شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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قسم

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Zoonotic Potential and Risk Factors Associated with Avian Influenza H5N1 Infection in Poultry and Their Handlers in Egypt

A Thesis presented by

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For
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(Zoonoses)

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Abstract

Since 2006, the highly Pathogenic Avian Influenza (HPAI) H5N1 virus subtype constitute animal and public health concerns in Egypt. The period between 2006 and 2017 showed huge outbreaks of H5N1 with high loss in poultry population, associated with human cases, The H5N1is now endemic in poultry Egypt. The present study examined the possible risk factors linked to H5N1 infection in poultry and in human work in direct contact with poultry. Tracheal swabs (n =824) were collected from domestic poultry species, including chickens (n=345), ducks (n=246), and turkeys (n=233) during the period from March 2016 to March 2017.

The samples were collected from household and farm sectors sited in the main three regions in Egypt, the Upper (Assiout and Menia), the Central (Cairo and Giza), and the Lower (Sharqia and Qaliobia). The detection of the HPAI H5N1 in tracheal samples of the poultry was performed by real-time real-PCR. Human work in contact with poultry n=53 were included. Blood samples were collected and subjected to hemagglutination inhibition test to examine the presence of antibodies against HPAI H5N1. Two structured questionnaires were used to gather the epidemiological data from poultry and humans included in the study. This was analyzed using Biostatistics software and the risk factors associated with infection with HPAI H5N1 were assessed.

The prevalence of poultry infection with HPAI H5N1 was 4.7 % (39 / 824). A higher prevalence of infection in poultry was found during Spring (7.9%) and Winter (5.9%) than during Summer (2.3%) and Autumn (1.7%). The risk of infection in household sector (7.6%) is higher than that recorded in the farm sector (1.9%). All tested human serum samples were negative to H5N1 antibodies.

In conclusion, the present results suggest that the possible risk factors linked to infection with HPAI H5N1 in poultry include, season (Spring and Winter), bird species (duck), the household sector, as well as frequent transmission of birds along governorates. Furthermore, Upper Egypt region is a high risk for HPAI H5N1 infection, indicating the necessity for regular examination of possible risk factors. This potentially enable an appropriate targeting of control strategies of H5N1 infection in poultry and minimize its impact on the public health.

Dedication

Thanks to ALLAH.

This work is dedicated to:

my father, my lovely mother, my lovely sister and my brothers whom I am indebted to them for my happiness in my life

Acknowledgement

In the Name of ***Allah***

In actual fact the prayful thanks at first to our merciful ALLAH who give me everything I have.

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Contents

List of Abbreviations

Abbreviation	Full name
AIV	Avian Influenza Virus
CDC	Centre for Disease Control and Prevention
GOVs	General Organization for Veterinary Services
HA	Hemagglutinin
HH	House Hold
HPAI	High Pathogenic Avian Influenza
LBMs	Life Bird Markets
OIE	World Organization for Animal Health
RT-PCR	Real-Time reverse transcription Polymerase Chain Reaction

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Introduction

In recent years, public health concerns have arisen due to the high pathogenicity of the avian influenza A (H5N1) virus, especially in South-East Asia and Egypt. Birds living in an aquatic habitat are naturally affected by avian influenza virus (AIV). Also the virus can infect domestic poultry, pet birds, other animal species, and occasionally also infecting humans (**WHO, 2015).**

The AIVs typically cause subclinical infection in domestic poultry including chickens, ducks, goose, and turkeys, while some strains can lead to a high mortality rate **(Abou El-Amaiem *et al.,* 2013)**. However, cases of human infection with AI have been reported, transmission from human to human rarely occurred [b](**CDC 2017**).

AIVs belong to type A influenza genus, family Orthomyxoviridae. An influenza a virus is an enveloped, eight segmented RNA virus, the genome is negative-sense, single-stranded and belongs to the Orthomyxoviridae family. Viruses of Type A (and B) cause nearly every year recurrent epidemics, causing significant human mortality and morbidity ***(*****Malik Peiris *et al.*, 2007*****)*** Eighteen haemagglutinin HA (H1-H18) and eleven neuraminidase NA (N1-N11) subtypes are well-known for influenza viruses A **(ICTV, 2017)**. It is usually difficult if not impossible for different types of HA or NA to cross-protect one another, and these functions are essential for the immune response.

The high variability is the result of mutation and genetic reassortment **(OIE, 2015),** by going through antigenic drift or shift, respectively. The antigenic drift represents the small changes that happen continually over time as the virus replicates, and usually result in new strain variants that are closely related. However, the antigenic shift denotes either major changes in the virus, or re-assortment between avian and human influenza strains, or between avian and other animal influenza strains which results in a new influenza A subtype **(Wimmer *et al.*, 2010)**.

Among the HP AIVs, H5N1 subtype represents a great concern particularly in South-East Asia and in Egypt **(Fasanmi *et al.*, 2017)**. This is attributed to the massive mortality caused by H5N1 in the domestic poultry, the unusual high virulence in wild birds, and the ability to infect humans **(Haider *et al.*, 2017)**, few cases of human-to-human transmission of H5N1 have been reported **(CDC, 2018)**.

In 2006, As an end result of this constant circulation, the HPAI H5N1 viruses have advanced and step by step diverged to a third-order genetic clade, namely, clade 2.2.1 has been reported in domestic poultry in Egypt by late 2007 and early 2008.

In 2008, the country was declared to be H5N1- clade 2.2.1 enzootic **(Cattoli *et al.*, 2011**). Despite the implementation of different control and preventive strategies including vaccination, yet, it failed to prevent outbreaks of the H5N1 in poultry **(Kayali *et al.*, 2016)**. Since most of Egypt's poultry production takes place within sectors 3 and 4, which have many premises and independent management systems, a low vaccination rate could be attributed to inherent logistical problems in applying any type of vaccine (**Elsobky *et al.*, 2020**).

Moreover, approximately 359 human cases of H5N1 were recorded in Egypt during the period from 2006 to 2017, 120 of them were fatal (case fatality rate: 33%) **(WHO, 2017)**. Almost all human cases had close contact with infected live or dead birds, or virus-contaminated environments (**Lai *et al.*, 2016**).

Poultry production systems in Egypt raises high-density poultry in various types of production, including large commercial farms, small and medium-sized unregistered unregulated farms and backyards **(Naguib *et al.*, 2019)**.

Many factors can affect the spread of the HPAI H5N1 virus between birds and the transmission to humans **(Abou El-Amaiem *et al.*, 2013)**. It cannot be completely ruled out that the movement of poultry and poultry products has caused the recent spread of the H5N1 virus, this geographic expansion like with high poultry density **(Malik *et al.*, 2007)**. Moreover, geoecological settings show higher levels of surface water than other adjacent regions, supporting higher populations of wild and domesticated water birds **(Ly *et al.*, 2016).**

As the human population's demographic characteristics contribute to an increase in poultry contact, poor poultry hygiene as it is attributable to culturally determined food market habits associated with poor poultry hygiene, HPAI H5N1 virus can persist and spread where there is an abundance of free-grazing ducks, therefore this study aims are;

1. Determine the prevalence of infection with HPAI H5N1 in poultry among different governorates in Egypt.
2. Investigate the risk factors associated with the high prevalence of infection,
3. Assess the level of exposure of poultry handlers to the virus.