding was tested from nasal washes and rectal swabs (ferrets), oral swabs and pooled feces (bats), nasal and rectal swabs (pigs) or oropharyngeal and cloacal swabs (chickens) between day 2 and day 21 post-infection. Two or three animals of each species were sacrificed on days 4, 8, and 12 days post-infection; all remaining animals were euthanized on day 21.

Summary of Main Findings

Pigs, pig cell lines, chickens, and chicken eggs were not susceptible to SARS-CoV-2 infection; fruit bats and ferrets were susceptible to infection, with limited pathological signs (predominantly rhinitis) in both animals. All inoculated bats became positive and oral swabs tested positive for viral genetic material between days 2 and 12 post-inoculation. Oral swabs from 2/3 contact animals were positive 8 days post-inoculation. Pooled feces from all bat cages also tested positive days 2 and 4 post-inoculation. All inoculated bats produced detectable SARS-CoV-2 antibodies starting at 8 days post-inoculation, and one contact bat at day 21, but titers were low. Eight of nine inoculated ferrets tested positive for SARS-CoV-2 between days 2 and 8 post-inoculation, and all three contact ferrets tested positive starting at day 8; rectal swabs also tested positive, although with lower amounts of virus than in nasal washes. Antibodies to SARS-CoV-2 were detected in all inoculated ferrets by 8 days post-infection, and by 21 days in all contact ferrets.

Study Strengths

The study corroborates results from Shi et al. finding that pigs and chickens are not susceptible to infection, and that ferrets are susceptible. This work

improves on this study by including contact animals to demonstrate transmission among ferrets. This is the only study to date that investigates replication and transmission of the virus in bats.

Limitations

Based on previous work on SARS-related coronaviruses, fruit bats are probably not the reservoir hosts of SARS-CoV-2, but rather insectivorous *Rhinolophus* spp. However, the ease of maintaining fruit bats in captivity compared to insectivorous bats makes them a useful model for studying virus-host interactions and transmission, but may have limited relevance in the field and to our understanding of the ecological maintenance of the virus. The study only tested an intranasal route of infection in animals; the possibility of alternative routes including fecal-oral transmission will need to be assessed. Inter-species transmission was also not investigated.

Value added

The study confirms that fruit bats and ferrets are susceptible to SARS-CoV-2 infection, and can transmit the virus between animals of the same species. It provided experimental verification that bats can be infected. Fruit bats are not the primary hosts of SARS-related coronaviruses, so this could have implications for understanding the ecology of the virus and the risk of transmission from humans into atypical host species (therefore further complicating management). Ferrets are useful animal models for studying the efficacy of antivirals and vaccines.

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