Influenza A virus antibodies in horses and pigs in Nigeria: The need for One Health approach

Andrew Adamu [*]

Australian Institute of Tropical Health and Medicine, James Cook University, Townsville, Queensland, 4811, Australia
College of Public Health, Medical and Veterinary Sciences, James Cook University, Townsville, Queensland, 4811, Australia
Department of Veterinary Public Health and Preventive Medicine, University of Abuja, 900105, Nigeria
Centre for Tropical Biosecurity, James Cook University, Queensland, 4811, Australia

Rachael Adetunji

Department of Veterinary Public Health and Preventive Medicine, University of Abuja, 900105, Nigeria

David Emmanuel

Nigeria Field Epidemiology and Laboratory Training Program, Abuja 900231, Nigeria

Alex Adikwu

College of Public Health, Medical and Veterinary Sciences, James Cook University, Townsville, Queensland, 4811, Australia
Center for Tropical Biosecurity, James Cook University, Townville, Queensland, 4811, Australia

Sunday Idoko

Department of Veterinary Pathology, University of Abuja, Nigeria 900105, Nigeria

Oyelola Adegboye

Menzies School of Health Research, Charles Darwin University, Darwin, Northern Territory 0810, Australia

Shekwoduza Baba

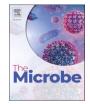*Yaya Scientific LLC, Nashville, TN, 37203, United States*

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ABSTRACT

Influenza A viruses are a great threat to human health because of their heterogeneity in its host range and the propensity of reassortment to novel viruses with pandemic potential. There is risk of zoonotic transmission of influenza A between humans and livestock due to close interactions. Due to the paucity of data on influenza A viruses among domesticated animals, we investigated the presence of nucleocapsid of influenza A virus antibodies using ID screen® influenza A antibody competitive multi-species enzyme linked immunosorbent assay. A total of 184 pigs were sampled from Benue state, and 92 horses were sampled from three local government areas of Kaduna state, Nigeria. Of the animals sampled, an estimated 25% (95% CI: 18.92, 31.90) of pigs and 93.48% (95% CI: 86.34, 97.57) of horses tested positive for influenza A virus IgG. The results indicate exposure of

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* Corresponding author at: Australian Institute of Tropical Health and Medicine, James Cook University, Townsville, Queensland, 4811, Australia.
  E-mail address: andrew.admu@my.jcu.edu.au.

domestic animals to influenza A virus, thereby raising concern of potential epidemics in both animals and humans. There is need for increased surveillance in both domestic animals and humans who are in close interaction.

Introduction

Since 1918, the influenza virus has expanded into diverse animal species (Nelson and Worobey, 2018). Although birds are believed to be virus reservoirs, antigenic shifts or drifts have resulted in mutations and the presence of the virus in humans and various animal species (Centers for Disease Control and Prevention, 2022). According to the World Health Organization, influenza is estimated to cause between 290,000 and 650,000 deaths annually (World Health Organization, 2023). Of the four types of influenza viruses (A-D), influenza A is known to have pandemic potential (Centers for Disease Control and Prevention, 2022). Whereas influenza has been associated with death in people over 65 in developed nations, children under five years are mostly affected in low-income countries (Thompson et al., 2009; Nair et al., 2011). There is a dearth of information on influenza A viruses in animals in Nigeria. Horses and pigs are valuable livestock appreciated for sporting events, religious festivals, and as a source of protein in different parts of Nigeria. These animals are known to be susceptible to arrays of pathogens such as influenza virus, West Nile virus, and Henipavirus (Olufemi et al., 2022; Musa-Gobe et al., 2022; Adamu et al., 2022a,2022b).

Methods

A total of 184 pigs were sampled from Benue state, and 92 horses were sampled from Kaduna state, Nigeria. Antibodies to influenza A virus were detected as described from previously published works by (Adamu et al., 2022b; Kittelberger et al., 2011) using I.D vet multispecies competitive ELISA (Grables, France), with over 95% sensitivity and specificity and the results interpreted as recommended by the manufacturer. Analysis of data was conducted using R version 4.0.1 with reference set at 95% confidence intervals and the results presented as frequencies and percentages as shown in Table 1.

Results and discussion

Both pigs, 25%, and horses 93.48% have been exposed to influenza A

Table 1
Seropositivity of influenza A virus antibodies among pigs and horses in Nigeria.

	Tested, n (%)	Positive, n	% of prevalence (95% CI)[a]
Pigs			
Overall	184 (100)	46	25 (18.92, 31.90)
Age			
<=5 years	69 (38)	17	24.64 (15.05, 36.49)
> 5 years	115 (63)	29	25.22 (17.58, 34.17)
Sex			
Female	28 (15)	7	25 (10.69, 44.87)
Male	156 (85)	39	25 (18.42, 32.55)
Horses			
Overall	92 (100)	86	93.48 (86.34, 97.57)
Age			
<=5 years	14 (15)	14	100 (76.84, 100)
> 5 years	78 (85)	72	92.31 (84.01, 97.12)
Sex			
Female	10 (11)	10	100 (69.15, 100)
Male	82 (89)	76	92.68 (84.75, 97.27)
Function			
Durbar	38 (41)	36	94.74 (82.25, 99.36)
Racing	54 (59)	50	92.59 (82.11, 97.94)
Fenced Area			
Yes	58 (63)	55	94.83 (85.62, 98.92)
No	34 (37)	31	91.18 (76.32, 98.14)

[a] Clopper-Pearson interval

virus from our study with varying levels of positivity. Most of these animals were raised extensively or, at best, semi-intensively with some degree of movement in search of feed. This brings them in proximity with wild birds that are considered as the natural reservoirs of the influenza A virus. Pigs have receptors that adequately support human and avian influenza virus replication to thrive, thereby creating a sub-type with pandemic potential (Nelson and Worobey, 2018). In Nigeria, evidence of influenza A virus has been reported in both pigs and pig handlers in Southwest Nigeria (Anjorin et al., 2023).

Furthermore, the horses sampled for our study were all local breed that are indigenous to northern Nigeria. Although, some of them could originate from neighboring West and Central African countries such as Niger Republic, Mali, and Burkina Faso. Some northern Nigerian states have international livestock markets Maigatari (Jigawa State), Mubi (Adamawa state), Mai'adua (Katsina state), Illela (Sokoto state), Gamboru (Borno state) and Nguru (Yobe state) which serve as a gateway for the transboundary movement of animals thereby resulting in the introduction of emerging and re-emerging disease pathogens.

The presence of influenza A virus antibodies in these animals poses a great challenge to humans in close contact with them. Furthermore, when considering the function of the horses, 38 horses used for Durbar (religious festival) purposes were tested, out of which 36 tested positive, similarly, of the 54 horses used for racing, 50 tested positive, resulting in a prevalence of 92.59%. While all the sampled pigs were from slaughterhouses across the state capital. In the two species, influenza A antibodies were present in pigs and horses irrespective of age categories and sex which further highlight the endemicity of the virus. In all these activities, there are mass gatherings of people, which could serve as a medium for virus dissemination. This corroborates with the study of Olufemi et al. (2022) who reported Durbar and sporting events as the most uses of horses in their study. Since Nigeria has yet to introduce the influenza vaccine into its expanded program on immunization for humans and animal, the country will continue to experience covert or overt circulation of influenza A viruses among its population. Therefore, the National Health Authorities should scale up surveillance on influenza viruses in humans and animals using a collaborative One Health approach. Data generated at animal-human interface on novel strains can be merged into evidence-based approaches for vaccine selection for an effective institution of control measures against influenza (Meseko and Dzikwi-Emennaa, 2023). The study is a preliminary data on influenza A virus circulating among domesticated pigs and horses which is limited by our inability to identify the various genotypes or subtypes of influenza A viruses that could further elucidate if they truly have pandemic potential. We recommend future studies should look at the evolutionary diversity of influenza A viruses in various animals in Nigeria.

Ethics statement

This study was approved by the University of Abuja Ethical Committee of Animal Use with reference number UAECAU/2021/0010.

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CRediT authorship contribution statement

Adetunji Rachael: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **Adamu Andrew:**

Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Baba Shekwoduza:** Conceptualization, Investigation, Methodology, Resources, Validation, Writing – original draft, Writing – review & editing. **Adegboye Oyelola:** Formal analysis, Methodology, Software, Visualization, Writing – review & editing. **Idoko Sunday:** Conceptualization, Methodology, Writing – review & editing. **Adikwu Alex:** Conceptualization, Methodology, Writing – review & editing. **David Emmanuel:** Conceptualization, Investigation, Methodology, Writing – review & editing.

Declaration of Competing Interest

Authors have no interest to declare.

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