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# RABIES OUTBREAK IN A NOMADIC COMMUNITY IN RINGIMAWA VILLAGE, KANO STATE, NIGERIA: A CASE REPORT

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## ABSTRACT

Rabies remains a significant public health concern in Nigeria, particularly among rural and nomadic populations with limited access to veterinary and healthcare services. This case study investigates a rabies outbreak that occurred in Ringimawa, a nomadic community in Garun Malam Local Government Area of Kano State. The outbreak was triggered by the bite of a rabid dog, which led to multiple exposures among animals. A total of 4 cattle and Five dogs were involved in the outbreak with 75% and 100% fatality in each dog and cattle species respectively. Brain tissues and saliva samples from the cows tested positive using chromatographic lateral flow assay (Shenzen Lvshiyuaun Biotecnology) and further confirmed positive by Florescent antibody assay by a reference Laboratory. In response, a rapid multi-sectoral team was mobilized to conduct emergency vaccination of dogs, community sensitization, and contact tracing. The outbreak underscores the urgent need for a One Health approach to rabies control, emphasizing improved access to veterinary and public health interventions, especially in underserved nomadic communities. Strengthening community-based surveillance, promoting responsible dog ownership, and integrating nomads into national rabies elimination programs are essential to achieving the global target of zero human deaths from dog-mediated rabies by 2030.

**Keywords**: Rabies, Outbreak, Cattle, Dog, Nomadic community

## INTRODUCTION

Rabies is the oldest known zoonotic fatal viral disease that affects only warm-blooded mammals Abdelmaliki et al., 2021). Rabies in livestock has been endemic in many developing countries for many years and diagnosed through clinical signs and dog-biting history (Abdelmaliki et al.,2021). The rabies virus (RABV) infects the central nervous system transmitted through direct contact with saliva or brain/nervous system tissue by an infected animal. Bites from rabid dogs are responsible for 99% of human rabies death in developing countries. Unfortunately, there is paucity of data on dog bite injuries and related mortality in most developing countries (Mshabwella et al., 2021). The estimated economic costs of canine rabies is 8.6 billion USD, mainly due to loss of productivity as a result premature deaths, costs of post-exposure prophylaxis (PEP), and income loss for seeking PEP. Costs of Livestock deaths were 512 million USD per year, especially in livestock-dependent African economies and some Asian countries such as Sudan, Ethiopia, India, Bangladesh and Pakistan (Harmpson et al., 2015).

The causative agent of rabies is Lyssavirus genus belonging to the Rhabdoviridae family. It is a bullet shaped virus, containing a single-stranded RNA genome (Moges, 2015). The lyssavirus is inactivated by exposure to sunlight and air and also prone to the ultraviolet radiation (Tojinbara et al., 2016). The transmission of this disease requires entrance of virus through the saliva of an infected animal due to biting, wounds or unwrap cuts in fur or mucous membranes (Langley, 2009). It can also be acquired by contact with neurological tissues, typically through mucous membranes or breaks in the skin. Some previous reports suggested infection following butchering of infected carcasses, (Tariq et al., 1991; Noah et al., 1998) and recently an unvaccinated veterinarian prepared domestic herbivores for submission for rabies testing without using personal protective equipment later succumbed to rabies (Brito et al., 2011). In the United States, ingestion of unpasteurized milk from rabid cows has been considered a possible exposure to virus (Centers for Disease Control and Prevention, 1999). After inoculation, the Rabies virus initially replicates locally in striated muscle cells or other subcutaneous tissues at the site of the bite (Hemachudha et al., 2013). The virus then enters peripheral nerves by binding to nicotinic acetylcholine receptors at neuromuscular junctions. This receptor-mediated entry facilitates the virus's retrograde transport through the axons of peripheral nerves toward the central nervous system (CNS) via motor and sensory neurons (Fooks et al., 2017). The virus travels centripetally (toward the CNS) within the axoplasm of peripheral nerves at a rate of approximately 12–100 mm per day (Jackson, 2013). Once in the spinal cord and brain, the virus undergoes extensive replication, particularly in the grey matter and this stage marks the onset of clinical symptoms, which may include hydrophobia, agitation, confusion, or paralysis depending on the form (furious or paralytic) of the disease (Warrell & Warrell, 2004). The virus may spread centrifugally (away from the CNS) to other tissues such as salivary glands, skin, cornea, and various viscera. The presence of virus in the salivary glands allows for continued transmission through bites (Hemachudha et al., 2013).

The incubation period in animals is usually around 2-3 weeks to 3 months, but it has been reported to range from a few days to 6 months, and even longer in rare cases (Spickler, 2021). It is widely held that some breeds of cattle succumb faster to rabies than others and young animals are more susceptible than adults (Ibrahim et al., 2017).

The clinical signs of the disease manifest 2-3 days after incubation and it start with behavioral changes (WHO, 2013). The diseases can manifest as furious or paralytic (Dumb) form. For furious form the disease is characterize by agitation, wandering, weeping, polypnea, excessive salivation, and

attacks upon other animals, community or unresponsive objects, ingestion of foreign items (Bano et al., 2016). In cattle, strange attentiveness can be an indication of this phase (Banyard et al., 2013). The "dumb" type of rabies is usually characterized by the progressive paralysis. Paralysis of the gullet and masseter muscles; the animal might be incapable of swallowing, and profuse salivating. There may be a change in voice of infected animal due to laryngeal paralysis, including atypical bellowing in cattle and barking in dogs (Bano et al., 2016). In addition to that, there might be facial paralysis along with dropping of the lower jaw. Ruminants may become isolated from the herd (Yang et al., 2012). Even though rabies is a highly fatal infection, it is preventable with the timely and proper administration of rabies post-exposure prophylaxis (Fooks et al., 2017).

**Case Presentation**

On the 23rd of September 2023, a Community Animal Health Worker (CAHW) alerted the Rano Zonal Veterinary Coordinator about suspected rabies cases in Ringimawa Village, Garun Malam LGA. Immediately after the report, an outbreak investigation team was deployed to conduct a case investigation. Upon visiting the affected herd, the herder informed the team that, on the 19th June, 2023, a stray dog entered the herd and attacked two puppies. One of the puppies died the same day while the other survived the attack.

After 15 days (4th Jul, 2023), the surviving puppy began to exhibit sign of madness (rabies-like symptoms) and subsequently bit its mother on the face, shoulder and leg. The puppy was killed and buried, while the bitch was treated using traditional herbs.

About three weeks later (24th July, 2023), the bitch also became aggressive and bit three adult cattle, one calf and a neighboring dog on the head, hind limb, dewlap and neck respectively. The bitch was later killed and buried. Further investigation revealed that the bitch was never vaccinated against rabies.

Subsequently, on the 19th September 2023, one of the cows bitten on the head became wild and aggressive. The animal was slaughtered and sold to local butchers on the 23rd September, 2023 which coincide with the day investigation team visited the herd (Figure: 1). The team traced the cow's head already sold to food vendors and partially processed for human consumption (Figure: 2). The head was retrieved from the vendors and sent to Gwale Veterinary Reference Laboratory for testing. Further inquiries confirmed that no human exposure occurred from either the rabid dog and the infected cattle.

Figure 1: Processing of meat from rabies positive cow for human consumption

Figure 2: Rabid cow's head processed for human consumption

**Table 1: Line list of the cases**

| Animal | Age | Sex | Date of Exposure | Site of exposure | Date of Onset | Clinica signs | Date reported | Intervention given | Outcome (Alive/Dead) | Mode of death |
|---|---|---|---|---|---|---|---|---|---|---|
| **Dog 1** | Adult | M | Unknown | Unknown | Unknown | Aggressiveness | Not reported | None | Dead | Killed |
| **Puppy 1** | Young | F | 19/06/23 | Face, leg and back | NA | NA | Not reported | None | Dead | Killed |
| **Puppy 2** | Young | M | 19/06/23 | Back, leg and abdomen | 04/07/23 | Aggressiveness, attacking animate and inanimate object | Not reported | Traditional herbs | Dead | Killed |
| **Bitch** | Adult | F | 04/07/23 | Face, shoulder and leg | 24/07/23 | Aggressiveness, biting inanimate objects, emaciation, pica | Not reported | Traditional herbs | Dead | Killed |
| **Cow 1** | Adult | F | 24/07/23 | Head | 19/09/23 | Aggressiveness, excessive salivation, hoarse bellowing and abnormal posture | 23/09/25 | Traditional herbs | Dead | Slaughtered |
| **Cow 2** | Adult | F | 24/07/23 | Head | 05/10/2025 | Dullness | 23/09/25 | PEP | Dead | Slaughtered |
| **Cow 3** | Adult | F | 24/07/23 | Fore leg | NA | NIL | 23/09/25 | PEP | Alive | NA |
| **Calf** | Young | M | 24/07/23 | Dewlap and neck | 02/10/23 | Aggressiveness, excessive salivation, hydrophobia | 23/09/25 | PEP | Dead | Slaughtered |
| **Dog 2** | Adult | A | 24/07/23 | Neck and head | NA | NA | 23/09/25 | NIL | Dead | Killed |

Key: PEP = Post exposure prophylaxis (human diploid rabies vaccine)

**Laboratory Investigation**

The whole head of the slaughtered cattle and saliva samples from the live cattle were sent to Gwale Veterinary Laboratory and screened using Rapid Immunochromatic assay test by (Shenzen Lvshiyuaun Biotechnology).

Test procedure: Rapid Immunochromatographic test for brain and saliva samples (Green Spring®)

Test procedure was performed according to Kit manufacturer. Brain tissue was removed from the animal's head. A 10% (w/v) brain tissue suspension was prepared by weighing 1 gram of brain tissue using a digital balance and placed into a sterile test tube containing 9 ml Phosphate-buffered saline (PBS). The tissue was thoroughly homogenized using sterile plastic stick. Using a sterile pipette, three drops of the homogenized suspension were transferred into the sample buffer provided with immunochromatographic test kit and mixed gently. The test cassette was removed from the foil pouch and placed horizontally on the table. Subsequently, three drops of the mixture were dispensed into the sample well of the cassette using a dropper, and the result was read after 10 minutes, following the manufacturer's instruction.

For the saliva sample, a sterile swab was gently immersed in the sample buffer and mixed thoroughly for 30 seconds. Three drops of the resulting mixtures were then dispensed into the sample well of the test cassette, and the result was read after 10 minutes.

## RESULTS AND DISCUSSION

**Results**

The brain sample (head) (Figure: 3) tested positive while the saliva from the live cattle negative. The brain sample was subsequently sent to National Rabies Laboratory at the National Veterinary Research Institute (NVRI), where the presence of rabies virus was confirmed using Direct Fluorescence Antibody Technique (DFAT).

Figure 3: Two band indicating Rabies positive

**Management/Outcome**

The herdsman declined professional advice to cull all the affected animals due to lack of government compensation. Consequently, he was advised to isolate the exposed animals and administer post-exposure prophylaxis (PEP) under supervision of zonal veterinary officer.

After nine days (2nd October, 2023), the calf began exhibiting abnormal behavior. A saliva sample was collected using sterile swab and tested positive for rabies. The result was positive and the calf was subsequently culled.

Three days later, saliva samples were collected from the remaining two cows. One turned out positive and the other was negative.

The third cow, which tested negative, received four doses of PEP. A follow-up saliva sample was collected three months after the fourth dose and tested. The test result was negative for Rabies (Figure: 4).

During a follow-up visit on 15th October, 2024, it was observed that the cow has given birth to a healthy calf.

A ring vaccination was conducted in Ringimawa and neighboring communities. A total of ninety-seven (97) cattle were vaccinated against rabies. Community sensitization was also conducted on prevention of rabies and the importance of early disease reporting to veterinarians/public health officers.

Figure 4: One band indicating rabies negative

**Discussion**

Rabies is a rapidly fatal disease threatening livestock and human beings in Nigeria. The disease has become one of the most serious Zoonoses in Nigeria, though its occurrence has been under reported (Ibrahim et al., 2017). According to the Nigerian Center for Disease Control, rabies is an endemic disease occurring in both humans and animals throughout Nigeria, and has been reported to be responsible for the death of over 50,000 people annually (WHO, 2019). Livestock and wildlife rabies in Nigeria have been much less studied and most livestock rabies cases in Nigeria occur after bites from rabid dogs (Mshelbwala et al.2013). The actual status of rabies in Nigeria remains unclear following serological surveillance due to the circulating antibodies from the protection rendered to thousands of humans receiving pre-exposure and post-exposure treatment annually (Alhassan et al., 2020).

The incubation period for the case presented was between 15 to 21 days in dogs and 54 to 66 days in cattle. This shows that incubation period is longer in cattle compared to dogs. Previous study reported longer incubation period in livestock with average of 37.4 days in cattle (Jamberu et al., 2013

This outbreak exposed poor vaccination coverage and lack of awareness among herders and community in general. All the positive rabies cattle were slaughtered for human consumption and this may lead to the spread of the virus among people that comes in contact with brain/spinal tissues and saliva of the affected animal. The affected cattle pose a serious risk to animal health workers herders as well as butchers and community members that had come in contact with the animal. In Iran, a case of human rabies due to contact with the saliva of rabid cattle was reported in 2012 (Simian et al., 2012).

All the four rabid dogs were killed and buried in the community and none of the cases was reported to veterinary authority and this can also increase the likelihood of the exposure and further spread of the infection. Additionally, there are high chances of other dogs and carnivores getting access to the dead carcasses or feasting on the carcass remnants thereby potentiating the transmission cycle. Furthermore, people should know that all suspected rabid animal should be reported to veterinarian or animal/health authority rather than killing/slaughtering the animal as this could serve as potential risk to people during the process of slaughter, killing or processing of carcass.

The treatment of all the affected animals using folklore medicine is a pointer to the need to intensify enlightenment on the appropriate ways of dog bites management. Audu, et.,al, advocated for total discouragement of traditional medicine intervention for the treatment of rabies cases and people should be better educated on the implication of such practice with its potentially fatal outcomes (Audu et al. 2019), as these may interfere with timely post exposure management (Jamberu et al., 2013). Global rabies conference vision of zero human deaths from dog-mediated rabies by 2030 is unlikely achievable in pastoralist community with the current attitude toward the use of post exposure vaccine and inefficient rabies control program (Abela-Ridder et al., 2016).

Although law/regulation to enforce vaccination of dogs against the disease exists in Nigeria, unfortunately the laws are not being enforced. Incidence of rabies in livestock as reported is significant and should be appreciated by veterinary authorities through public education and purposeful animal vaccination campaigns in dogs and cats against the disease (Ibrahim et al., 2017). This will help in improving vaccination coverage as control and prevention of rabies in Nigeria lies with the dog owners. This is especially important considering the significant impact the disease has on health and socioeconomic wellbeing of society. The enlightenment should highlight the need to avoid contact exposure to all potentially rabies-infected wildlife and susceptible domesticated animals (Ngugi et al., 2018). Previously few reports of Bovine rabies outbreak were reported in Kano State, Nigeria (Ibrahim et al.) There might have been similar reports that might not have been reported in Kano state and other parts of Nigeria.

To eliminate rabies transmitted through dog bite, creation of awareness among dog owners and community on rabies mass vaccination is important. There is also a need for updated law/regulation to enforce vaccination in dogs with provision for harsh fine or dog seizure for defaulters. Previously few reports of Bovine rabies outbreak were reported in Kano State, Nigeria (Ibrahim et al.) There might have been similar reports that might not have been reported in Kano state and other parts of Nigeria.

## CONCLUSION

Rabies incidence is increasing in Kano state and this could be largely due to poor vaccination coverage and lack of efficient community awareness on rabies prevention and control. There is a need of provision of adequate rabies vaccine and logistics as well as proper planning, mobilization and implementation of mass dog vaccination. Similarly, we strongly advocate a one-health approach involving multidisciplinary professionals to raise more awareness on rabies/dog bite management as well as mass awareness to dog owners especially hunters on rabies and rabies vaccination as this will also help in reducing the number rabies cases and subsequently rabies elimination in the state. We also strongly recommend provision of adequate post-exposure vaccine and rabies immunoglobulin as this will help in reducing number of clinical rabies cases. There is a need for government/legislature to review dog vaccination act and ensure strict compliance with the act.

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