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Rabies among animals in Saudi Arabia

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ABSTRACT

Background: Rabies is a fatal viral disease that continues to threaten human and animal health in endemic countries. Rabies is endemic in animals in the Arabian Peninsula. Although Saudi Arabia is the largest country on the Peninsula, little has been reported in the country about rabies situation.
Methods: A total of 199 animals suspected of rabies from 2010 to 2017, were examined for rabies infection using the Direct Fluorescent Antibody Test (DFAT).
Results: There were 158 (79.4%) positive cases of rabies of the examined animals, Most positive cases were found in Al-Qassim (63), Eastern region (48), Riyadh (25) and Al-Madina (10). Rabies was diagnosed in Procavia capensis and monkeys (Papio hamadryas hamadryas) in Saudi Arabia for the first time. In addition, infected livestock, especially camels, sheep and goat that pose a risk to veterinarians and farmers which increases the risk of potential zoonosis of rabies in Saudi Arabia.
Conclusion: These findings indicate that Rabies in Saudi Arabia remain a public health problem and dogs and camels are the main reservoir and continue to present health risks for both human and animals throughout the country, underscoring the importance of applying rabies control measures to animals and humans.

Introduction

Rabies is one of the most life-threatening zoonotic diseases in the world because it can lead to fatal encephalitis. This is due to the rabies virus (genus Lyssavirus; family Rhabdoviridae) that can affect all warm-blooded animals and humans [1,2]. Rabies is usually transmitted to humans and animals by bites through the saliva of a rabid animal; scratch wounds or contaminated mucous and if left untreated, it leads to a fatal result [3–5]. The World Health Organization (WHO) estimates approximately 30,000 human deaths annually due to canine rabies in Asia out of 61,000 deaths annually due to rabies worldwide [6,7].

Saudi Arabia is the largest country in the Arabian Peninsula; little has been reported about the state of rabies in the country. Previous reports have shown that the majority of animal bites of humans have involved dogs, cats, rodents, and foxes, and that foxes are the most important rabies reservoir [8,9]. Recent reports believe that rabies is also transmitted by wild dogs and continues to present health risks for both human and animals throughout the country [10]. In 2007, a survey was conducted in Al-Qassim region among 4124 camels, indicating clinical rabies incidence of 0.2%, probably due to the transmission by wild dogs (70%), followed by foxes (17%). The diagnosis of rabies was confirmed in 26 dogs, 10 foxes, 8 camels, and seven cats in Al-Qassim region between 1997 and 2006 [11].

It is estimated that a total of 11,069 animal bites to humans have been reported to the Saudi Ministry of Health (MoH) and Saudi Ministry of Environment, Water and Agriculture (MEWA) during 2007–2009. Most injuries were caused by dogs and cats, 49.5% and 26.6% of all injuries respectively, followed by mice and rats (12.6%), camels (3.2%), foxes (1.3%), monkeys (0.7%), and wolves

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(0.5%), stressing the importance of rabies surveillance and control program of animal rabies in a key issue for its prevention [10].

Although the Saudi Ministry of Health (MoH) has not reported any confirmed cases of human rabies over the past 10 years, animal-related injuries remain a public health problem in Saudi Arabia, where wild dogs are the majority of humans' bites and for the majority of animals found to be rabid [10]. More detailed information on the epidemiology of animal rabies in Saudi Arabia will be of great importance.

Materials and methods

Sampling and detection of rabies by direct fluorescent antibody test

In this report, a total of 199 samples (carcass or head) provided for diagnosis came from animals that were strongly suspected of having rabies, showing clinical signs include a sudden change in behavior, sexual arousal, ataxia, attacking human or each other, sudden falling after violent excretion, muscle tremors, paralysis and excessive salivation, with the former often resulting in a human or animal bite incident requiring rabies virus exclusion. In these circumstances, the bite-victim, farmers and in many cases the animal owner, delivered the animals for urgent diagnostic testing. Samples were collected from different regions of Saudi Arabia between 2010 and 2017 and tested for rabies infection through histopathological monitoring of Negri bodies in the brain. Diagnostic tests for rabies virus were conducted at three national reference laboratories; they are located in Al-Qassim, Al-Hassa, and Jeddah. Brain samples and collection of hippocampal tissue were performed for diagnostic evaluation using the rabies virus direct fluorescent antibody test (DFAT) [12]. The DFAT requires a tissue impression or smear on a microscope slide stained with a FITC anti-rabies monoclonal globulin conjugate that is specific for rabies virus (Fujirebio Diagnostics Inc., USA) which is visualized by fluorescent microscopy.

Statistical analysis

The data was collected and transferred into the statistical Package for Social Sciences (SPSS) Version 22.0 (SPSS Inc., Chicago, Illinois) for descriptive statistical analysis. The 2-tailed chi-square test was done for testing the incidence of rabies regarding to the different regions in KSA and also for the incidence of this disease between different species of animal according to the collected samples. The association in the chi-square test was considered significant when $P \leq 0.05$.

Results

Detection of rabies in animals and regions

The overall number of rabies positive cases was 158 (79.4%), of which 34 were dogs (21.5%), thirteen cats (8.2%), eighteen foxes (11.4%), twenty six sheep (16.5%), thirty four camels (21.5%), twenty six goats (16.5%), four wolves (2.5%), two monkeys (Papio hamadryas hamadryas) (1.3%) and one procavia capensis (0.6%) (Table 1).

During the sampling period 2010-2017, the total number of recorded positive rabies cases in different animal species was 158 from 199 suspected cases with positivity percentage 79.4%. The majority of rabies cases came from Al-Qassim region (63/158; 39.9%), Eastern region (48/158; 30.4%), Riyadh region (25/158; 15.8%) and Al-Madina region (10/158; 6.3%). Fewer rabies-confirmed cases were recorded from animals in Hail (3/158; 1.9%), Tabuk (3/158; 1.9%), Jouf (3/158; 1.9%), Gazan (2/158; 1.3%) and Northern Boundaries (1/158; 0.6%) (Table 2) (Fig. 1).

Table 1
Recorded cases of animal rabies in Saudi Arabia 2010–2017.

Animal species	Suspected cases	Negative cases	Confirmed cases	Positivity percentage
Dog	47	13	34	72.3%
Cat	19	6	13	68.4%
Fox	24	6	18	75%
Wolf	6	2	4	66.7%
Sheep	31	5	26	83.9%
Goat	29	3	26	89.7%
Camel	40	6	34	85%
Procavia capensis	1	0	1	100%
Monkeys	2	0	2	100%
Total	199	41	158	79.4%

Table 2
The incidence of animal rabies in different regions in Saudi Arabia.

Region	No of tested animals	No of positive animals	Percentage of positivity
Riyadh	29	25	85.2%
AL-Qassim	84	63	75%
Eastern region	59	48	81.4%
Northern boundaries	1	1	100%
Jouf	3	3	100%
Al-Madina	14	10	71.4%
Hail	4	3	75%
Gazan	2	2	100%
Tabuk	3	3	100%
Total	199	158	79.4%

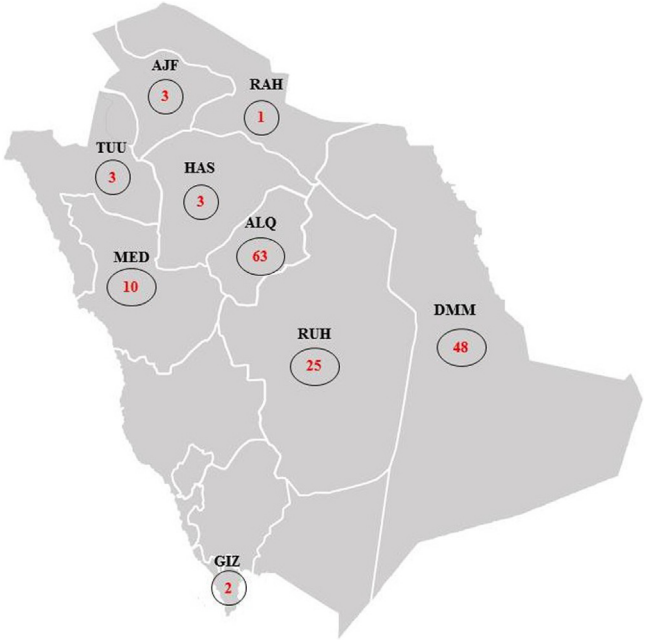

Fig. 1. Map of Saudi Arabia indicating the number of rabies cases in different regions in the period from 2010 to 2017.
Abbreviations: TUU, Tabuk; AJF: Jouf; HAS: Hail; RAH: Northern Boundaries; ELQ: El-Qassim; MED: Al-Madina; RUH: Riyadh; GIZ: Gizan; DMM: Eastern region.

Discussion

At present, according to the growing population in Saudi Arabia, many new cities are being developed stretching into the desert regions. This extension increases the chance of wild carnivores to

attack farm animals and human [13–15]. Most livestock cases were reported to be carnivores as incidents where livestock were not been vaccinated, and therefore rapid protection should be provided to maintain safe national livestock. The World Organization for Animal Health (OIE) has recommended rabies prophylactic vaccination for farm animals and it has succeeded in endemic countries [15–17].

The data presented here clearly demonstrate that dog and cat rabies remains a significant public health problem in Saudi Arabia. During the period from 2010 through 2017, the number of dog and cat rabid cases were 34 (72.3%) and 13 (68.4%) respectively. Camels, sheep and goats are the most affected species among farm animals by rabies (21.5%, 16.5% and 16.5%, respectively). These data were in agreement with the previous reports, showed that affected livestock pose potential risk to veterinarians and farmers which underline the importance of applying rabies control measures to humans [10,14]. In addition, the current study shows that foxes and wolves (11.4% and 2.5%, respectively) are the most common wild animals infected with rabies in Saudi Arabia,' can be supported by the study findings due to selection bias (passive surveillance) and unknown denominators. Moreover, rabies is diagnosed for the first time in Saudi Arabia in two monkeys (Papio hamadryas hamadryas) (1.3%) and one procavia capensis (0.6%). MEWA unpublished data from the years 1988–1991 indicated that 103 out of 161 heads of different animal species, were positive for rabies (63.9%) and the highest positivity were recorded in foxes and wolves. Moreover, the majority of positive cases were recorded in Taif, Asir, Al-Madina, Riyadh and Al-Qassim.

In the current study, the higher cases of rabies-positive animals were recorded in Al-Qassim (63 cases), Eastern region (48), Riyadh (25) and Al-Madina regions (10). Also rabies cases were recorded in different regions in Saudi Arabia as Jouf, Hail, Tabuk, Northern Boundaries and Gizan. However, this observation is likely to be affected by sampling bias due the proximity of these districts to diagnostic facilities and rabies control knowledge.

This study has a number of limitations. A major drawback in determining the true burden of animal rabies in Saudi Arabia is the passive nature of surveillance. At present, the only source of samples for rabies diagnosis is those that were submitted after an animal bite incident, of which the majority are caused by feral dogs. This is likely to reduce the actual number of rabies cases and may represent only the "tip of the iceberg".

A policy specifying the suspect's procedures for a sample of tested animal brain and the procedures for submission to reference diagnostic laboratories are provided by the Saudi MEWA. The effective post exposure prophylaxis (PEP) protocol for unvaccinated domestic animals exposed to rabies includes immediate vaccination against rabies. This PEP schedule has proven to be effective for controlling rabies in domestic animals. Previous reports showed that rabies can be prevented by timely administration of PEP. In addition, the post exposure immunization of animals should be implemented as soon as possible in a timely manner after exposure is recommended for the same periods [18,19].

Successful control and eradication of rabies are achieved through effective vaccination programs for pet animals especially dogs and cats, to achieve acceptable levels of immunity to control rabies [20]. With regard to rabies-control and eradication in Saudi Arabia, the MEWA has an active program with the aim of elimination human rabies mediated by dogs by 2030, including advocacy by the authorities for the prevention and control of rabies, community mobilization, dog immunization, resources allocation, public awareness, provision of post-exposure prevention and facilitation of the coordination between human and animal health sectors.

In conclusion, the data presented here show that rabies remains a major challenge to public and animal health in Saudi Arabia. More detailed information on the animal rabies (epidemiology, virus isolation, genomic sequencing and phylogenetic analysis) in Saudi Arabia would be of great interest.

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Competing interests

None declared.

Ethical approval

Not required.

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