The First International Avian Influenza Summit

The University of Arkansas

Fayetteville, Arkansas, USA on October 16-17, 2023

Organizing Committee

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DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
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UNIVERSITY OF ARKANSAS
Dale Bumpers College of Agricultural, Food & Life Sciences
Poultry Science

CENTER OF EXCELLENCE FOR POULTRY SCIENCE

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

The First International Avian Influenza Summit

Guillermo Tellez-Isaias

Center of Excellence for Poultry Science, Division of Agriculture, University of Arkansas

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
gtellez@uark.edu

Dear Esteemed Guests, Distinguished Speakers, Honorable Delegates, and all participants worldwide

With great pleasure and excitement, we extend our warmest welcome to the First International Avian Influenza Summit, a momentous event hosted by the Center of Excellence in Poultry Science of the University of Arkansas. This groundbreaking summit, set to take place in Fayetteville, Arkansas, USA, on October 16-17, 2023, promises to be a significant milestone in the global efforts to combat Avian Influenza. Through the convergence of leading experts, innovators, and stakeholders worldwide, we aim to forge new frontiers in research, policy, and industry collaboration. The unique free hybrid format of this event, blending both in-person and virtual participation (a total of 1,842 participants from all over the world, see Figure 1), ensures that knowledge exchange and networking opportunities are accessible to a diverse and global audience. Whether you join us in Fayetteville or connect remotely, you will be crucial in advancing our collective understanding and response to this critical challenge. Over the course of two days, the summit will feature a dynamic program encompassing keynote addresses, panel discussions, workshops, and interactive sessions. Together, we will explore the latest advancements in avian influenza research, surveillance strategies, vaccination initiatives, and emergency response protocols. Moreover, this summit provides a vital platform for fostering collaborations between academia, industry, government agencies, and non-governmental organizations. By harnessing all stakeholders' collective expertise and resources, we can catalyze innovation and drive solutions that protect both avian and human populations.

In the spirit of unity and shared purpose, we look forward to the stimulating conversations, valuable insights, and lasting connections that will emerge from this summit. Together, we can profoundly impact the global fight against Avian Influenza. Once again, welcome to the First International Avian Influenza Summit. We are honored to have you with us, and we are confident that your contributions will help pave the way for a safer and more resilient future.

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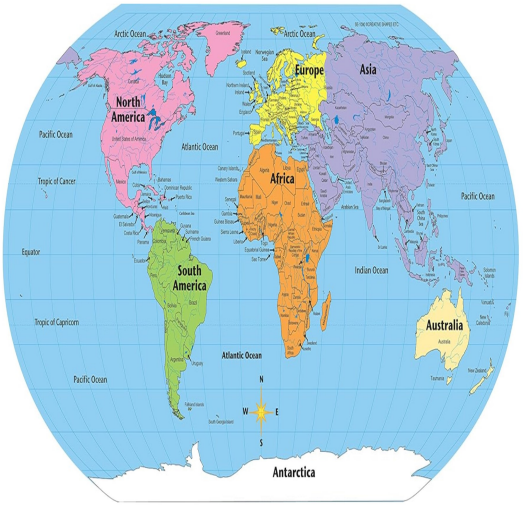
eISSN:2747-5735

First International Avian Influenza Summit
Number of participants
Fayetteville, Arkansas, USA
October 16-17, 2023



- **Registrants**
- In person: 123
- Online: 1,719
- Total: 1,842

- **Countries represented**: 81

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Figure 1: First International Avian Influenza Summit: Number of participants Fayetteville, Arkansas, USA. October 16-17, 2023

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Acknowledgment to the German Multidisciplinary Publishing Center (GMPC)

Guillermo Tellez-Isaias

Center of Excellence for Poultry Science, Division of Agriculture, University of Arkansas

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**

gtellez@uark.edu

I am writing on behalf of the organizing committee and the Center of Excellence in Poultry Science at the University of Arkansas to express our deepest gratitude for your invaluable contribution in editing and publishing the proceedings of the First International Avian Influenza Summit, which took place on October 16-17, 2023, in Fayetteville, AR.

Your dedication to the field of veterinary research and your commitment to advancing knowledge in avian influenza have played a pivotal role in disseminating the insights and findings shared during the summit. The meticulous editing and rigorous review process conducted by GMPC have ensured that the published proceedings are of the highest quality, making them a valuable resource for researchers, practitioners, and scholars in the field.

We are truly honored to have had the opportunity to collaborate with the GMPC team in this endeavor. Your expertise and guidance have greatly enriched the scholarly content of the proceedings, and we are confident that they will serve as a cornerstone for future research and advancements in avian influenza studies.

We extend our heartfelt appreciation to you and your esteemed team for the outstanding work in bringing this publication to fruition. Your contributions have significantly impacted the global veterinary community, and we look forward to the journal's continued success.

Once again, thank you for your unwavering support and dedication to disseminating knowledge in veterinary research. We eagerly anticipate future collaborations and endeavors to enhance our shared mission further.

Please accept our warmest regards and best wishes,

Guillermo Tellez-Isaias

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eISSN:2747-5735

Acknowledgment to Jessica Wesson (Communications Manager)

Guillermo Tellez-Isaias

Center of Excellence for Poultry Science, Division of Agriculture, University of Arkansas

Jessica Wesson

Communications Manager

Dear Jessica Wesson,

I am writing to extend my deepest gratitude for your exceptional efforts in orchestrating the inaugural International Avian Influenza Summit. Your dedication and tireless work as the Communications Manager of the Center of Excellence for Poultry Science at the University of Arkansas truly shone through, making this event a resounding success.

Your meticulous planning, attention to detail, and unwavering commitment ensured that every aspect of the summit was executed seamlessly. From coordinating registrations to managing logistics, your expertise played a pivotal role in creating a memorable and enriching experience for all participants.

The high caliber of discussions and the valuable insights shared by experts from around the world were a testament to the meticulous planning that went into this event. Furthermore, your warm and professional demeanor made working with you an absolute pleasure.

Your ability to communicate effectively and build rapport with stakeholders, participants, and speakers alike was commendable and undoubtedly contributed to the overall positive atmosphere of the summit.

The success of the International Avian Influenza Summit is a direct reflection of your hard work, passion, and dedication to advancing knowledge and collaboration in the field of avian health. Your contributions have not only elevated the reputation of the Center of Excellence for Poultry Science but have also had a profound impact on the broader scientific community.

Once again, Jessica, I extend my heartfelt thanks for your outstanding efforts in making this summit a resounding success. Your contributions have not gone unnoticed, and I am confident that the knowledge shared during this event will have a lasting impact on avian health research and policy.

Looking forward to the prospect of future collaborations and events organized under your capable leadership.

Warm regards,

Guillermo Tellez-Isaias

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eISSN:2747-5735

Thanks for the First International Avian Influenza Summit Sponsors

Guillermo Tellez-Isaias

Center of Excellence for Poultry Science, Division of Agriculture, University of Arkansas

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
gtellez@uark.edu

Dear Valued Sponsors,

It is with immense gratitude and a heart full of thanks that we write to express our deepest appreciation for your invaluable support of the first International Avian Influenza Summit, organized by the Center of Excellence for Poultry Science at the University of Arkansas.

Your generous contributions and unwavering commitment to the success of this summit have played an instrumental role in making it a resounding triumph. Your sponsorship has provided the necessary financial support and demonstrated a shared vision for a healthier, more resilient poultry industry worldwide.

Through your sponsorship, you have enabled us to assemble a diverse and distinguished group of experts, researchers, and industry leaders to foster a collaborative environment for exchanging cutting-edge knowledge and innovative solutions in the field of avian influenza. The insights and strategies discussed at the summit will undoubtedly profoundly impact the poultry industry, with far-reaching benefits for both human and avian health.

We would also like to extend our deepest gratitude for your trust and belief in the mission of the Center of Excellence for Poultry Science. Your support has bolstered our efforts in advancing research, education, and outreach initiatives, driving progress in poultry science and industry practices.

The success of this summit is a testament to the power of collective dedication and the meaningful difference that can be made when like-minded partners join forces. We are sincerely grateful for your invaluable contribution, which has been pivotal in turning this vision into reality.

We look forward to the opportunity to express our thanks and gratitude during the summit personally. Your presence and support will undoubtedly enrich the discussions and enhance the impact of the event.

Once again, on behalf of the organizing committee, please accept our heartfelt thanks for your generosity, support, and shared commitment to the advancement of avian health and the poultry industry.

Warm regards,
Guillermo Tellez-Isaias

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eISSN:2747-5735

Program Syllabus

Monday, October 16, 2023

Time starts	Time end	Speaker	Presentation Title
8:00	8:05	**Guillermo Tellez-Isaias Chairman**	**Welcome and Introduction to the Summit. Why this event?**
8:00	8:15	**Deacue Fields** VP, Division of Agriculture-University of Arkansas	**Official Welcome-** Inauguration and the importance of the Summit as a National and Global Security topic
8:15	8:55	**Ramiro H. D. Franco**	**What awaits us in the next bird migration?**/ ¿Que nos espera en la próxima migración de aves?
8:55	9:40	**Julianna Lenoch**	**Avian Influenza in Wild birds and Mammals in the United States**/ Influenza aviar en aves silvestres y mamíferos en el Estados Unidos
9:40	10:05	**Brian Umberson**	**Avian influenza's decimation of the poultry food supply requires open discussion of new strategies**/ La destrucción de grandes núcleos avícolas por la Influenza aviar y su impacto en el suministro alimenticio requiere una discusión abierta sobre nuevas estrategias
10:05	10:20		**Break**
10:20	10:50	**Helena L. Ferreira**	**Avian Influenza Virus in wild birds from Brazil**/ Virus de la influenza aviar en aves silvestres de Brasil.
10:50	11:20	**Maria E. I. D'Arrigo**	**Experiences in Peru for surveillance in the fight against highly pathogenic H5N1 avian influenza**/ Experiencias en Perú para la vigilancia en la lucha contra la influenza aviar altamente patógena H5N1
11:20	11:50	**Alejandro M. Cuevas**	**Avian influenza in Mexican poultry farming, teachings and learning** Influenza Aviar en la avicultura Mexicana, enseñanzas y aprendizajes
11:50	12:30	**Alvaro G. Rubio**	Outbreak IAAP H5N1 in Chile 2022 – 2023: Epidemiology and Control / Brote IAAP H5N1 en Chile 2022 – 2023: Epidemiología y Control
12:30	13:45		**Launch Break**
13:45	14:15	**Miguel Á. J. Márquez**	**Current Situation of High Avian Influenza Pathogenicity by Subtype A/H5N1 in Mexico**/ Situación Actual de la Influenza Aviar de Alta Patogenicidad por el Subtipo A/H5N1 en México
14:15	14:45	**Ricardo H. Rauber**	**Avian Influenza in Brazilian Poultry Production: Current Situation and Prevention Strategies**/ Influenza Aviar en la Producción Avícola Brasileña – Situación Actual y Estrategias de Prevención
12:30	13:45		**Break**
15:00	15:30	**Daniel R. Perez**	**The emergence of poultry adapted H9 subtype avian influenza viruses**/ La emergencia de los virus de influenza aviar subtipo H9 adaptados a las saves
15:30	16:00	**Alberto Torres**	**HPAI. Considerations for vaccination and implications for international trade. A Primary Breeder's perspective**/ IAAP. Consideraciones para la vacunación e implicaciones para el comercio internacional. Una perspectiva desde el punto de vista de progenitoras pesadas

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eISSN:2747-5735

Tuesday, October 17, 2023

Time starts	Time end	Speaker	Presentation Title
8:00	8:05	**Morgan Farnell**	**Welcome back (house-keeping)**
8:05	8:45	**Gary Flory**	**New Developments in animal mortality management during disease outbreaks**/ Nuevos desarrollos en el manejo de la mortalidad animal durante los brotes de enfermedades
8:45	9:05	**Pedro Jimenez-Bluhm**	**Influenza surveillance in wild and domestic animals in Chile**/ Vigilancia de la influenza en animales salvajes y domésticos en Chile
9:05	9:35	**Alice Green**	**Risk Factors for Introduction of H5N1 HPAI onto Commercial Table Egg Farms in the United States, 2022: A Case-Control Study**/ Factores de riesgo para la introducción de la IAAP H5N1 en granjas comerciales de huevos de mesa en los Estados Unidos, 2022: un estudio de casos y controles
9:35	10:05	**Victoria Fields**	**Risk Factors for Introduction of H5N1 HPAI onto Commercial Turkey Farms in the United States, 2022: A Case-Control Study**/ Factores de riesgo para la introducción de la IAAP H5N1 en Granjas comerciales de pavos en los Estados Unidos, 2022: un estudio de casos y controles
10:05	10:20		**Break**
10:20	11:00	**Susano M. Jaramillo**	**Biosecurity in poultry. A point of view**/ Bioseguridad en avicultura. Un punto de vista
11:00	11:30	**Morgan Farnell**	M**icrobial Evaluation of Poultry Farm Pathogen Interventions to Improve Biosecurity**/ Evaluación microbiana de intervenciones de patógenos en granjas avícolas para mejorar la bioseguridad
11:30	12:00	**Jaime A. Á. Isaza**	**Comprehensive Effect of Essential Oils on Viral Disease Control in Poultry Farming**/ Efecto integral de los aceites esenciales en virus Control de Enfermedades en la Avicultura.
12:30	13:45		**Launch Break**
13:15	13:50	**Inkar Castellanos-Huerta**	**New strategies for developing vaccines against the H5N1 avian influenza virus**/ Nuevas estrategias para el desarrollo de vacunas contra la virus de la influenza aviar H5N1
13:50	14:20	**Awad A. Shehata**	**Vaccination against HPAI from opposition to acceptance** / Vacunación contra la IAAP de la oposición a la aceptación
14:20	14:55	**Guillermo Tellez-Isaias**	**CRISPR and Quorum Sensing as strategic control measurements for Avian Influenza Virus**/ CRISPR y Quorum Sensing como medidas estratégicas de control contra el virus de la influenza aviar
10:05	10:20		**Break**
15:10	15:50	**Darrell R. Kapczynski**	**Control Strategies for 2.3.4.4 Highly Pathogenic Avian Influenza Virus-From Vaccines to Host Disease Resistance**/ Estrategias de control de virus de alta patogenicidad de influenza aviar 2.3.4.4 - de las vacunas a la resistencia a la enfermedad del huésped
15:50	16:30	**Mike McGrew**	**Genome editing to investigate avian influenza resistance in chickens**/ Edición del genoma para investigar la resistencia a la influenza aviar en pollos
16:30	16:40	**Guillermo Tellez-Isaias**	**Closing remarks and adjourn**/ Palabras de cierre y clausura

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eISSN:2747-5735

What awaits US in the next bird migration in South America: Prospects for the detection and incidence of HPAIV H5N1 in commercial poultry and wild birds

Ramiro H. Delgado

Technical Director of Nutriavicola, Colombia

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**

Ramiro H. Delgado
rdelgado@nutriavicola.com

Abstract

Highly pathogenic avian influenza virus (HPAIV) H5N1 poses a significant threat to both commercial poultry operations and wild bird populations worldwide. South America, with its rich avian biodiversity and extensive poultry industry, is susceptible to the introduction and spread of this devastating virus. This study explores the imminent challenges and potential outcomes associated with the upcoming bird migration season in South America, focusing on the detection and incidence of HPAIV H5N1. Employing a multidisciplinary approach is necessary to integrate spatial modeling, genomic surveillance, and epidemiological analyses to forecast the dynamics of HPAIV H5N1 in the region. By examining historical migration patterns, host susceptibility, and environmental factors, it will be possible to elucidate potential pathways for virus dissemination among wild bird populations and spillover into commercial poultry farms. Furthermore, this study evaluates the efficacy of current surveillance and monitoring strategies in detecting HPAIV H5N1, identifying potential gaps, and offering recommendations for enhanced surveillance protocols. Leveraging advanced molecular techniques is necessary to analyze viral genomes to track potential mutations associated with increased virulence or altered host range, thereby providing crucial insights for targeted intervention measures. The outcomes of this research will advance our understanding of the ecological and epidemiological factors influencing the spread of HPAIV H5N1 in South America and inform proactive strategies for early detection, containment, and mitigation of future outbreaks. This comprehensive assessment is a pivotal step towards safeguarding poultry industries and avian biodiversity in the face of emerging infectious diseases.

Keywords: HPAI, wild birds, H5N1, Molecular diagnosis, Epidemiology

Citation. Delgado, R. H. 2023. What awaits the US in the next bird migration in South America: Prospects for the detection and incidence of HPAIV H5N1 in commercial poultry and wild birds. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 8. https://doi.org/10.51585/gtop.2023.1.0011

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Avian influenza in wild birds and mammals in the United States

Julianna B. Lenoch

USDA National Wildlife Research Center, USA

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**

Julianna B. Lenoch

julianna.b.lenoch@usda.gov

Abstract

Avian influenza, caused by influenza A viruses, has emerged as a critical zoonotic threat with implications for both public health and wildlife conservation. This abstract provides an overview of the prevalence, transmission dynamics, and potential impacts of avian influenza in wild birds and mammals within the United States. Drawing on comprehensive surveillance data and scientific studies, we highlight the diverse range of avian influenza strains circulating in wild bird populations and emphasize their potential spillover into mammalian species. The intricate interplay between wild birds, domestic poultry, and mammals in the context of avian influenza ecology is examined, shedding light on potential transmission pathways. Furthermore, we delve into the consequences of avian influenza outbreaks on both wild avian and mammalian species, elucidating the varying susceptibility and potential reservoir roles of different taxa. The function of migratory birds in the long-distance dissemination of avian influenza strains across geographical boundaries is explored, emphasizing the need for international cooperation in surveillance and response efforts. Additionally, we discuss the implications of avian influenza for public health and address the possibility of viral adaptation and reassortment events that may lead to novel strains with pandemic potential. We highlight the importance of early detection and robust surveillance systems to mitigate the risks associated with avian influenza outbreaks in both wildlife and human populations. In conclusion, this abstract underscores the critical need for interdisciplinary research and collaborative efforts between public health authorities, wildlife biologists, and veterinary experts to understand better the dynamics of avian influenza in wild birds and mammals in the United States. By elucidating these complex interactions, we aim to inform targeted interventions, policies, and strategies for effective prevention and control of avian influenza outbreaks in both wildlife and domestic animal populations.

Keywords: Influenza, Wild birds, U.S., Outbreak, Public health, Prevention and control

Citation. Lenoch, J. B. 2023. Avian influenza in wild birds and mammals in the United States. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 9. https://doi.org/10.51585/gtop.2023.1.0012

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Avian influenza virus in wild birds from Brazil

Helena L. Ferreira

University of São Paulo, Brazil

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**

Helena L. Ferreira

hlage@usp.br

Abstract

South American countries such as Argentina, Chile, Brazil, Paraguay, Peru, and Uruguay reported the detection of HPAIV H5N1 clade 2.3.4.4 b in domestic and wild birds for the first time in the region from the end of 2022 to the beginning of 2023. Human infections were reported for the first time in South America, Ecuador, and Chile. Since October 2022, the PREVIR-MCTI network, a Brazilian network for virus surveillance in wild animals, has been collecting samples from asymptomatic wild waterfowl in different regions of Brazil. Avian influenza viruses (AIVs) circulate among wild bird populations worldwide, posing a significant threat to avian and human health. This study investigates the prevalence, genetic diversity, and potential transmission dynamics of AIVs in wild bird populations across Brazil. We collected and analyzed samples from wild bird species through comprehensive surveillance efforts spanning diverse ecological regions. Using molecular techniques, we identified and characterized avian influenza viruses, focusing on highly and low pathogenic viruses. We identified viruses in different wild bird populations. Our study provides insights into the role of wild birds in maintaining and disseminating AIVs, emphasizing the need for continued surveillance and monitoring efforts. This talk will discuss the valuable data of global efforts to understand and mitigate the threat posed by avian influenza viruses, particularly in regions with rich biodiversity and diverse bird populations like Brazil. The knowledge generated herein informs strategies for early detection, risk assessment, and preparedness to safeguard one health (animal, human, and environmental health).

Keywords: Influenza, Wild birds, Epidemiology, Risk assessment, Surveillance

Citation. Ferreira, H. L. 2023. Avian influenza virus in wild birds from Brazil. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 10. https://doi.org/10.51585/gtop.2023.1.0013

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Experiences in Peru for surveillance in the fight against highly pathogenic H5N1 avian influenza

Maria E. I. D'Arrigo

Universidad Nacional Mayor de San Marcos, in Lima, Peru

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**

Maria E. I. D'Arrigo

eliana.icochea@gmail.com

Abstract

The emergence of highly pathogenic H5N1 avian influenza poses a significant threat to human and animal health worldwide. This summary provides an overview of the surveillance efforts implemented in Peru to combat the spread of H5N1 avian influenza. Joint efforts between the authority, the productive sector, and academia date back to the first influenza outbreak in Chile in 2002. Since then, the government has been developing intense clinical and serological surveillance in the domestic birds and poultry industry. In parallel, the university has been carrying out important research to identify and typify the viruses that circulate in the resident and migratory wild bird populations of the Peruvian coast, having detected and identified during these years around 50 strains of influenza viruses of 10 different hemagglutinin subtypes and 8 neuraminidases, a single strain of the low pathogenicity H7N3 subtype. Until then, an H5-type virus had never been detected in wild birds. With the arrival of the virus in North America, a comprehensive response was developed in which the key components of the surveillance program included active and passive clinical surveillance in wild bird populations, commercial poultry, and backyard and game bird populations. Regarding surveillance of wild birds, the authority has received 238 notifications, of which 64 were confirmed positive, from 15 regions. In the Avian Pathology Laboratory of the UNMSM, actions were carried out to support the active surveillance of wild birds of the Peruvian coast in the impact zones for poultry farming, analyzing 405 samples of fresh feces from 41 species of asymptomatic coastal aquatic wild birds, being positive 12 (2.96%). Additionally, 45 samples of wild birds with suspicious symptoms were analyzed and sent by different government institutions (SENASA, SERFOR, SERNAMP), with 19 (42%) being confirmed positive. Regarding domestic bird populations, 1,676 notifications have been made to SENASA, of which 194 were positive for the H5N1 virus in 13 country regions. On the other hand, the Avian Pathology Lab received 16 confirmed positive cases by PCR and viral isolation in SPF embryonated eggs from ducks, quails, layers, native birds, and one case of turkeys. The complete genome analysis of 09 strains of wild birds, 04 of domestic birds, and one of sea lions has been carried out. Analysis of new samples is in process. NGS analysis has identified the IA H5N1 clade 2.3.4.4b virus; however, it has been found that the Peruvian strains are lining up in a group together with the Chilean strains. All these activities are possible to carry out thanks to the financial support of national and international institutions: NAMRU, Concytec-World Bank, Peruvian Poultry Association, and ALA-US Poultry. The high vulnerability of poultry populations in the country is due to its location along the coast, where tens of thousands of dead wild birds have fallen, in addition to being surrounded by a very high population of ducks, fighting, and backyard birds. The government determined emergency vaccination, as well as the continuation of clinical and virological surveillance in vaccinated and unvaccinated poultry populations. SENASA has been evaluating the protection of approved vaccines, both by the serological response with hemagglutination inhibition tests using local antigens and by challenge. The industry has responded by significantly increasing the levels of structural and operational biosafety, as well as directly supporting control actions at the regional level. Since March, no outbreaks have been reported in industrially farmed birds.

Keywords: HPAI, H7N3, PCR, NGS, NAMRU, SENASA, Peru, Surveillance

Citation. D'Arrigo, M. E. I. 2023. Experiences in Peru for surveillance in the fight against highly pathogenic H5N1 avian influenza. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 11. https://doi.org/10.51585/gtop.2023.1.0014

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

HPAI H5N1 outbreak in Chile, 2022 - 2023

Alvaro G. Rubio

Agricultural and Livestock Service–SAG, Peru

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas,
USA
October 16-17, 2023

***Correspondence:**

Alvaro G. Rubio

alvaro.gonzalez@sag.gob.cl

Abstract

In Chile, from December 5, 2022, to date (August 30), 892 HPAI H5N1 HPAI-positive samples have been detected in wild birds, affecting 50 species, with 94 zones under control. To date, more than 35,000 wild birds are dead. In addition, 175 positive backyard bird premises have been detected, with more the 14,000 birds culling distributed in the 16 regions of the country in 97 zones under sanitary control. This is the event 4,775 registered in the WAHIS system. In addition, since March 13, 2023, the HPAI H5N1 virus was identified in a broiler genetics unit. Since that date, 12 outbreaks have been detected nationwide, which were distributed in 12 flocks (1.47% of the total number of industrial flocks). Of these, 5 were in laying hens (1.4% of the national total), 3 in broiler turkeys, 2 in turkey breeders, 1 in broilers, and 1 in broiler breeders. As a result of these outbreaks, the total number of susceptible birds was eliminated, corresponding to 1,479,433 birds. The procedure for each poultry outbreak is determined in the current AI Contingency Plan, which defines in general terms the establishment of a Zone under Sanitary Control (ZBCS), where a protection zone (3 km radius) and a surveillance zone of 7 km radius are defined, forming a total restriction zone of 10 km radius around each outbreak. For outbreaks in poultry, 7 ZBCS were created, concentrating all commercial outbreaks. commercial outbreaks. In some cases (as in ZBCS_102 and 114), more than one outbreak was detected in each one. The actions carried out within each ZBCS in wildlife and in poultry and non-poultry are surveillance in the protection and surveillance zones, including clinical, molecular, and serological surveillance. Chile declared itself free of highly pathogenic avian influenza on August 22, 2023. On the other hand, on February 16, 2023, the first case of HPAI H5N1 in aquatic mammals was recorded, being a sea lion, the affected individual. To date, more than 20,000 sea lions have been stranded and died from the disease, and cases have been reported in other aquatic mammal species. In this outbreak, one human case has been reported in the north of the country and one terrestrial mammal (Geoffroy's cat) in Patagonia. The Chilean A/H5 HA genes were genetically closest related to samples detected in Peru around the same period, and both Peruvian and Chilean strains derive from A/H5N1 viruses, causing widespread outbreaks in poultry and wild birds across North America. This outbreak corresponds to the first incursion of a HPAI H5 virus of Euro-North American lineage to South America, having serious consequences for wildlife, affecting backyard poultry and commercial flocks, which forces us to improve our capacities for risk assessment, surveillance, biosecurity, diagnosis, training and risk communication to poultry farmers, professionals and publishers in Chile as well as in Latin America.

Keywords: HPAI, Chile, H5N1, Biosecurity, Risk assessment, Surveillance

Citation. Rubio, A. G. 2023. HPAI H5N1 outbreak in Chile, 2022 - 2023. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 12. https://doi.org/10.51585/gtop.2023.1.0015

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Current situation of avian influenza due to the highly pathogenic subtype A/H5N1 in Mexico

Miguel A. Márquez

Department of Avian Medicine and Zootechnics. FMVZ.UNAM. México

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Miguel A. Márquez
miguel.marquez@unam.mx

Abstract

The first report of news of an epizootic of Avian Influenza (AI) occurred in the neighborhoods of the city of Turín, Italy, in family poultry farms in 1878, which resulted in high mortality rates. The infection spread to the north and west of Europe, ending a year later in England. It was the distinguished Italian veterinarian Edoardo Bellarmino Perocitto (1847-1936), who created a detailed clinical, pathological, and epidemiological description of this viral infection of birds. In 2014, a virus emerged that has since commanded the attention of researchers. This virus was isolated from a domestic goose in Guangdong, China, and was classified as A/Goose/Guandong/1/14. This line sparked a strong focus among avian pathologists because, since its appearance, it has caused death in domestic and wild birds and has spread to more than 76 countries in Asia, Europe, North America, and South America. It is well known that migratory aquatic birds are the main actors in the ecology of Orthomyxoviruses of Avian Influenza. IA is caused by an Orthomyxovirus whose envelope contains surface glycoproteins: Hemagglutinin (HA) and Neuraminidase (NA). Types A, B, and C are isolated from animals. Types B and C have been isolated from man. Type A viruses are capable of infecting birds, humans, horses, and other mammals. The incubation period of AI Orthomyxoviruses is one to seven days and clinically causes a severe congestive-hemorrhagic respiratory, intestinal, and neurological condition, with mortality rates of 90 to 95% and mortality rates of 95 to 100%. Both Avian Influenza and Human Influenza have a seasonal presentation during the autumn and winter months of each year. Currently, the AI viruses H5N1 and H7N9 are zoonotic. Asian strain subtypes with greater impact on the health of people and their origin have occurred due to the spread between different species of wild birds, domestic and productive birds, and the people who take care of them and sell them. The global situation of Avian Influenza, a cross-border disease, continues to threaten the health of birds in practically all countries under agreement with the World Organization for Animal Health (OMSA/OIE). From 2021 to December 2022, more than 8,142 outbreaks of Highly Pathogenic Avian Influenza H5N1 appeared in 76 countries on four continents, affecting more than 120 million birds. The poultry industry in the United States of America has slaughtered more than 60 million commercial, domestic, and free-range birds (chickens, turkeys, and ducks), and wild birds between 2022-2023. This serious and worrying situation at a global level means that the World Animal Health Organization located in Paris, France, organized a meeting with all countries affected by AI in October 2022, during which it was concluded and authorized in an unprecedented decision for the first authorizing vaccination against AI in affected countries and publishing a manual "OIE Vaccination: A tool for the control of Avian Influenza.

Keywords: Influenza, Epidemiology, Mexico, Poultry, Control, Vaccination

Citation. Márquez, M. A. 2023. Current situation of avian influenza due to the highly pathogenic subtype A/H5N1 in Mexico. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 13. https://doi.org/10.51585/gtop.2023.1.0016

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Avian influenza and Brazilian poultry production – Current situation and prevention strategies

Ricardo H. Rauber

Animal Health Consultant at Vetinova– Strategic Animal Health, Curitiba, Paraná, Brazil

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**

Ricardo H. Rauber

rauber@vetinova.com.br

Abstract

Highly Pathogenic Avian Influenza (HPAI), particularly caused by the influenza virus A genus, is a paramount concern for global poultry health. The strains associated with HPAI are known to precipitate mortality rates exceeding 90%. Beyond the immediate and catastrophic impact on poultry, the emergence of HPAI strains disrupts international poultry trade, leading countries to impose trade bans and shake consumer confidence. By September 19th, 2023, Brazil had reported 106 confirmed outbreaks of HPAI. Most of these incidents were linked to wild birds, totaling 103 cases, while backyard chickens accounted for the remaining three. Notably, most of these outbreaks are situated in coastal regions. However, an exception that demanded attention was the HPAI detection in backyard chickens in Bonito, Mato Grosso do Sul. State-wise analysis reveals differential prevalence patterns. São Paulo and Rio Grande do Sul have documented cases far from their primary poultry hubs. In juxtaposition, Espírito Santo's proximity to the outbreak areas heightens its risk profile. The southern broiler-producing regions, which account for a significant 64% of Brazil's total production and a whopping 79% of exports, currently face diminished immediate threats due to their inland geographies. Nevertheless, the episode in Bonito-MS underscores the escalating risks even in regions previously considered low-threat and amplifies the call for perpetual vigilance. Brazil's approach to HPAI defense is structured and well-planned, not a result of hasty improvisation or last-minute measures. It's a result of a long-standing commitment and rigorous planning. The country's legal framework for HPAI prevention has evolved since the 1994 introduction of the National Poultry Health Plan. Successive years saw further tightening of regulations, climaxing with the 2013 National Contingency Plan for Avian Influenza, which underwent revision in 2023. Brazil's strategy to ward off HPAI is deeply rooted in stringent biosecurity measures. Farms are mandated to erect physical barriers, strictly regulate vehicular and human movement, and uphold rigorous cleaning and disinfection standards. Farm personnel are also trained in and adhere to meticulous personal hygiene protocols. Simultaneously, comprehensive waste management practices are firmly in place. Additionally, the Brazilian government plays a proactive role. Border surveillance, active monitoring of avian populations, and the deployment of passive surveillance within commercial flocks manifest the government's unwavering dedication to the poultry sector. One of Brazil's trump cards against diseases like HPAI is its vertically integrated poultry production model. This modus operandi permits companies and cooperatives to oversee every production stage. Such centralized oversight minimizes financial risks, guarantees consistent quality, and facilitates the swift roll-out of biosecurity directives. Traceability, a cornerstone for rapid disease containment, is inherently assured in this system. The private sector in Brazil not only meets governmental biosecurity standards but frequently surpasses them. It's common to see the integration of extended quarantine durations, intensified disinfection routines, and stringent farm access controls. The commitment to a tiered biosecurity mechanism across diverse poultry production stages is a testament to the industry's intent to ensure a holistic health foundation. Brazil's comprehensive and adaptive approach to HPAI is commendable. The country's strategic alignment between governmental regulations and private sector commitment, especially in the face of recent outbreaks, underscores Brazil's unwavering focus on safeguarding its poultry industry. While the road ahead demands continuous vigilance, Brazil's current strategies and learnings provide valuable insights for global stakeholders.

Keywords: Brazil, Influenza, HPAI, Poultry, Preventive strategies, Biosecurity

Citation. Rauber, R. H. 2023. Avian influenza and Brazilian poultry production – Current situation and prevention strategies. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 14. https://doi.org/10.51585/gtop.2023.1.0017

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

The emergence of poultry-adapted H9 subtype avian influenza viruses

Daniel R. Perez

Department of Population Health, College of Veterinary Medicine at the University of Georgia, USA

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**

Daniel R. Perez

dperez1@icloud.com

Abstract

Avian influenza is a highly contagious disease that severely affects poultry production and food security. Several countries have developed vaccination programs to prevent and control avian influenza. Unlike currently available vaccines, modified live virus (MLV) vaccines have the potential to be easily mass-applied. Concerns of reversion, recombination, and unintended transmission have slowed the development of MLVs against avian influenza for use in poultry. To address these concerns, we generated reassortment-impaired, non-transmissible, safe, immunogenic, and protective MLVs based on the rearrangement of internal gene segments and additional modifications of the surface gene segments HA and NA. The HA was produced to carry the unique DR-PAVIAN peptide marker, whereas NA was modified as a chimera encoding the chicken interleukin-18 (ckIL18) gene (MLV-IL). As a proof of principle and given its economic importance and widespread geographic distribution, we tested the MLV and MLV-IL approaches in chickens against a prototypic H9N2 low pathogenic avian influenza virus (MLV-H9N2 and MLV-H9N2-IL, respectively). *In-vitro*, the MLV-H9N2 and MLV-H9N2-IL candidates were stable and achieved yields similar to the wild-type H9N2 strain. Co-infection studies with a wild-type H9N2 virus showed that the altered HA segment in the MLV-H9N2 and MLV-H9N2-IL candidates has a fitness disadvantage and did not reassort. Likewise, the modified NA segment in the MLV-H9N2-IL candidate was impaired in reassortment. *In-vivo*, the MLV-H9N2 and MLV-H9N2-IL candidates did not transmit chicken-to-chicken via direct contact. MLV-H9N2- and MLV-H9N2-IL-vaccinated chickens showed no clinical signs upon intranasal vaccination, and all were seroconverted. More importantly, including ckIL18 in the MLV-H9N2-IL vaccine enhanced the generation of neutralizing antibodies, suggesting a role in the host immune response. A significant decrease in viral loads post-challenge demonstrated the protective effect of the MLVs. The MLV-H9N2-IL vaccine administered via drinking water was immunogenic in chickens in a dose-dependent manner and generated levels of neutralizing antibodies after prime and boost predictive of protection, which was later confirmed upon aggressive homologous virus challenge. In summary, this work provides the basis for novel and safe MLVs against avian influenza amenable for mass vaccination.

Keywords: Influenza, H9N2, Vaccine, Modified live virus, MLV, HA, Immune response

Citation. Perez, D., R. 2023. The emergence of poultry-adapted H9 subtype avian influenza viruses. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 15. https://doi.org/10.51585/gtop.2023.1.0018

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

HPAI: Considerations for vaccination and implications for international trade. A primary breeder's perspective

Alberto Torres

Export Mgr. Cobb-Vantress, LLC, USA

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**

Alberto Torres

alberto.torres@cobbvantress.com

Abstract

Vaccination against avian influenza requires the assessment of multiple technical, legislative, and trade aspects related to its epidemiology and the country's veterinary infrastructure, commerce policies, and interests. According to the World Organization of Animal Health (WOAH), vaccination against AI should not preclude a country from eligibility for trade as long as it can prove freedom from natural infection. Importing countries may have policies above the general guidelines offered by WOAH; however. Whether living with the disease for a long(er) time, having to adjust vaccines to better protect against newer avian influenza virus variants or clades, and/or whether there are indemnity incentives available to compensate growers for the losses related to outbreaks, considerations pertaining to the geographic spread of the disease across the country's territory, the sector(s) of the poultry industry being affected, and whether all alternatives to combat the disease have been explored, and perhaps exhausted, should also be taken into consideration. WOAH's guidelines for the continuation of trade include zoning that limits restrictions to a geographical area (10 km, county, or state) instead of the entire country. Compartmentalization also offers another approach to the continuation of trade for premises that demonstrate robust biosecurity and management programs backed by testing to demonstrate freedom from infection. Alternatives to avoid or reduce waste products (e.g., meat and eggs) should also be considered according to implications to the risk involved of further spread onto other avian and poultry populations. Considering the fact that the 2.3.4.4b clade has been able to infect a large number of wild bird and mammalian species and, at least for countries where the disease is not endemic in its commercial sectors, vaccinating only poultry, at least in countries with low prevalence and incidence rate would not prevent the spread of the disease amongst that large pool of susceptible animal species. For this latter aspect, perhaps vaccination strategies would be more effective if developed towards mitigating prevalence in the natural reservoirs. This implies developing vaccines capable of being deployed in mass. In the large scheme of things and within the one-health concept, this latter approach may have a larger impact on combatting high pathogenicity avian influenza.

Keywords: Influenza, HPAI, Clades, One-Health, Vaccination, Preventive measures, 2.2.4.4b clades

Citation. Torres, A. 2023. AHPAI: Considerations for vaccination and implications for international trade. A primary breeder's perspective. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 16. https://doi.org/10.51585/gtop.2023.1.0019

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Control strategies for 2.3.4.4 highly pathogenic avian influenza virus - From vaccines to host disease resistance

Darrell R. Kapczynski

Exotic & Emerging Avian Viral Diseases Research Unit, USDA-ARS-USNPRC, 934 College Station Road Athens, GA 30605, USA

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Darrell R. Kapczynski
darrell.kapczynski@usda.gov

Abstract

Avian influenza virus (AIV) is a highly contagious and lethal disease that can have major impacts on the global poultry industry and food supply. While more frequent in Asia and Europe, highly pathogenic avian influenza virus (HPAIV) outbreaks have traditionally been rare in the U.S. However, in recent years, the U.S. has seen an increase in the incidence of HPAIV outbreaks in wild birds and commercial poultry. In 2014/2015 and in 2021/2022, outbreaks of HPAIV subtype H5NX clade 2.3.4.4 resulted in the death and destruction of over 50 million birds, each costing billions of dollars to the U.S. economy. Here, we present a comprehensive overview of control strategies against the 2.3.4.4 HPAI virus, encompassing both vaccination approaches and host-driven disease resistance mechanisms. The first section outlines the advancements in vaccine development tailored specifically for the 2.3.4.4 HPAI subtype. Through a critical analysis of experimental studies and field trials, we discuss the efficacy, safety, and cross-protection capabilities of various vaccine formulations, including inactivated whole-virus vaccines, vector-based platforms, and novel recombinant technologies. Furthermore, this section explores the challenges associated with vaccine design, including strain diversity, antigenic differences, and logistical hurdles in large-scale vaccination campaigns. The second section delves into host-centric strategies aimed at enhancing natural resistance against 2.3.4.4 HPAI virus infections. Because vaccines are not currently approved for use in the U.S., control strategies for HPAIV are dependent on biosecurity and culling of infected flocks. New strategies for HPAIV control based on gene editing of poultry species could offer solutions for disease control. Two different strategies for improving disease resistance to HPAIV are based on enhancing the innate immunity of the bird and targeting the viral RNA genome inside the cell. By harnessing genetic engineering techniques, including CRISPR/Cas-9 or -13, natural resistance to avian influenza can be achieved in poultry. Taken together, we will examine the current basis of control strategies for the 2.3.4.4 HPAI virus, offering insights into the strengths and limitations of both vaccination and novel gene-editing technologies to enhance host disease resistance to HPAI. By expanding our toolbox, this work contributes to the ongoing efforts to mitigate the impact of 2.3.4.4 HPAI on global poultry industries and public health.

Keywords: HPAIV, CRISPR/Cas-9, 2.3.4.4 HPAI, Control strategies, Host disease resistance

Citation. Kapczynski, D. R. 2023. Control strategies for 2.3.4.4 highly pathogenic avian influenza virus - From vaccines to host disease resistance. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 17. https://doi.org/10.51585/gtop.2023.1.0020

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Avian influenza's decimation of the poultry food supply requires open discussion of new strategies

Brian Umberson

Arkansas IAFP Chapter and National Science Foundation Innovation Corps (NSF I-Corp) Industry

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Brian Umberson
brian.umberson1024@outlook.com

Abstract

Avian influenza outbreaks have emerged as a critical threat to global food security as they continue to devastate poultry populations worldwide. This paper addresses the urgent need for an open and comprehensive discussion of novel strategies to mitigate the impact of avian influenza on the poultry food supply chain. The review integrates current scientific literature, epidemiological data, and socio-economic analyses to underscore the severity of the crisis. It highlights the complex interplay between viral evolution, poultry production practices, and international trade networks, emphasizing the multifaceted challenges faced by stakeholders in the poultry industry. The paper evaluates the existing approaches to avian influenza control and containment, examining their limitations and potential for improvement. It also explores emerging technologies, such as advanced surveillance systems, rapid diagnostic tools, and vaccine development, which offer promising avenues for proactive prevention and early intervention. Additionally, the discussion extends to alternative production models, including biosecure facilities, diversified farming practices, and sustainable supply chain management, as potential strategies to enhance resilience in the face of future outbreaks. Furthermore, the socio-economic repercussions of avian influenza outbreaks are examined, emphasizing their disproportionate impact on vulnerable communities and economies heavily reliant on poultry production. The paper underscores the importance of equitable distribution of resources and knowledge sharing to build global preparedness and response capacity. In conclusion, this review advocates for an open and collaborative discourse among stakeholders, including scientists, policymakers, industry leaders, and civil society, to collectively address the avian influenza crisis. It calls for a holistic approach that encompasses enhanced surveillance, innovative technologies, and diversified production methods while prioritizing inclusivity and equity in implementation. By fostering a transparent and forward-thinking dialogue, the global community can forge a resilient and sustainable future for the poultry food supply chain in the face of evolving avian influenza threats.

Keywords: Influenza, Surveillance systems, Rapid diagnostic tools, Vaccine development, Collaborative discourse

Citation. Umberson, B. 2023. Avian influenza's decimation of the poultry food supply requires open discussion of new strategies. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 18. https://doi.org/10.51585/gtop.2023.1.0021

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

New developments in animal mortality management during disease outbreaks

Gary A. Flory

G.A. Flory Consulting LLC, USA

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Gray A. Flory
garyaflory@gmail.com

Abstract

In the face of escalating global concerns about the occurrence of animal disease outbreaks, effective and sustainable methods for the management of animal mortalities have become a critical component of public health and biosecurity strategies. This abstract presents a comprehensive overview of recent advancements in the field of animal mortality management, with a specific focus on innovative technologies, practices, and policies designed to mitigate the environmental, economic, and health impacts associated with mass mortalities during disease outbreaks. (1) Emerging technologies for mortality disposal: this section highlights current technologies such as composting, shallow burial with carbon, rendering, and incineration that offer more efficient and environmentally responsible alternatives to traditional disposal methods like deep burial and open burning. These technologies demonstrate promise in minimizing the spread of pathogens and reducing the environmental impact of traditional methods. (ii) biosecurity measures in mortality handling: addressing biosecurity risks associated with the transportation and disposal of animal carcasses is paramount in preventing secondary outbreaks. The abstract examines the opportunities posed by centralized carcass disposal and the protocols required to ensure that proper measures are in place to protect human and animal health. (iii) Regulatory frameworks and policy innovations: a critical aspect of effective mortality management involves the development and implementation of robust regulatory frameworks and guidance documents. This section explores recent policy developments at local, national, and international levels, with a focus on adaptive strategies that promote rapid response and coordination during outbreaks. (iv) Community engagement and stakeholder collaboration: successful mortality management necessitates transparent communication, community engagement, and collaboration among various stakeholders, including government agencies, veterinary professionals, farmers, and the public. This section explores innovative approaches to fostering partnerships and enhancing public awareness and understanding of mortality management practices. By synthesizing recent research and developments in animal mortality management, this abstract provides a comprehensive resource for policymakers, veterinarians, researchers, and practitioners involved in public health and biosecurity efforts. These advancements offer a promising foundation for more effective, environmentally conscious, and sustainable approaches to managing animal mortalities during disease outbreaks.

Keywords: Influenza, Biosecurity, Mortality handling, Regulatory frameworks, Stakeholder collaboration

Citation. Flory, G. A. 2023. New developments in animal mortality management during disease outbreaks. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 19. https://doi.org/10.51585/gtop.2023.1.0022

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Wild bird origin Influenza A subtype diversity and reassortment events during the HPAI H5N1 outbreak in Chile, 2022-2023

Pedro Jimenez-Bluhm[1*], Soledad Ruiz[1], María Antonieta González[1], Camila Rojas[2], Pablo Galdames[2], Cristóbal Oyarzún[2], Cecilia Baumberger[2], Bridgett Shap[3], Shaoyuan Tan[3], Christopher Hamilton-West[2] and Stacey Schultz-Cherry[3]

[1]Escuela de Medicina Veterinaria, Pontificia Universidad Católica de Chile, Santiago, Chile. [2]Departamento de Medicina Preventiva Animal, Facultad de Ciencias Veterinarias Pecuarias, Universidad de Chile, Chile. [3]Department of Infectious Diseases, St. Jude Children's Research Hospital, Memphis, TN, USA

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Pedro Jimenz-Bluhm
pedro.jimenez@uc.cl

Abstract

Highly pathogenic avian influenza (HPAI) H5N1 viruses continue to pose a significant threat to animal and human health worldwide. Since the onset of the HPAI H5N1 outbreak in South America, our research group has been conducting environmental influenza A virus (IAV) surveillance in different wetlands throughout Chile to detect and characterize circulating IAV strains. Between November 2022 and June 2023, we collected and screened 3275 environmental samples for IAV by RT-qPCR targeting the M gene. Of these, 133 were IAV-positive (4.1%). Further testing by H5-specific RT-qPCR revealed that 14 (10.5%) of the positive samples corresponded to HPAI H5 2.3.4.4b, collected during the month of November (2), December (8 positives), January (1 positive), March (1 Positive) and June (1 positive). Samples obtained during spring (November and December) were obtained at the Lluta River estuary in the extreme north of Chile. Samples obtained during Summer (January and March) were obtained in Lluta and at Punta Arenas, located in the extreme South of Chile. The sample obtained in Winter (June) was obtained in Maipo, located in Central Chile. Sequence analysis of 6 fully sequenced H5N1 viruses revealed that all segments were closely related to other H5N1 2.3.4.4b viruses circulating at the time in South America. Interestingly, we also obtained several other subtypes of low pathogenic avian influenza viruses (LPAI) during the sampling period: H13N9, H13N8, H12N5, H8N4, H6N8, H6N5, H5N7, H4N6, H2N8 and H2N2. Phylogenetic analysis of these viruses revealed that locally circulating LPAI H12N5, H6N8, and H5N7 subtype viruses, additionally to 4 more viruses without subtype information, had reassorted with HPAI viruses in at least one of the PA and NP segments. The role that these novel reassortant viruses play in the ecology of IAV in Chile and their pathogenic potential is unknown; however, in light of these reassortment events, further surveillance is warranted to detect potentially novel HPAI H5Nx viruses circulating in wild birds in Chile that could have unknown pathogenic and transmission potential.

Keywords: HPAI, LPAI, Wild-birds, Reassortment, Chile

Citation. Jimenez-Bluhm, P., Ruiz, S., González1, M. A., Rojas, C., Galdames, P., Oyarzún, C., Baumberger, C., Shap, B., Tan, S., Hamilton-West, C. and Schultz-Cherr, S. Wild bird origin Influenza A subtype diversity and reassortment events during the HPAI H5N1 outbreak in Chile, 2022-2023. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 20. https://doi.org/10.51585/gtop.2023.1.0023

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Investigation of risk factors for the introduction of highly pathogenic avian influenza H5N1 virus onto table egg farms in the United States, 2022: A case-control study

Alice L. Green[1*], Matthew Branan[1], Victoria L. Fields[1], Kelly Patyk[1], Stephanie K. Kolar[1], Andrea Beam[1], Katherine Marshall[1], Rachel McGuigan[1], Matthew Vuolo[1], Alexis Freifeld[1], Mia K. Torchetti[2], and Amy H. Delgado[1]

[1]Center for Epidemiology and Animal Health, Animal and Plant Health Inspection Service, United States Department of Agriculture, Fort Collins, CO 80526, United States. [2]National Veterinary Services Laboratories, Animal and Plant Health Inspection Service, United States Department of Agriculture, Ames, IA 50010, United States.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Alice A. Green
alice.green@usda.gov

Abstract

Introduction: The 2022–2023 highly pathogenic avian influenza (HPAI) H5N1 outbreak in the United States (U.S.) is the most geographically extensive and costly animal health event in U.S. history. In 2022 alone, over 57 million commercial and backyard poultry in 47 U.S. states were affected. Over 75% of the affected poultry were part of the commercial table egg production sector. Methods: We conducted a case–control study to identify potential risk factors for the introduction of the HPAI virus onto commercial table egg operations. Univariate and multivariable analyses were conducted to compare farm characteristics, management, and biosecurity factors on case and control farms. Results: Factors associated with increased risk of infection included being in an existing control zone, sightings of wild waterfowl, mowing or bush hogging vegetation less than 4 times a month, having an off-site method of daily mortality disposal (off-site composting or burial, rendering, or landfill), and wild bird access to feed/feed ingredients at least some of the time. Protective factors included a high level of vehicle washing for trucks and trailers entering the farm (a composite variable that included having a permanent wash station), having designated personnel assigned to specific barns, having a farm entrance gate, and requiring a change of clothing for workers entering poultry barns. Discussion: Study results improve our understanding of risk factors for HPAI infection and control measures for preventing HPAI on commercial U.S. table egg farms.

Keywords: HPAI, Risk factors, Biosecurity, U.S.A, Table eggs farms

Citation. Green, A. L., Branan, M., Fields, V. L., Patyk, K., Kolar, S. K., Beam, A., Marshall, K., McGuigan, R., Vuolo, M., Freifeld, A., Torchetti, M. K., Lantz, K. and Delgado, A. H. Investigation of risk factors for the introduction of highly pathogenic avian influenza H5N1 infection among commercial turkey operations in the United States, 2022: A case-control study. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 21. https://doi.org/10.51585/gtop.2023.1.0024

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Investigation of risk factors for the introduction of highly pathogenic avian influenza H5N1 infection among commercial turkey operations in the United States, 2022: A case-control study

Kelly Patyk[1], Victoria L. Fields[1*], Andrea Beam[1], Matthew Branan[1], Rachel McGuigan[1], Alice L. Green[1], Mia K. Torchetti[2], Kristina Lantz[2], Alexis Freifeld[1], Katherine Marshall[1], and Amy H. Delgado[1]

[1]Center for Epidemiology and Animal Health, Animal and Plant Health Inspection Service, United States Department of Agriculture, Fort Collins, CO 80526, United States. [2]National Veterinary Services Laboratories, Animal and Plant Health Inspection Service, United States Department of Agriculture, Ames, IA 50010, United States.

[#] These authors have contributed equally to this work and share the first authorship.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Victoria L. Fields
victoria.fields@usda.gov

Abstract

The 2022–2023 highly pathogenic avian influenza (HPAI) H5N1 outbreak in the United States (U.S.) is the largest and most costly animal health event in U.S. history. Approximately 70% of commercial farms affected during this outbreak have been turkey farms. We conducted a case-control study to identify potential risk factors for the introduction of the HPAI virus into commercial meat turkey operations. Data were collected from 66 case farms and 59 control farms in 12 states. Univariate and multivariable analyses were conducted to compare management and biosecurity factors on case and control farms. Factors associated with increased risk of infection included being in an existing control zone, having both brooders and growers, having toms, seeing wild waterfowl or shorebirds in the closest field, and using rendering for dead bird disposal. Protective factors included having a restroom facility, including portable, available to crews that visit the farm and workers having access and using a shower at least some of the time when entering a specified barn. The study results provide a better understanding of risk factors for HPAI infection and can be used to inform prevention and control measures for HPAI on U.S. turkey farms.

Keywords: HPAI, Turkeys, United States, Risk-factors

Citation. Patyk, K., Fields, V. L., Beam, A., Branan, M., McGuigan, R., Green, A. L., Torchetti, M. K., Lantz, K., Freifeld, A., Marshall, K. and Delgado, A. H. Investigation of risk factors for the introduction of highly pathogenic avian influenza H5N1 infection among commercial turkey operations in the United States, 2022: a case-control study. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 22. https://doi.org/10.51585/gtop.2023.1.0025

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Microbial assessment of poultry farm biosecurity

Morgan Farnell*, and Lindsey Wythe[1]

Department of Poultry Science, Texas A&M AgriLife Research and Extension, College Station, TX 77843, United States.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas,
USA
October 16-17, 2023

***Correspondence:**
Morgan Farnell
mfarnell@tamu.edu

Abstract

Biosecurity may be defined as protection from pathogens or disease. This may include the separation of the flock from living vectors or inanimate objects called fomites. While prevention of host-specific and zoonotic diseases is important, the commercial poultry industry is already preoccupied with the challenges of day-to-day operations. The purpose of this project was to illustrate how surfaces that may seem clean are heavily contaminated with microorganisms that may be responsible for human and avian diseases. We also evaluated three common intervention strategies, including disposable boot covers, foot baths, and tire disinfection. Poultry environmental samples were collected at the Texas A&M University Poultry Science Research Center, including fan shrouds, side air inlets, cool cell reservoirs, truck tires, truck floor mats, doorknobs, controller panels, a bioaerosol air sampler, and an impactor air sampler. A total of 30 samples were collected per sample type, which was homogenized, serially diluted, and spread plated onto agar media to culture total aerobes, *Staphylococci*, and coliform bacteria. 6.6 $\log_{10}$ colony-forming units (cfu/cm_2) of aerobic bacteria were found at the greatest concentration, followed by *Staphylococci* (5.6 $\log_{10}$ cfu/cm_2) and coliforms (2 $\log_{10}$ cfu/cm_2). This pattern was observed in most of the samples. Boot covers, foot baths, and tire disinfection were tested for efficacy. While disposable boot covers significantly reduced the number of aerobes, *Staphylococci*, and coliforms, as many as 300 microorganisms per cm_2 still made it through to the inner boot cover. Disinfectants are commonly misused due to not properly clearing the surface prior to application or allowing the proper contact time. We found that while disinfection significantly reduced these indicator organisms, that reductions were only 10 to 100-fold, leaving many viable bacteria behind. Increased contact time from 3 seconds to 10 minutes resulted in significant reductions of aerobes and Staphylococcus. The tire wash data mirrored our foot bath data. Data was shared from previous laboratory and field trials. Less than 1% sterile poultry litter significantly reduced disinfectant efficacy across four product categories. Extended storage time of 30 weeks reduced product efficacy as well. We shared electron micrographs to illustrate how visually clean and smooth surfaces provide many hiding places for microbes, reducing disinfectant efficacy. While risk can never be reduced to zero, it may be reduced and controlled with good management practices. Cleaning and disinfection should follow a five-step process of dry cleaning, soap wash, rinse, drying, and finally disinfection. Labels should be read closely so that the product is used safely and effectively. While there are many viable products on the market, disinfecting a clean surface and following recommendations for contact time are very important to get the best results. Following best management practices such as reducing pest (insect/rodent) harborage and following your integrated pest management program will help reduce risk significantly.

Keywords: Influenza, Biosecurity, Disinfection, Indicator organisms, *Staphylococci*, Coliforms, Bacterial counts, Colony-forming units

Citation. Farnell, M. and Wythe, L. Microbial assessment of poultry farm biosecurity. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 23. https://doi.org/10.51585/gtop.2023.1.0026

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Biosecurity: A holistic One-Health concept for enhancing the health, welfare, and productivity of commercial poultry - A point of view

Susano M. Jaramillo

Technical Director Grupo Buenaventura, Mexico.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Susano M. Jaramillo
medina@gpobuenaventura.com.mx

Abstract

The poultry industry plays a pivotal role in meeting global demands for protein-rich food. However, it faces significant challenges due to emerging infectious diseases, environmental concerns, and ethical considerations surrounding animal welfare. This abstract presents a comprehensive perspective on the integration of biosecurity measures within the framework of One Health, with the aim of enhancing the overall health, welfare, and productivity of commercial poultry operations. The concept of One Health emphasizes the interconnectedness of human, animal, and environmental health. Applied to the poultry industry, this approach acknowledges the potential transmission of pathogens between animals, humans, and the environment, emphasizing the need for coordinated strategies. Biosecurity emerges as a central component, encompassing a multifaceted set of preventive measures designed to mitigate risks and safeguard the health of poultry populations. Key elements of an effective biosecurity program include physical barriers, hygiene protocols, vaccination strategies, and rigorous disease monitoring and surveillance. These measures are bolstered by the implementation of strict quarantine protocols for newly introduced birds, as well as restricted access to farms and controlled movements within the premises. Moreover, biosecurity extends beyond the farm gate, involving collaboration with veterinarians, government agencies, and industry stakeholders to establish best practices and response plans. Improving the welfare of commercial poultry is another critical aspect of this holistic approach. This involves providing optimal living conditions, access to clean water, balanced nutrition, and appropriate space allowances. Enrichment strategies, such as environmental enhancements and behavioral opportunities, contribute to the overall well-being of the birds, reducing stress and enhancing their natural behaviors. Furthermore, the integration of biosecurity and One Health principles positively impacts the productivity of commercial poultry operations. Reduced disease incidence leads to lower mortality rates and increased flock performance, translating to higher production efficiency. Additionally, improved welfare conditions contribute to reduced behavioral issues, resulting in better growth rates and feed conversion ratios. In conclusion, the adoption of biosecurity measures within the framework of One Health offers a comprehensive strategy for enhancing the health, welfare, and productivity of commercial poultry. This integrated approach not only mitigates the risks posed by emerging diseases but also addresses environmental and ethical concerns associated with poultry production. By embracing this holistic concept, stakeholders in the poultry industry can achieve sustainable and responsible production practices, ensuring the long-term viability of this crucial sector in global food security.

Keywords: Influenza, Biosecurity, One-Health, Stakeholders, Poultry industry, Hygiene protocols, Vaccination strategies, Monitoring and surveillance

Citation. Jaramillo, S. M. Biosecurity: A holistic One-Health concept for enhancing the health, welfare, and productivity of commercial poultry - A point of view. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 24. https://doi.org/10.51585/gtop.2023.1.0027

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Comprehensive effect of essential oils on viral disease control in poultry farming

Blanca C. Martínez, Álvaro J. Uribe, Angi L. Montoya, and Jaime Ángel-Isaza*,

Research, development, and innovation unit of Promitec Santander, Colombia.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Jaime Ángel-Isaza
nutricionanimal@promitec.com.co

Abstract

Viral diseases that affect the respiratory system of poultry, such as Avian Infectious Bronchitis (IBV), Newcastle Disease (ND), and Avian Influenza (IFV), have a significant and detrimental impact on the health of the animals. This, in turn, has negative consequences for the profitability of poultry producers. To control these types of diseases, the poultry industry has primarily relied on strengthening biosecurity plans, along with the implementation of various vaccination strategies. However, despite all the efforts made for their Control, viral diseases continue to be a major challenge to the profitability of poultry production. In this regard, the search for new alternatives that complement comprehensive strategies for controlling viral diseases has become necessary. In recent years, using natural compounds, especially essential oils (EOs), has demonstrated the ability to contribute at different stages of viral disease control. Therefore, it has become essential to delve into the application of these potential antiviral compounds, with the aim of using them in prevention, controlling infected animals, or reducing viral loads in the environment. This serves as an alternative or complement to the biosecurity and vaccination plans employed by poultry companies. This study aimed to delve into the comprehensive effects of EOs on viral diseases, considering their antiviral activity, modulation of the immune system, and potential to enhance biosecurity measures. It was achieved by compiling various unpublished studies conducted between 2014 and 2023 as part of the innovation processes of the research and development group at Promitec Santander (Colombia). The study key results are; (i) Antiviral Properties: The use of Eos demonstrated protective effects against embryonic death in eggs inoculated with NDV or IBV when these viruses were pre-incubated with EOs. Subsequently, plaque assay experiments revealed that EO blends had the ability to inhibit the production of infectious viral particles of SARS-CoV-2 by between 45% and 98%. (ii) Immunomodulatory Effects: Through *in-vitro* and *in-vivo* studies, it was observed that EOs had the ability to increase the gene expression of cellular virus recognition receptors and some antiviral effector proteins in animals both without viral challenges and in the presence of NDV and IBV vaccine strains. Finally, the talk will discuss potential avenues for further research and development in this field. Regarding prospects and opportunities, there are significant possibilities for the use of EOs as part of complementary strategies in virus disease prevention, Control of infected animals, and inactivation in the environment. However, ongoing research is necessary to investigate antiviral mechanisms of action and conduct *in-vivo* and field tests against the avian influenza virus H5N1.

Keywords: Essential oils, Avian influenza, Poultry farming, Antivirals, Immunomodulation, Biosecurity, Economic viability

Citation. Martínez, B. C., Uribe, A. J., Montoya, A. L. and Ángel-Isaza, J. Comprehensive effect of essential oils on viral disease control in poultry farming. Proceeding of The First International Avian Influenza Summit, University of Arkansas-October 16-17, 2023". GMPC TOP. 3(1). pp. 25. https://doi.org/10.51585/gtop.2023.1.0028

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

New strategies for developing vaccines against the H5N1 avian influenza virus

Inkar Castellanos[1], Alberto Torres-Rodriguez[2], Victor M. Petrone-Garcia[3], and Guillermo Tellez-Isaias[1*]

[1]Department of Poultry Science, University of Arkansas Agricultural Experiment Station, Fayetteville, AR 72701, United States. [2]Export Mgr. Cobb-Vantress, LLC. [3]Departamento de Ciencias Pecuarias, Universidad Nacional Autónoma de México (UNAM), Cuautitlan Izcalli, Estado de México 54714, México.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Guillermo Tellez-Isaias
gtellez@uark.edu

Abstract

The H5N1 avian influenza virus poses a significant threat to poultry populations and human health, with sporadic outbreaks and the potential for pandemic emergence. Traditional vaccine development approaches have faced challenges in achieving broad-spectrum protection due to the high mutation rate of the virus. This abstract outlines novel strategies that have emerged to address these hurdles. Firstly, advances in reverse genetics technology have enabled the creation of recombinant vaccines, allowing for the precise manipulation of viral genes to enhance immunogenicity. These platforms facilitate the development of multi-valent vaccines capable of targeting multiple H5N1 strains simultaneously. Additionally, viral replicant or no-replicant vector vaccines employing non-pathogenic viruses as delivery systems show promise in eliciting robust immune responses against H5N1. Secondly, integrating computational modeling and artificial intelligence techniques in antigen design has accelerated the identification of conserved epitopes within H5N1, including MHC I, enabling the development of more effective and broadly protective vaccine candidates. Furthermore, using adjuvants, immune potentiators, antigen labeling for immune system cells, and novel delivery systems has enhanced the efficacy of H5N1 vaccines, providing more durable and cross-protective immunity. Moreover, implementing advanced manufacturing technologies of protein expression, such as cell-based (animal/plants/yeasts/bacteria) and virus-like particle (VLP) platforms, has streamlined production processes and increased vaccine accessibility. These platforms offer scalable and adaptable solutions to meet global demands during outbreaks and potential pandemics. Lastly, incorporating one health approach, emphasizing collaborative efforts between human, animal, and environmental health sectors, is crucial for comprehensive pandemic preparedness. Surveillance systems, early warning mechanisms, and rapid response strategies are integral to a proactive defense against H5N1 outbreaks. In conclusion, this abstract highlights the promising strides in developing vaccines against the H5N1 avian influenza virus through innovative approaches. These strategies, ranging from advanced genetic engineering techniques to cutting-edge computational modeling, offer a comprehensive toolkit for achieving broader and more durable protection against this formidable pathogen. By synergizing these advancements with a holistic health framework, we can significantly enhance our ability to mitigate the impact of H5N1 outbreaks on animal and human populations.

Keywords: Influenza, Vaccines, Multi-valent vaccines, Virus-like particle, Epitopes, MHC-I

Citation. Castellanos, I., Torres-Rodriguez, A., Petrone-Garcia, V. M. and Tellez-Isaias, G. New strategies for developing vaccines against the H5N1 avian influenza virus. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 26. https://doi.org/10.51585/gtop.2023.1.0029

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Vaccination against highly pathogenic avian influenza (HPAI): From opposition to acceptance

Awad A. Shehata[1*], **and Guillermo Tellez-Isaias**[2]

[1]Bavarian NMR Center (BNMRZ), Structural Membrane Biochemistry, Technical University of Munich, Garching, Germany.

[2]Department of Poultry Science, University of Arkansas Agricultural Experiment Station, Fayetteville, AR 72701, United States.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas,
USA
October 16-17, 2023

***Correspondence:**
Awad A. Shehata
awad.shehata@tum.de

Abstract

The emergence of Highly Pathogenic Avian Influenza (HPAI) strains poses a significant threat to both avian populations and human health. Vaccination has been identified as a critical tool in mitigating the spread of HPAI. However, the acceptance and implementation of avian influenza vaccination programs have been met with opposition from various stakeholders, including poultry producers, public health authorities, and consumers. This abstract provides a comprehensive overview of the evolving landscape of HPAI vaccination strategies, tracing the trajectory from initial resistance to widespread acceptance. Initially, concerns surrounding vaccine efficacy, potential adverse effects, and the economic burden associated with large-scale vaccination campaigns led to hesitancy among poultry producers and industry stakeholders. Additionally, public health authorities grappled with challenges related to regulatory approval, vaccine strain selection, and the development of robust surveillance systems. Over time, advancements in vaccine technology and extensive research demonstrating the safety and effectiveness of HPAI vaccines have gradually shifted perceptions. Adopting innovative vaccination strategies, such as vector-based vaccines and recombinant technologies, has addressed previous limitations and bolstered confidence in immunization as a viable control measure. Moreover, collaborative efforts between international organizations, governments, and research institutions have played a pivotal role in establishing standardized vaccine development, distribution, and administration protocols. These endeavors have facilitated harmonizing global strategies and enhanced the preparedness and response mechanisms for potential HPAI outbreaks. Consumer attitudes have also evolved, driven by increased awareness of the public health implications of avian influenza and a growing demand for sustainable and ethically produced poultry products. This shift in consumer sentiment has incentivized industry stakeholders to embrace vaccination as a proactive measure to safeguard both avian welfare and human health. In conclusion, this abstract highlights the transformative journey of HPAI vaccination programs, underscoring the pivotal role of scientific innovation, collaborative partnerships, and evolving consumer perspectives in overcoming initial resistance. As the global community continues to confront emerging infectious diseases, the successful trajectory of HPAI vaccination provides valuable insights into the dynamic interplay between science, policy, and public perception in the face of evolving health challenges.

Keywords: Vaccination, HPAI, Vaccine safety and efficacy, Vaccine technology, Consumer attitudes

Citation. Shehata, A. A. and Tellez-Isaias, G. Vaccination against highly pathogenic avian influenza (HPAI): From opposition to acceptance. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 27. https://doi.org/10.51585/gtop.2023.1.0030

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

CRISPR, Quorum Sensing, and Arbitrium as strategic control measures for avian influenza virus

Guillermo Tellez-Isaias[1*], Magdalena Escorcia[2], Inkar Castellanos[1], Victor M. Petrone-Garcia[3], Awad A. Shehata[4], and Alberto Torres-Rodriguez[5],

[1]Department of Poultry Science, University of Arkansas Agricultural Experiment Station, Fayetteville, AR 72701, United States. [2]Department of Bird Medicine and Zootechnics. FMVZ-UNAM. [3]Departamento de Ciencias Pecuarias, Universidad Nacional Autónoma de México (UNAM), Cuautitlan Izcalli, Estado de México 54714, México. [4]Bavarian NMR Center (BNMRZ), Structural Membrane Biochemistry, Technical University of Munich, Garching, Germany. [5]Export Mgr. Cobb-Vantress, LLC.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Guillermo Tellez-Isaias
gtellez@uark.edu

Abstract

Avian Influenza Virus (AIV) poses a significant threat to both avian populations and human health due to its potential for zoonotic transmission. The emergence of highly pathogenic strains necessitates the development of innovative control strategies. This abstract presents a comprehensive overview of the potential of CRISPR-based technologies, Quorum Sensing (QS) systems, and the application of the synthetic inducer molecule Arbitrium as strategic control measures for mitigating AIV outbreaks. CRISPR-based technologies have revolutionized genetic engineering and hold immense promise in combating AIV. By leveraging the adaptive immune system of prokaryotes, CRISPR offers precise and targeted gene editing capabilities. This enables the creation of AIV-resistant poultry strains by introducing specific antiviral sequences, thereby reducing viral transmission within avian populations. Quorum Sensing, a cell-to-cell communication mechanism utilized by bacteria, can be harnessed to modulate AIV infectivity. By engineering QS systems to detect AIV-specific molecular signatures, it becomes possible to trigger population-wide responses in avian hosts. This includes activating immune responses and initiating antiviral signaling cascades, effectively conferring enhanced resistance to AIV infection. The incorporation of Arbitrium, a synthetic signaling molecule, represents a novel approach to controlling AIV. By engineering avian hosts to recognize Arbitrium, it is possible to orchestrate precise temporal and spatial responses to viral challenges. This programmable control system empowers the host organism to mount robust antiviral defenses upon exposure to AIV, providing an additional layer of protection. Furthermore, a synergistic approach integrating CRISPR, QS, and Arbitrium technologies holds the potential to create a comprehensive and adaptable defense system against AIV. This multi-pronged strategy addresses viral challenges at multiple levels, from genetic modification to population-wide immune responses, thereby bolstering the overall resilience of avian populations to AIV outbreaks. In conclusion, integrating CRISPR-based technologies, Quorum Sensing, and Arbitrium signaling represents a promising avenue for developing strategic control measures against Avian Influenza Virus. The synergistic application of these technologies offers precise and targeted genetic modifications and enables dynamic, population-level responses to AIV challenges. This innovative approach holds significant potential for revolutionizing AIV control strategies and safeguarding both avian and human health.

Keywords: CRISPR, Quorum Sensing, Control Measures, Avian influenza, Poultry

Citation. Tellez-Isaias, G., Escorcia, M., Castellanos, I., Petrone-Garcia, V. M., Shehata, A. A. and Torres-Rodriguez, A. CRISPR, Quorum Sensing, and Arbitrium as strategic control measures for avian influenza virus. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 28. https://doi.org/10.51585/gtop.2023.1.0031

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Mexico's experience when vaccinating against Avian Influenza: Advantages, disadvantages, and needs

Magdalena Escorcia[1*], **and Guillermo Tellez-Isaias**[2]

[1]Departamento de Medicina y Zootecnia de Aves FMVZ-UNAM Av. Universidad 3000, Col. UNAM CU. Coyoacán, Cd Mx. CP 04510. [2]Department of Poultry Science, University of Arkansas Agricultural Experiment Station, Fayetteville, AR 72701, USA.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas, USA
October 16-17, 2023

***Correspondence:**
Magdalena Escorcia
magdaesc@unam.mx

Abstract

The experience. The silent entry of the Avian Influenza (AI) virus into Mexican territory, for the experience. In March 1994, a Low Pathogenicity (LP) subtype H5N2 virus entered Mexico stealthily and spread fast in poultry districts. The virus was common in flocks when discovered. It became an HP virus in December, jeopardizing food security. A biological was developed using biosafety. December 1995 saw HPAI-free nation. From January to December 1995, 383 million vaccinations were given. The biological was an intravenous emulsion-inactivated vaccine. Due to excessive mortality in two Altos de Jalisco districts, the National Emergency Device in Animal Health (DINESA) was established in June 2012, and the HPAI H7N3 subtype was determined as the cause. About 20 towns in Los Altos de Jalisco generate 80% of the region's eggs, with 70,000,000 birds and 40% of per capita consumption. This endangered national food security. A 2006 migratory duck virus was used to develop a vaccination, then a reverse genetics vaccine. Both vaccinations were inactivated and emulsified for parenteral administration. A recombinant vaccine was made from the Newcastle virus vector and HA protein insert. Final data: 22.4 million birds infected, 140 million vaccinated. Wild, backyard, and production birds had HPAI virus subtype H5N1 in October 2022. The outbreaks occurred in strategic poultry regions: the Yucatan Peninsula, where parent and reproductive farms are; Jalisco, which produces 54.84% of the nation's eggs and 15.60% of chickens; Sonora, which produces 7.88% of eggs, and Nuevo León which produces 2.8% of eggs and 1.82% of Control was achieved with two emulsified parenteral subunit and reverse genetics vaccinations. Following the outbreak, 201,652,000 doses were delivered. In April, authorities halted immunization against this subtype because there were no isolates, hoping to weaken antibodies and declare the country free. Advantages and disadvantages of vaccinating. Emulsified vaccines are the most common in Mexico to combat the infection. These vaccines provide robust systemic protection, protect against mortality and productivity drops, do not promote local IgA production or memory cell development, require continual revaccination, and do not prevent infection. Since local immunity is poor and delayed, emulsified vaccinations should be used with recombinant vaccines. Vaccinating in Mexico protects food safety and indirectly reduces zoonoses because vaccinated birds remove less virus. Main drawback: Vaccination can make the virus endemic. Needs. Mexico produces a lot of chicken and eggs; therefore, HPAI has been a major issue for the sector. If we keep vaccinating, our most urgent needs will be (1) new vaccines from seed viruses, which must be refreshed cyclically to match the challenge virus, (2) a biological that stimulates local neutralizing immunity (IgA), (3) bivalent or trivalent biologicals that facilitate flock management to protect productive parameters, and (4) diffusion of the information about viral behavior and vaccine use. Insufficient information is a dangerous weapon.

Keywords: HPAI, LPAI, Mexico, Subunit vaccine, Immunity, DINESA, Hemagglutinin, IgA

Citation. Escorcia, M. and Tellez-Isaias, G. Mexico's experience when vaccinating against Avian Influenza: Advantages, disadvantages, and needs. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 29. https://doi.org/10.51585/gtop.2023.1.0032

GMPC-Thesis and Opinions Platform

eISSN:2747-5735

Genome editing to create avian influenza resistance in chickens

Mike McGrew

The Roslin Institute, Royal Dick School of Veterinary Studies, University of Edinburgh, UK.

Avian Influenza Summit
University of Arkansas
Fayetteville, Arkansas,
USA
October 16-17, 2023

***Correspondence:**
Mike McGrew
mike.mcgrew@roslin.ed.ac.uk

Abstract

Avian influenza (AI) significantly threatens global poultry production and public health. Efforts to combat this viral disease have been predominantly focused on vaccination strategies, with limited success in controlling its spread. This study explores a novel approach utilizing genome editing techniques to enhance avian influenza resistance in chickens. Specifically, we employ CRISPR-Cas9 technology to target the ANP32 genes, endogenous proteins co-opted by influenza for replication in chicken cells. Through the precise modification of these genes, we aimed to elucidate their role in conferring resistance to low and high pathogenic avian influenza strains. We employed genome editing methodologies to introduce specific modifications in the chicken genome of reproductive cells. By introducing targeted genetic alterations in the germ cells, we created chickens that transmit their resistance trait to subsequent generations of chickens. The outcomes of this research have the potential to change avian influenza management strategies, offering a new paradigm for disease resistance in poultry populations. This approach holds promise for sustainable and cost-effective AI management strategies, reducing reliance on continuous vaccination campaigns. Moreover, the knowledge gained from our study may have broader implications for understanding host-influenza interactions in multiple species and inform future strategies for combating emerging infectious diseases at the human-animal interface.

Keywords: Influenza, Public health, CRISPR-Cas9, ANP32 genes, Vaccination campaigns

Citation. McGrew, M. Genome editing to create avian influenza resistance in chickens. Proceeding of The First International Avian Influenza Summit, University of Arkansas- October 16-17, 2023". GMPC TOP. 3(1). pp. 30. https://doi.org/10.51585/gtop.2023.1.0033

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