Research Article

Occurrence of Lassa Fever Virus Infections and Control Efforts in Nigeria

Martha Echioda Ogbole*, James Agbo Ameh, Samuel Mailafia, Olatunde Hamza Olabode and Bridget Jessica Adah

Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Abuja.

Abstract | Lassa fever (LF), caused by Lassa virus (LV), is a severe and acute viral haemorrhagic fever. The LV is a single-stranded RNA virus of the family *Arenaviridae*, transmitted by the *Mastomys natalensis* rodent. This retrospective study was undertaken to determine the annual prevalence, distribution and case fatality rate (CFR) of LF in Nigeria with a view to establish the disease burden and dynamics, and to guide a sustainable control plan. The LF weekly epidemiological reports were obtained from the Nigeria Center for Disease Control (NCDC) between January 2016 - January 2021. Positive cases were confirmed based on laboratory confirmation of LV- transcription polymerase chain reaction (LASV-RT- PCR). The number of suspected and confirmed cases as well as total deaths and case fatality rates in the years under review were collated. Out of the total number of 17,777 suspected cases, 2959 cases were confirmed positive for LF by a laboratory test, while 781 deaths were recorded. Annual distribution of LF showed significant increase in number of cases with 152 (9.6%) confirmed cases recorded in 2016, 143 (19.51%) in 2017, a very high and steady increase was observed in 2018, 2019 and 2020 with confirmed cases at 633 (18%), 833(16%) and 1189 (17%) respectively. LF is endemic in Nigeria especially among both gender within 11 - 40 years of age within the rural settings characterized by sporadic outbreaks of the disease occurring mostly during the dry season. It is hereby recommended that policy makers should timely provide prioritized budgetary allocation for the control of LF. In addition, sustained public enlightenment campaigns on strict hygienic practices and rodent control are also advocated.

Received | December 13, 2021; **Accepted** | December 24, 2021; **Published** | February 10, 2022
***Correspondence** | Martha Echioda Ogbole, Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Abuja; **Email:** echioda.martha@uniabuja.edu.ng
Citation | Ogbole, M.E., J.A. Ameh, S. Mailafia, O.H. Olabode and B.J. Adah. 2022. Occurrence of lassa fever virus infections and control efforts in Nigeria. *Hosts and Viruses*, 9: 7-11.
DOI | https://dx.doi.org/10.17582/journal.hv/2022/9.1.7.11
Keywords: Lassa virus, Lassa fever, Rodents, Control, Nigeria

Introduction

Lassa fever (LF) was first described in Sierra Leone in the 1950s but the virus responsible for the disease was not identified until 1969 when two missionary nurses died in Nigeria, and the cause of their illness was found to be Lassa virus (LV), named after Lassa town in Southern Borno, Nigeria, where it was first isolated (Ogbua *et al*., 2007). LV the etiological agent of LF, belongs to the family *Arenaviridae* within the genus *Arenavirus*. The LV is an enveloped, round or pleomorphic particle, measuring about 110 to 130 nm in diameter. Its genome consists of two single stranded RNA segments (bi-segmented), the large L segment and the small S segment. The large segment code the viral polymerase and zinc binding protein while the small segment encodes the structural proteins-nucleoprotein and glycoprotein precusor (Yaro *et al*.,

2021).

The reservoir hosts of LV are rodents of the genus *Mastomys natalensi*s, a multimammate rat that is common in West Africa. Once infected, the rodent shed the virus in urine for a long time or the rest of its life (Olayeme *et al*., 2017). Humans presumably become infected through contact with infected rodent excreta, urine, tissues, or blood (Okwor *et al*., 2018).

Incubation period of the disease is between 3 and 21 days, it affects all age groups, both men and women. Persons at greatest risk are those living in rural areas where the *M. natalensis* is usually found, especially in areas of poor sanitation or crowded living conditions. Health care workers are at risk if proper barrier nursing and infection control are not maintained (WHO, 2020).

Lassa fever is a severe viral haemorrhagic fever listed among the WHO priority diseases in need of urgent research and development and it is classified as a category "A" bioterrorism agent that can serve as biological weapon (WHO, 2021). Unfortunately, the disease is endemic in several West African countries including Nigeria, Sierra Leone, Guinea, Ivory coast, Togo, Mali and Liberia. With over 300,000-500,000 infections yearly and over 5,000 deaths annually (Aeez-Akande, 2016).

Clinical manifestations of Lassa fever are variable, and often nonspecific as many of its symptoms are seen in other febrile infectious diseases in endemic areas, the body temperature may increase to 40°C, and constant fever for 10 days or more is alarming (Shehu *et al*., 2018). A clinical and epidemiologic study done in Plateau state, Nigeria, between 2012 and 2013 showed that 100% of Lassa fever patients were from Rural/sub-urban residence, and 100% presented with fever, 83.3% with hemorrhage, 66.7% with cough, 33.3% with sore throat, 33.3% with proteinuria, and 16.7% with retrosternal chest pain (Isa *et al*., 2013).

Clinical diagnosis of LF is often difficult especially in the early course of infection, may be difficult to distinguish from diseases that are common in the tropics such as severe malaria, typhoid fever, yellow fever and other viral haemorrhagic fevers. Accurate diagnosis of Lassa fever is facilitated by history of the disease, its clinical manifestations, epidemiological data and laboratory findings. The Nigeria center for disease control often employ the use of enzyme linked immunosorbent assays and other rapid diagnostic test kits (RDT) in detecting lassa virus specific antibodies (IgG and IgM) and antigens specific for lassa virus nucleoproteins in sera and confirmed positive using lassa virus-reverse transcription polymerase chain reaction (LASV-RT- PCR) (NCDC, 2017).

Like other severe hemorrhagic fevers, clinical management of Lassa fever is centered on supportive therapy. The only antiviral agent with a proven therapeutic effect against lassa virus is ribavirin and it is considered the current drug of choice. The virus can be inactivated by chemical agents such as 0.5% sodium hypochlorite, 0.5% phenol and 10% formalin (NCDC, 2017). Case fatality rate (CFR) of the disease in Nigeria ranges from 13 to 27%, however, during epidemic outbreak, the case fatality may be up to 50 percent or even higher (Idemyor, 2010; Yaro *et al*., 2021). Increasing outbreaks of the disease pose a serious public health problem in Nigeria. This study was undertaken to determine information on the annual prevalence, distribution and case fatality of LF in Nigeria.

Materials and Methods

Study area

Nigeria is a West Africa country with 36 states and a Federal Capital Territory (FCT). The country has six geopolitical zones namely: The North central, North east, North west, South east, South south and the South west. Nigeria shares land borders with the Republic of Benin in the west, Chad and Cameroon in the east, and Niger in the north. Its coast lies on the Gulf of Guinea in the south and it borders Lake Chad to the northeast. The Adamawa Plateau, Mambilla Plateau, Jos Plateau, Obudu Plateau, the Niger River, Benue River, and Niger Delta are notable geographical features in the country**.** It has a tropical climate with two distinct seasons the raining season and dry season. Nigeria has a population of over 200 million with a total land area of 923,769 km2 (Mylne *et al*., 2015).

Source of data

The data used for this retrospective study was obtained from the Nigeria center for disease control (NCDC) official website. The flow of these surveillance data to NCDC starts from the community (Ward/LGA - States) up to the National through the Integrated

Disease Surveillance Response Strategy (IDSR). Positive cases were based on Lassa virus-reverse transcription polymerase chain reaction (LASV-RT-PCR) confirmed at the NCDC's National Reference Laboratory in Abuja, Irrua Specialist Teaching Hospital in Edo State, Federal Medical Centre Owo in Ondo State, Alex Ekweme Federal Teaching Hospital Abakaliki and Lagos University Teaching Hospital. Weekly epidemiological reports on LF cases were collated from 1st January 2016 to January 2021.

Statistical analysis

Statistical analysis in this study was done using Statistical packages for social science (SPSS) software (version 26.0 for windows Xp and vistal). Simple descriptive statistics such as percentages, tables and charts were used to express the frequency and annual distribution of LF in Nigeria. CFR was calculated as: Number of death/number of cases x 100.

Results and Discussion

A total number of 17,777 suspected LF cases were reported across the federation from January 2016 to January 2021. Of these, 2959 cases were confirmed positive for LF by a laboratory test and 781 LF confirmed deaths were recorded with an overall case fatality rate of 26.39% in the years under reviewed. Collated data showed significant increase in number of cases, 152 (9.6%) confirmed cases were recorded in 2016, 143 (19.51%) in 2017, a very high and steady increased was observed in 2018, 2019 and 2020 with confirmed cases at 633 (18%), 833 (16%) and 1189 (17%), respectively (Table 1). The highest prevalence of 19.51% was recorded in 2017. CFR was highest in 2016 (78%), 49.7% was recorded in 2017, while CFR of 27%, 20.9% and 20 52% were recorded in 2018, 2019 and 2020 respectively (Table 2). Majority of the confirmed cases were reported from Ondo State 75%, Edo State 32%, Ebony State 7%, Bauchi State 7%, Taraba State 5% and Plateau State 4%. The disease spread from 19 states in 2016 and 2017 to 26 states and the FCT in 2018, then to 30 states and the FCT in 2019. At the end of December 2020 and first week of January 2021 at least one confirmed case of LF was recorded in 32 States across 147 local government areas of Nigeria over the last for years.

This retrospective study reports the prevalence, annual distribution and case fatality of LF in Nigeria, for a period of five years. The trend of the annual occurrence of LF between 2016-2021 indicates steady increase involving 28 States in 2016 and 32 States as well as FCT in 2021 as shown in Table 1. This could be as a result of poor handling of farm produce characterized by contaminators such as *M. natalensis* rodents, the known natural carrier of LFV and poor rodent control enhanced by increasing rodents' population. The high lushness of the rodents in human dwelling is due to the ability of the rodent to multiply very fast, an important factor in the spread of the virus, thus has a direct impact on prevalence of the disease in the country (Yaro *et al.*, 2021). Also, harvesting of agricultural products is mostly done during the dry season, and the practice of drying grains and other food products under the sun mostly along roadsides predisposes the agricultural produce to contamination with urine and faces of *M. natalensis* rodents, thus facilitating the transmission of the virus to humans as previously reported (Olayeme *et al.*, 2017).

Table 1: *Annual distribution of Lassa fever cases in Nigeria (Jan. 2016- Jan 2021).*

Year	Suspected case	Confirmed cases	Prevalence (%)
2016	1589	152	9.6
2017	733	143	19.51
2018	3498	633	18
2019	5057	833	16
2020	6791	1189	17
2021 wk1	109	9	8
Total	17777	2959	16.64

Table 2: *Annual case fatality rate of Lassa fever cases in Nigeria.*

Year	Confirmed cases	No of deaths	CFR (%)
2016	152	119	78.28
2017	143	71	49.65
2018	633	171	27.01
2019	833	174	20.88
2020	1189	244	20.52
2021 wk1	9	2	22.22
Total	2959	781	26.39

Similarly, the nonspecific signs and symptoms of the disease, makes it difficult to differentiate it from other endemic diseases in Nigeria. Failure to observed high level of suspicion for lassa fever in patients presenting with severe malaria, typhoid fever, yellow fever is responsible for increase in lassa fever nosocomial infections in hospital settings especially among

health care workers. Nosocomial transmissions have been attributed largely to failure to adhere to strict adherence to infection prevention and control (ICP) practices (Hamblion *et al*., 2018).

In this study, 2,959 cases were confirmed positive for LF by a laboratory test using the Lassa virus reverse transcription polymerase chain reaction The collated data showed significant annual increase in the number of confirmed LF cases in the years under reviewed as shown in Figure 1. This could be attributed to the recent advanced developments in LF diagnostic techniques and laboratories which has increased the testing capacity, with more sensitive and specific diagnostic techniques thus providing more accurate diagnosis. However, considering the number of existing LF laboratories in the country, there exist a diagnostic capacity deficit that requires urgent national attention for provision of additional laboratories and strengthening of existing laboratory capacity for better outbreak detection and prevention of epidemics.

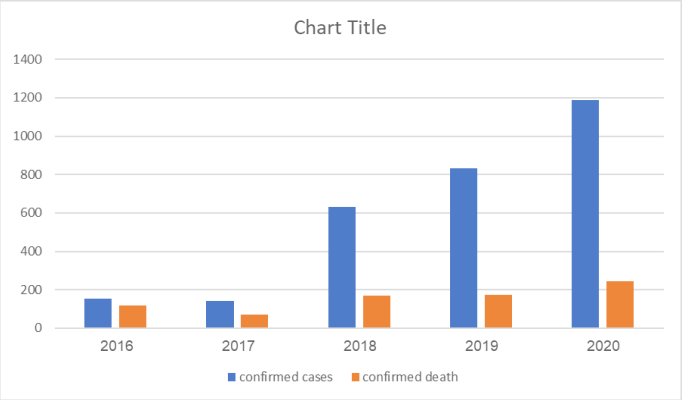

Figure 1: *A chat showing confirmed LF cases and deaths for a period of five years.*

The case fatality rate of LF in this study showed an irregular increase and decrease in the no of death in the years under reviewed. This could be associated with the instability in the hospital settings in Nigeria occasioned by the intermittent strike actions occasioned by labor unions that characterized developing nations like Nigeria. The upsurge of the death rate in the year 2020 may not be unconnected with possible co infection and complications of COVID-19 infections with the resultant precipitating the fatality rates during the pandemic period.

LF occurs in all age groups but the most predominant age affected is 11- 40 years in both sexes. The female to male ratio for confirmed cases is 1:1. People living in rural areas where *M. natalensis* rodents are predominant, especially in communities with poor sanitation or crowded living conditions are at greater risk of the disease (NCDC, 2017). The occurrence of LF in Nigeria is mostly during the dry season, that is from November to March, and this could be attributed to the practice of bush burning in the country aided by the harmattan wind (Ter Meulen *et al*., 1996).

There has been concerted efforts by the Nigeria Centre for Disease Control, the World Health Organization and other supporting partners in the control of LF in Nigeria through disease surveillance, laboratory and health care emergency response by designated teams. The Rapid Response Teams (RRTs) constitute stakeholders from the State and Federal Ministry of Health, Federal Ministry of Agriculture and the Federal Ministry of Environment.

Conclusions and Recommendations

In conclusion, this study provides preliminary findings in the endemicity of LF in Nigeria characterized by increasing annual cases and high case fatality rate amongst male and female especially 11-40 years.

It is hereby recommended that policy makers should prioritize budgetary allocation for the control of LF, establish new Lassa fever laboratories across the 36 states of the Federation and strengthen existing laboratory capacity for better outbreak detection and the prevention of epidemics. In addition, encourage public enlightenment campaigns strict hygienic practices and sustained rodent control.

Acknowledgments

Special thanks to the Nigeria Center for Disease Control for providing the weekly epidemiological update on LF.

Author's Contribution

MEO contributed to the general design, collation of data and writing of the paper. OHO, SM and JAA helped in the review and editing of the manuscript. BJA contributed to the design of the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

References

Azeez-Akande, O., 2016. A review of Lassa fever, an emerging old world haemorrhagic viral disease in sub-Saharan Africa. Afr. J. Clin. Exp. Microbiol., 17(4): 282-289. https://doi.org/10.4314/ajcem.v17i4.9

CDC, 2021. Lassa fever Available at: https://www.cdc.gov/vhf/lassa/index.html. Accessed on 11 september 2021.

Hamblion, E.L., Rafttery, P., Wendland, A., Dweh, E., Williams, G.S., George, R.N.C., Soro, L., Katawera, V., Clemet, P., Gasasira, A.N., Musa, E., and Nagbe, T.K., 2018. The challenges of detecting and responding to a Lassa fever outbreak in an Ebola-affected setting. Int. J. Infect. Dis., 66: 65-73. https://doi.org/10.1016/j.ijid.2017.11.007

Idemyor, V., 2010. Lassa virus infection in Nigeria: Clinical perspective overview. J. Natl. Med. Assoc., 102: 1243-1246. https://doi.org/10.1016/S0027-9684(15)30780-X

Isa, E., Shehu, N., Juryit, R., Simji, S., Shuaibu, J., and Egah, D., 2013. Epidemiological and clinical description of Lassa fever in Jos, Nigeria. High Med. Res. J., 13: 4.

Mylne, Q.N.A., Pigott, D.M., Longbottom, J., Shearer, F., Duda, K.A., and Messina, J.P., 2015. Mapping the zoonotic niche of Lassa fever in Africa. Trans. R. Soc. Trop. Med. Hyg., 109(8): 483-492. https://doi.org/10.1093/trstmh/trv047

NCDC, 2017. Viral haemorrhagic fevers preparedness and response plan. Abuja. NCDC. 2021. Situation report of Lassa fever outbreak in Nigeria. http://www.ncdc.gov.ng/diseases/sitreps/Nigeria. Retrieved 11 August, 2021.

Ogbua, O., Ajuluchukwub, E., and Unekec, J.C., 2007. Lassa fever in West African sub-region: An overview. J. Vector Borne Dis., 44: 1–11.

Okwor, T.J., Ndu, A.C., Okeke, T.A., Aguwa, E.N., Arinze-Onyia, S.U., and Chinawa, A., 2018. A review of Lassa fever outbreaks in Nigeria from 1969 to 2017: Epidemiologic profile, determinants and public health response. Niger. J. Med., 27: 219–233. https://doi.org/10.4103/1115-2613.278784

Olayemi, A., Obadare, A., Oyeyiola, A., Fasogbon, S., Igbokwe, J., Igbahenah, F., Ortsega, D., Gunther, S., Verheven, E., and Fichet-Calvet, E., 2017. Small mammal diversity and dynamics within Nigeria, with emphasis on reservoirs of the Lassa virus. Syst. Biodiv., 16(2): 118–127. https://doi.org/10.1080/14772000.2017.1358220

Shehu, N.Y., Simji, S., Gomerep, S.E., Isa, K.O., Iraoyah, J., Mafuka, N., Bitrus, M.C., Dachom, J.E.O., Asukwo, E.O., Kenneth, O., Ephraim, O., Daniel, Z.E., Mateer, E.J. and Slobodan, P.L.F., 2016. Outbreak in Plateau State, Nigeria. The changing epidemiology and clinical presentation. Front. Publ. Health, 6: 232. https://doi.org/10.3389/fpubh.2018.00232

Ter Meulen, J., Lukashevich, I., and Sidibe, K., 1996. Hunting of peri domestic rodents and consumption of their meat as possible risk factors for rodent-to-human transmission of Lassa virus in the Republic of Guinea. Am. J. Trop. Med. Hyg., 55: 661–666. https://doi.org/10.4269/ajtmh.1996.55.661

World Health Organization, 2021. Lassa Fever. Available at: https://www.who.int/en/news-room/fact-sheets/detail/lassa-fever. Accessed on 5 September 2021.

World Population Review, 2020. Nigeria population review (Live). https://worldpopulationreview.com/countries/nigeria-population. Retrieved 31st October, 2020.

Yaro, C.A., Ezekiel, K., Kenneth, N.O., Gaber, E.B., Roua, S.B., Ashraf, A., Farag, M.A.A., Innocent, U.E., and James, P.O., 2021. Infection pattern, case fatality rate and spread of Lassa virus in Nigeria. BMC Infect. Dis., 21: 149. https://doi.org/10.1186/s12879-021-05837-x