## Avian Influenza bio-surveillance in Nepal: Status, opportunities and challenges

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Avian influenza is a highly infectious disease of poultry with significant socio-economic impacts but also equally important public health threat due to its zoonotic potential. Nepal faced its first outbreak of highly pathogenic avian influenza (HPAI) H5N1 in 2009, and more than 400 outbreaks have been confirmed since then causing huge financial losses to the poultry industry. Apart from HPAI, low pathogenic avian influenza (LPAI), especially the H9N2, circulation in the country has posed serious economic threat to the poultry industry. Surveillance of poultry population on a regular basis helps to monitor the virus and can be controlled before it spreads to the population level. The Food and Agriculture Organization of the UN is supporting the Central Veterinary Laboratory in conducting the avian influenza active bio-surveillance from avian influenza high-risk districts. The objective of this study is to present the findings of the avian influenza bio-surveillance conducted between 2019 to 2025 and discuss the opportunities and challenges of avian influenza bio-surveillance in Nepal. Samples were collected during December 2019- March 2020 (8 districts), September- October 2024 (16 districts) and February- April 2025 (16 districts). In total, 2708 swabs and environmental samples were collected from live markets, slaughter places, poultry and pig farms and wild-bird interfaces. The collected samples were tested by using Real Time Reverse Transcriptase Polymerase Chain Reaction (rRT PCR) for M-gene first followed by further testing of positive samples for subtype H5, H9, H7, N1, N6, N8, N9 and N2 at the Central Veterinary Laboratory, Kathmandu. Results indicated that 434 out of 2708 samples tested (16.02%) were positive for LPAI H9N2 with variability across the years (22.8% during 2019-2020; 7.38% in 2024 and 14.3% in 2025) while none of the samples tested positive for HPAI. Among LPAI H9N2 positive samples, there were substantial variations observed by districts, species and sample types. These bio-surveillance program has provided an opportunity to track the circulation of the avian influenza virus in poultry and pig population of high-risk districts of Nepal and has contributed to build a sustained capacity for conducting surveillance and testing of avian influenza virus for early detection and warning. Challenges include failure of surveillance to detect the HPAI virus, limited spatial coverage (only 16 out of 77 districts of Nepal) and limited participation of large-scale poultry farmers in the surveillance. Another challenge is the lack of gene sequencing capacity to track the changes in the virus over the years. In summary, avian influenza active bio-surveillance program in Nepal has provided evidence of different avian influenza virus circulating in the poultry and pig population in a real time basis and will provide valuable information in formulating control policies and developing early warning system in the country in the future. A combination of active and passive surveillance will be needed to detect both HPAI and LPAI virus circulating in the country. We recommend continuing the avian influenza bio-surveillance program expanding spatial and temporal coverage and building gene sequencing capacity to track the rea changes in the circulating virus.

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