Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi
Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Abdelwhab, E., Veits, J., Tauscher, K., Ziller, M., Grund, C., Hassan, M., Shaheen, M., Harder, T., Teifke, J., Stech, J., dan Mettenleiter, T. 2016. Progressive glycosylation of the haemagglutinin of avian influenza H5N1 modulates virus replication, virulence, and chicken-to-chicken transmission without significant impact on antigenic drift. *J. Gen. Virol.* 97: 3193–3204.

Achenbach, J. dan Bowen, R. 2011. Transmission of avian influenza A viruses among species in an artificial barnyard. Colorado State University. Colorado. USA. *PLoS One* 6(3): 1–7.

Adi, A., Kardena, I., Astawa, N., dan Matsumoto, Y. 2012. Pelacakan secara imunohistokimiawi antigen virus pada ayam yang diinfeksi dengan virus penyakit tetelo. *J. Vet.* 13: 278–283.

Alexander, D. 1993. Paramyxovirus infections. Viral infections of birds. Elsevier science publishers. Amsterdam. 321–340.

Alexander, D.J. 2000. A review of avian influenza in defferent bird species. *Vet. Microbiol.* 74: 3–13.

Ali, A., Elmowalid, G., Abdel-Glil, M., Sharafeldin, T., Abdallah, F., Mansour, S., Nagy, A., Ahmed, B., dan Abdelmoneim, M. 2015. Etiology and pathology of epidemic outbreaks of avian influenza H5N1 infection in Egyptian chicken farms. *Pol. J. Vet. Sci.* 18(4): 779–786.

Anonim. 2014. OFFLU OIE/FAO Network of expertise on avian influenza. Influenza a cleavage site.

Anonim. 2015. Dirjenakeswan. Perkembangan Kasus Avian Influenza (AI) pada Unggas Kondisi s/d Maret 2015. Online: http://keswan.ditjenak.pertanian.go.id/index.php/blog/read/berita/perkembangan-kasus-avian-influenza-ai pada-unggas-kondisi-sd-31-maret-2015. (diakses tanggal 3 Januari 2020)

Bahr, J. dan Johnson, P. 1991. Reproduction in poultry. In reproduction in domestic animals. USA: Academi Press, Inc.

Bancroft, J. dan Gamble, M. 2008. Theory and practice of histological techniques 6th ed. Churchill Livingstone. Elsevier.

Boenisch, T. 2001. Formalin-fixed and heat-retrieved tissue antigens: A comparison of their immunoreactivity in experimental antibody diluents. *Appl. Immunohistochem. Mol. Morphol.* 9: 176–179.

Bouvier, N.M. dan Lowen, A.C. 2010. Animal models for influenza virus pathogenesis and transmission. *Viruses-Basel.* 2(8): 1530–1563.

Boyce, W.M, Sandrock, C., Kreuder-Johnson, C., Kelly, T., dan Cardona, C. 2009. Avian influenza viruses in wild birds: A moving target. *Comp. Immunol. Microbiol. Infec. Dis.* 32: 275–286.

Brown, C.C., Olander, H.J., dan Senne, D.A. 1992. A pathogenesis study of highly pathogenic avian influenza virus H5N2 in chickens, using immunohistochemistry. *J. Comp. Pathol.* 107: 341–348.

UNIVERSITAS GADJAH MADA
Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Campitelli, L., Ciccozzi, M., Salemi, M., Taglia, F., Boros, S., Donatelli, I., dan Rezza, G. 2006. H5N1 influenza virus evolution: a comparison of different epidemics in birds and humans (1997-2004). *J. Gen. Virol.* 87: 955–960.

Capua, I. dan Alexander, D.J. 2004. Avian Influenza and Newcastle Disease A field and Laboratory Manual. 1th. Springer. 73–80.

Capua, I. dan Alexander, D.J. 2008. Ecology, epidemiology and human health implications of avian influenza viruses: why do we need to share genetic data?. *Zoonoses Public Health* 55: 2–15.

Capua, I. dan Marangon, S. 2000. A review: the avian influenza epidemic in Italy, 1999-2000. *Avian Pathol.* 9457(4): 289–294.

Cattoli, G., Milani, A., Temperton, N., Zecchin, B., Buratin, A., Molesti, E., Aly, M., Arafa, A., dan Capua, I. 2011. Antigenic drift in H5N1 avian influenza virus in poultry is driven by mutations in major antigenic sites of the hemagglutinin molecule analogous to those for human influenza virus. istituto zooprofilattico sperimentale delle venezie. Viale dell'Universita'. Italy. *J. Virol.* 85(17): 8718–8724.

Chamnanpood, C., Sanguansermsri, D., Pongcharoen, S., dan Sanguansermsri, P. 2011. Detection of distribution of avian influenza H5N1 virus by immunohistochemistry, chromogenic in situ hybridization and real-time pcr techniques in experimentally infected chickens. *Southeast Asian J. Trop. Med. Public Health* 42(2): 303–310.

Choi, J., Kang, H., Jeon, W., Choi, K., Kim, K., Song, B., Lee, H., Kim, J., dan Lee, Y. 2013. Characterization of clade 2.3.2.1 H5N1 highly pathogenic avian influenza viruses isolated from wild birds (Mandarin duck and Eurasian eagle owl) in 2010 in Korea. *Viruses* 5: 1153–1174.

Collins, R., Ko, L., So, K., Ellins, T., Lau, L., dan Yu, A. 2003. A NASBA methods to detect high and low pathogenicity H5 avian influenza viruses. *Avian Dis.* 47(3): 1069–1074.

Connor, R., Kawaoka, Y., Webster, R., dan Paulson, J. 1994. Receptor specificity in human, avian and equine H2 and H3 influenza virus isolates. *J. Virol*. 205: 17–23.

Dabbs, D. 2013. Diagnostic immunohistochemistry: theranostic and genomic applications: techniques of immunohistochemistry: principles. pitfalls, and standarization 4th ed. United States of America: Elsevier Saunders. 1–19.

Damayanti, R., Dharmayanti, N., Indriaani, R., Wiyono A., dan Darminto. 2004. Deteksi virus avian influenza subtipe H5N1 pada organ ayam yang terserang flu burung sangat patogenik di Jawa Timur dan Jawa Barat dengan teknik imunohistokimia. *JITV*. 9: 197–203.

Damayanti, R., Dharmayanti, N., Indriani, R., Wiyono, A., dan Adjid, R. 2005. Monitoring kasus penyakit avian influenza berdasarkan deteksi antigen virus subtipe H5N1 secara imunohistokimia. *JITV*. 10: 322–330.

De, J. dan Hien, T. 2006. Avian influenza A (H5N1). *J. Clin. Virol.* 35(1): 2–13.

UNIVERSITAS
GADJAH MADA
**Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi
Telur**
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Dharmayanti, N. 2010. Struktur dan peranan genom segmen 7 (protein matriks) dan segmen 8 (nonstruktural) dalam siklus hidup dan virulensi virus influenza. *Wartazoa* 20(2): 55–67.

Dharmayanti, N., Hartawan, R., Hewajui, D., Hardiman, Wibawa, H., dan Pudjiatmoko. 2013. Karakteristik molekuler dan patogenesitas virus H5N1 Clade 2.3.2 asal Indonesia. *JITV.* 18(2): 99–113.

Dharmayanti, N., Indriani, R., dan Nurjanah, D. 2020. Vaccine efficacy on the novel reassortant H9N2 virus in Indonesia. *Vaccines* 8(449): 1–17.

Elfidasari, D., Frisa, A., Soejoedono, R., Murtini, S., dan Solihin, D. 2015. Mekanisme penyebaran virus avian influenza subtipe H5N1 pada burung air liar dan unggas peliharaan di kawasan cagar alam pulau dua serang. *Bio. Wallacea* 1(2): 93–97.

Elnifro, E., Ashshi, A., Cooper, R., dan Klapper, P. 2000. Multiplex PCR: Optimization and application in diagnostic virology. *Clin. Microbiol. Rev.* 13: 559–570.

Elton, D., Simpson-Holley, M., Archer, K., Medcalf, L., Hallam, R., McCauley, J., dan Digard, P. 2001. Interaction of the influenza virus nucleoprotein with the cellular CRM1-mediated nuclear export pathway. *J. Virol.* 75: 408–419.

Escorcia, M., Vazquez, L., Mendez, S., Rodriguez-Ropon, A., Lucio, E., dan Nava, G. 2008. Avian influenza: genetic evolution under vaccination pressure. *J. Virol.* 5(15): 1-5.

Fouchier, R., Munster, V., Wallensten, A., Besterboer, T., Herfst, S., Smith, D., Rimmelzwann, G., Olsen, B., dan Osterhaus, A. 2005. Characterization of a novel virus influenza a hemaglutinin subtype (H16) Obtained from Black Headed Gull. *J. Virol.* 79(5): 2814–2822.

França, M. dan Brown, J. 2014. Influenza pathobiology and pathogenesis in avian species. *Curr. Top. Microbiol. Immunol.* 221–242.

Fukuyama, S. dan Kawaoka, Y. 2011. The pathogenesis of influenza virus infections: the contributions of virus and host factors. *Curr. Opin. Immunol.* 23: 481–486.

Gambaryan, A., Tuzikov, A., Pazynina, G., Bovin, N., Balish, A., dan Klimov, A. 2006. Evolution of receptor binding phenotype of influenza A (H5) viruses. *J. Virol.* 344: 432–438.

Garman, E. dan Laver, G. 2004. Controlling influenza by inhibiting the virus's neuramidase. *Curr. Drug Targets* 5(2): 119–136.

Ge, J., Deng, G., Wen, Z., Tian, G., Wang, Y., Shi, J., Wang, X., Li, Y., Hu, S., Jiang, Y., Yang, C., Yu, K., Bu, Z., dan Chen, H. 2007. Newcastle disease virus-based live attenuated vaccine completely protects chickens and mice from lethal challenge of homologous and heterologous H5N1 avian influenza viruses. *J. Virol.* 81(1): 150–158.

UNIVERSITAS
GADJAH MADA
**Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi
Telur**
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Gerdil, C. 2003. The Annual Production Cycle for Influenza Vaccine. *Vaccine* 21: 1776–1779.

Giannecchini, S., Clausi, V., Di, L., Falcone, E., Terregino, C., Toffan, A., Cilloni, F., Matrosovich, M., Gambaryan, A., Bovin, N., Delogu, M., Capua, I., Donatelli, I., dan Azzi, A. 2010. Molecular adaptation of an H7N3 wild duck influenza virus following experimental multiple passages in quail and turkey. *J. Virol*. 408(2): 167–173.

Giles, B. 2011. Development of a broadly reactive vaccine for highly pathogenic H5N1 influenza, Disertasi: University of Pittsburgh.

Gu, M., Chen, H., Li, Q., Huang, J., Zhao, M., Gu, X., Jiang, K., Wang, X., Peng, D., dan Liu, X. 2014. Enzootic genotype S of H9N2 avian influenza viruses donates internal genes to emerging zoonotic influenza viruses in China. *Vet. Microbiol.* 174: 309–315.

Guan, Y., Smith, G., Webby, R., dan Webster, R. 2009. Molecular epidemiology of H5N1 avian influenza. *Rev. Sci. Tech.* 28: 39–47.

Hagag, I., Mansour, S., Zhang, Z., Ali, A., Ismaiel, E., Salama, A., Cardona, C., Collins, J., dan Xing, Z. 2015. Pathogenicity of highly pathogenic avian influenza virus H5N1 in naturally infected poultry in Egypt. *PLoS ONE* 10(5): 1–15.

Harimoto, T. dan Kawaoka, Y. 2005 Influenza: lessons from past pandemics, warnings from current incidents. *Nat. Rev. Microbiol*. 3: 591–600.

Hassan, K., Shany, S., Ali, A., Dahshan, A., El-Sawah, A., dan El-Kady, M. 2016. Prevalence of avian respiratory viruses in broiler flocks in Egypt. *Poult. Sci.* 95: 1271–1280.

Hassan, K., Ali, A., Shany, S., dan El-Kady, M. 2017. Experimental co-infection of infectious bronchitis and low pathogenic avian influenza H9N2 viruses in commercial broiler chickens. *Res. Vet. Sci.* 115: 356–362.

Hay, A., Nicholson, K., Webster, R., dan Hay, A. 1998. The virus genome and its replication. In: textbook of influenza. London. 43–53.

Hewajuli, D. dan Dharmayanti, N. 2008. Karakterisasi dan identifikasi virus avian influenza (AI). *Wartazoa* 18(2): 86–100.

Hoffman, B., Beer, M., Reid, S., Martens, P., Qura, C., Rijn, P., Slomka, M., Banks, J., Brown, I., Alexander, D., dan King, D. 2009. A review of RT-PCR technologies used in veterinary virology and disease control: sensitive and specific diagnosis of livestock disease notifiable to the World Organization for animal health. *Vet. Microbiol*. 139: 1–23.

Hooper, P., Russell, G., Selleck, P., dan Stanislawek, W. 1995. Observation on the relationship in chickens between the virulence of some avian influenza viruses and their pathogenicity for various organs. *Avian Dis*. 39: 458–464.

Hooper, P. dan Selleck. 1998. Pathology of low and high virulent influenza virus infections. In D.E. Swayne and R.D. Slemons (ed.). Proceedings of the

UNIVERSITAS GADJAH MADA
Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Fourth International Symposium on Avian Influenza. U.S. Animal Health Association, Richmond, Va. 134–141.

Horwood, P., Horm, S., Suttie, A., Thet, S., Phalla, Y., Rith, S., Sorn, S., Holl, D., Tum, S., Ly, S., Karlsson, E., Tarantola, A., dan Dussart, P. 2018. Co-circulation of influenza A H5, H7, and H9 viruses and co-infected poultry in live bird markets, Cambodia. *Emerg. Infect. Dis.* 24(2): 352–355.

Howarth, M., Chinnapen, D., Gerrow, K., Dorrestein, P., Grandy, M., Kelleher, N., Husseini, E., Ting, A., dan Alice, Y. 2006. A monovalen streptavidin with a single fentomolar biotin binding site. *Nat. Methods* 3: 267–273.

Hulse, D., Webster, R., Russell, R., dan Perez, D., 2004. Molecular determinants within the surface proteins involved in the pathogenicity of H5N1 influenza viruses in chickens. *J. Virol*. 78(18): 9954–9964.

Isnawati, R., Wuryastuty, H., dan Wasito, R. 2019. Peneguhan diagnosis avian influenza pada ayam petelur yang mengalami gejala penurunan produksi. *J.S.V.* 37(1): 1–10.

Ito, T., Nelson, J., Couceiro, S., Kelm, S., Baum, L., Krauss, S., Castrucci, M., Donateli, I., Kida, H., Paulson, J., Webster, R., dan Kawaoka, Y. 1998. Molecular basis for the generation in pigs of influenza A viruses with pandemic potential. *J. Virol.* 72: 7367–7373.

Jakhesara, S., Bhatt, V., Patel, N., Prajapati, K., dan Joshi, C. 2014. Isolation and characterization of H9N2 influenza virus isolates from poultry respiratory disease outbreak. *SpringerPlus*. 3(196): 1–8.

Jestin, V. dan Jestin, A. 1991. Detection of newcastle disease virus RNA in infected allantoic fluids by in vitro enzymatic amplification (PCR). *Arch. Virol.* 118: 151–161.

Johnson, C. 1999. Issues in immunohistochemistry. *Toxicol. Pathol.* 27(2): 246–248.

Kalthoff, D., Breithaupt, A., dan Teifke, J. 2008. Highly pathogenic avian influenza virus (H5N1) in experimentally infected adult mute swans. *Emerg. Infect. Dis.* 14: 1267–1270.

Kalthoff, D., Globig, A., dan Beer, M. 2010. (Highly Pathogenic) avian influenza as a zoonotic agent. *Vet. Microbiol.* 140: 237–245.

Katikireddy dan O'Sullivan. 2011. Immunohistochemical and immunofluorescence procedures for protein analysis. gene expression profiling: methods and protocols. *Methods Mol. Biol.* 784: 155–167.

Kilany, W., Arafa, A., Erfan, A., Ahmed, M., Nawar, A., Selim, A., Khoulosy, S., Hassan, M., Aly, M., Hafez, H., dan Abdelwhab, E. 2010. Isolation of highly pathogenic avian influenza H5N1 from table eggs after vaccinal break in commercial layer flock. *Avian Dis.* 54: 1115–1119.

Kilbourne, E., Smith, C., Brett, I., Pokorny, B., Johansson, B., dan Cox, N. 2002. The total influenza vaccine failure of 1947 revisited: major intrasubtypic

UNIVERSITAS GADJAH MADA
Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

antigenic change can explain failure of vaccine in a post world war II epidemic. *Proc. Natl. Acad. Sci.* 99: 10748–10752.

Kim, J., Ryu, S., dan Seo, S. 2005. Cells in the respiratory and intestinal tracts of chicken have different proportions of both human and avian influenza virus receptors. *J. Microbiol.* 43(4): 366–369.

Kim, S., Roh, J., dan Park, C. 2016. Immunohistochemistry for pathologists: protocols, pitfalls, and tips. *J. Pathol. Transl. Med.* 50(6): 411–418.

Kimble, B., Nieto, G., dan Perez, D. 2010. Characterization of influenza virus sialic acid receptors in minor poultry species. *J. Virol.* 7(365): 1–10.

Kobayashi, Y., Horimoto, T., Kawaoka, Y., Alexander, D., dan Itakura, C. 1996. Pathological studies of chickens experimentally infected with two highly pathogenic avian influenza viruses. *Avian Pathol*. 25: 285–304.

Kompas. 2008. Kerugian Akibat Flu Burung Capai Rp. 4,1 Triliun, http://nasional.kompas.com/read/2008/03/24/1551076/Kerugian.Akibat.Flu.Burung.Capai.Rp4.1 Triliun (diakses pada tanggal 10 Agustus 2019).

Krejcova, L., Mivchalek, P., Hynek, D., Adam, V., dan Kizek, R. 2015. Structure of influenza virus, connected with influenza life cycle. *J. Metallomics Nanotechnol*. 1: 13–19.

Ladman, A., Rosenberger, S., Rosenberger, J., Pope, C., dan Gelb, J., 2008. Virulence of low pathogenicity H7N2 avian influenza viruses from the Delmarva Peninsula for broiler and leghorn chickens and turkeys. *BioOne* 52(4): 623–631.

Lamb, R. dan Krug, R. 2001. Orthomyxoviridae: The viruses and their replication. In: Fields BN, Knipe DM, Howley PM, eds. Philadelphia, Pennsylvania: Lippincott-Raven. Fields Virology 4th ed. 1487–1532.

Latifa, R. dan Sarmanu. 2008. Manipulasi reproduksi pada itik petelur afkir dengan pregnant mare serum gonadotropin. *J. Penelit. Med. Eksakta* 7(1): 83–91.

Laudert, E., Sivanandan, V., dan Halvorson, D. 1993. Effect of an H5N1 avian influenza virus infection on the immune system of mallard ducks. *Avian Dis.* 37: 845–853.

Laura, E., Perkins, L., dan Swayne, D., 2002. Pathogenicity of a Hong Kong origin H5N1 highly pathogenic avian influenza virus for emus, geese, ducks, and pigeons. *Avian Dis.* 46 (1): 53–63.

Lee, M., Chang, P., Shien, J., Cheng, M., dan Shieh, H. 2001. Identification and subtyping of avian influenza viruses by reverse transcription-PCR. *J. Virol. Methods* 97: 13–22.

Levine, A. dan Enquist, L. 2007. History of virology, in Fields Virology, 5th Edn, eds D. M. Knipe, P. M. Howley, D. E. Griffin, R. A. Lamb, M. A. Martin, B. Roizman, and S. E. Straus. Philadelphia, PA: Lippincott Williams and Wilkins. 3–23.

Li, K., Guan, Y., Wang, J., Smith, G., Xu, K., Duan, L., Rahardjo, A., Puthavathana, P., Buranathai, C., Nguyen, T., Estoepangestie, A., Chaisingh, A.,

UNIVERSITAS
GADJAH MADA
**Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi
Telur**
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Auewarakul, P., Long, H., Hanh, N., Webby, R., Poon, L., Chen, H., Shortridge, K., Yuen, K., Webster, R., dan Peiris, J. 2004. Genesis of A highly pathogenic and potentially pandemic H5N1 influenza virus in Eastern Asia. *Nature* 430: 209–213.

Liu, J., Stevens, D., Haire, L., Walker, P., Coombs, P., Russell, R., Gamblin, S. dan Skehel, J. 2009. Structures of receptor complexes formed by hemagglutinins from the Asian influenza pandemic of 1957. *Proc. Natl. Acad. Sci.* 106: 17175–17180.

Lockhart, C., Inui, K., Mcgrane, J., Oberoi, M., Dauphin, G., Martin, V., Wainwright, S., Lubroth, J., Morzaria, S., Claes, F., dan Pinto, J. 2014. Update on the continuous spread and expansion of H5N1 highly pathogenic avian influenza. *FAO Focus On* 7: 1–13.

Löndt, B., Nunez, A., Banks, J., Nili, H., Linda, K., Alexander, D., dan Johnson, L. 2008. Pathogenesis of highly pathogenic avian influenza A/turkey/Turkey/1/2005 H5N1 in Pekin ducks (Anas platyrhynchos) infected experimentally Pathogenesis of highly pathogenic avian influenza A/turkey/Turkey/1/2005 H5N1 in Pekin ducks. *Avian Pathol.* 27(6): 618–627.

Mair, C., Ludwig, K., Herrmann, A., dan Sieben, C. 2014. Receptor binding and PH stability: how influenza A virus hemaglutinin affects host specific virus infection. *B.B.A.* 1838: 1153–1168.

Magub, S. 2016. Immunohistochemistry: Getting the Stain You Want. http:// bitesizebio.com/7619/immunohistochemistry-getting-the-stain-you-want/.
(diakses pada tanggal 27 Desember 2019).

Malau-Aduli, A., Bawa, G., dan Joel, K. 2003. Factors affecting egg production and layer bird mortality in private poultry farms in the subhumid zone of nigeria. *Anim. Sci. J.* 74: 239–242.

Matrosovich, M., Matrosovich, T., Gray, T., Roberts, N., dan Klenk, H. 2004. Human and avian influenza viruses target different cell types in cultures of human airway epithelium. *Proc. Natl. Acad. Sci. U.S.A.* 101(13): 4620–4624.

Medina, R. dan Garcia-Sastre, A. 2011. Influenza A viruses: new research developments. *Nat. Rev. Microbiol*. 9: 590–603.

Muflihanah, Andesfha, E., Wibawa, H., Zenal, F., Hendrawati, F., Siswani, Wahyuni., Kartini, D., Rahayuningtyas, I., Hadi, S., Mukartini, S., Poermadjaja, B., dan Rasa, F. 2017. Kasus pertama low pathogenic avian influenza subtipe H9N2 pada peternakan ayam petelur di Kabupaten Sidrap, Sulawesi Selatan, Indonesia. *Diagnosa Veteriner* 16: 1–13.

Munson, P. 2007. Immunohistochemistry, In: H.R.H. Patel, M. Arya, and I.S. Shergill (Eds). Basic science techniques in clinical practice. Shergill (Eds). Springer-Verlag London. 19–30.

UNIVERSITAS GADJAH MADA
Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Murphy, F., Gibbs, E., Horzinek, M., dan Studdert, M. 2008. Orthomyxoviridae. Veterinary Virology, 3th ed. San Diego, California 92101-4495, USA. 459–46.

Nakatani, H., Nakamura, K., Yamamoto, Y., Yamada, M., dan Yamamoto Y. 2005. Epidemiology, pathology, and immunohistochemistry of layer hens naturally affected with H5N1 highly pathogenic avian influenza in Japan. *Avian Dis.* 49: 436–441.

Nuradji, H., Bingham, J., Payne, J., Harper, J., Lowther, S., Wibawa, H., Long, N., dan Meers, J. 2017. Highly pathogenic avian influenza (H5N1) virus in feathers: tropism and pathology of virus-infected feathers of infected ducks and chickens. *Vet. Pathol.* 54(2): 226–233.

Office International Des Epizooties (OIE). 2015. OIE Terrestrial Manual 2015. Avian Influenza (Infection with Avian Influenza Viruses). Chapter 2.3.4. 1-23.

Ogiwara, H., Yasui, F., Munekata, K., Takagi-Kamiya, A., Munakata, T., Nomura, N., Shibasaki, F., Kuwahara, K., Sakaguchi, N., Sakoda, Y., Kida, H., dan Kohara, M. 2014. Histopathological evaluation of the diversity of cells susceptible to H5N1 virulent avian influenza virus. *Am. J. Pathol.* 184: 171–183.

Owen, R., Cowen, B., Hattel, A., Naql, S., dan Wilson, R. 1991. Detection of viral antigen following exposure of one day old chicken to the Holland strain of infectious bronchitis virus. *Avian Pathol.* 20: 663–673.

Palese, P. dan Shaw, M. 2007. Orthomyxoviridae: The viruses and their replication. In: Knipe, D.M., Howley, P.M. (eds.), Fields Virology, 5th ed. Lippincott Williams and Wilkins, Philadelphia, Pennsylvania, United States. 1649–1656.

Palese, P. dan Young, J. 1983. Molecular epidemiology of influenza virus. in genetics of influenza viruses. Edited by P. Palese and D. W. Kingsbury. New York: Springer-Verlag. 321–336.

Pantin-Jackwood, M. dan Swayne, D. 2007. Pathobiology of Asian highly pathogenic avian influenza H5N1 virus infections in ducks. *Avian Dis.* 51: 250–259.

Pantin-Jackwood, M. dan Swayne, D. 2009. Pathogenesis and pathobiology of avian influenza virus infection in Bird. *Rev. Sci. Tech. Off. Int. Epiz*. 28: 113–136.

Patrick, I., Jubb, T., dan Rolfe, P. 2008. A scoping study investigating opportunities for improving biosecurity on commercial poultry farms in Indonesia. Australian Center for International Agricultural Research (ACIAR). Canberra, Australia.

Petersen, K. dan Pedersen, H. 2016. Detection methods. Dako IHC Guidebook.

Plotkin, J. dan Dushoff, J. 2003. Codon bias and frequency-dependent selection on the hemagglutinin epitopes of influenza A virus. *Proc. Natl. Acad. Sci*. 100: 7152–7157.

UNIVERSITAS
GADJAH MADA
**Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi
Telur**
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Purwaningsih, D. 2014. Peternakan ayam ras petelur di Kota Singkawang. *JMARS*. 2(2): 74–88.

Putri, K., Widyarini, S., Sugiyono, dan Asmara, W. 2019. The thrift of avian influenza in Indonesia, viruses and viral infections in developing countries. IntechOpen. 1–17.

Qi, X., Tan, D., Wu, C., Tang, C., Li, T., Han, X., Wang, J. Liu, C., Li, R., dan Wang, J. 2016. Deterioration of eggshell quality in laying hens experimentally infected with H9N2 avian influenza virus. *Vet. Res.* 47(35): 1–10.

Ramos-Vara, J., Ecvp, D., Segalés, J., Duran, C., Campbell, K., Domingo, M. dan Ecvp, D. 1999. Diagnosing infectious porcine diseases using immunohistochemistry. *J. Swine Health Prod.* 7: 85–91.

Ramos-Vara, J. dan Miller, M. 2014. When tissue antigens and antibodies get along: revisiting the technical aspects of immunohistochemistry—The red, brown, and blue technique. *Vet. Pathol.* 51(1): 42–87.

Rickert, R. dan Maliniak, R. 1989. Intralaboratory quality assurance of immunohistochemical procedures. Recommended practices for daily application. *Arch. Pathol. Lab. Med.* 113: 673–679.

Rimmelzwaan, G., Kuiken, T., Amerongen, G., Bestebroer, T., Fouchier, R., dan Osterhaus, A. 2001. Pathogenesis of influenza A (H5N1) virus infection in a primate model. *J. Virol.* 75: 6687–6691.

Samy, A. dan Naguib, M. 2018. Avian respiratory coinfection and impact on avian influenza pathogenicity in domestic poultry: field and experimental findings. *Vet. Sci.* 5: 943–946.

Santos, C., Sakai, V., Machado, M., Schippers, D., dan Greene, A. 2004. Reverse transcription and polymerase chain reaction: principles and applications in dentistry. *J. Appl. Oral. Sci.* 12(1): 1–11.

Schat, K., Bingham, J., Butler, J., Chen, L., Lowther, S., Crowley, T., Moore, R., Donis, R., dan Lowenthal, J. 2012. Role of position 627 of PB2 and the multibasic cleavage site of the hemagglutinin in the virulence of H5N1 avian influenza virus in chickens and ducks. *PLoS One* 7(2): 1–11.

Selleck, P. 2007. Serological tests for the detection of antibodies againts avian influenza. CSIRO Australian Animal Health Laboratory, Geelong, Australia.

Setyawati, S., Soejoedono R., Handharyani, E., dan Sumiarto, B. 2010. Deteksi virus avian influenza H5N1 pada anak ayam umur satu hari dengan teknik imunohistokimia. *J. Vet.* 11(4): 203–209.

Seo, S. dan Webster R. 2000. Cross-reactive, cell-mediated immunity and protection of chickens from lethal H5N1 influenza virus infection in Hong Kong poultry markets. *J. Virol.* (75)6: 2516–2525.

Shehata, A., Sedeik, M., Elbestawy, A., El-Abideen, M., Ibrahim, H., Kilany, W., dan Ali, A. 2019. Co-infections, genetic, and antigenic relatedness of avian

UNIVERSITAS GADJAH MADA
Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

influenza H5N8 and H5N1 viruses in domestic and wild birds in Egypt. *Poult. Sci.* 98(6): 2371–2379.

Shi, S., Shi, Y., dan Taylor, C. 2011. Antigen Retrieval Immunohistochemistry: Review and Future Prospects in Research and Diagnosis over Two Decades. *J. Histochem. Cytochem.* 59(1): 13–32.

Slemons, R., Byrum, B., dan Swayne, D. 1998. Bacterial proteases and co-infections as enhancers of virulence. In proceedings of the fourth international symposium on avian influenza, D.E. Swayne and R.D. Slemons, eds. U.S. Animal Health Association, Richmond, Virginia. 203–208.

Smith, G., Naipospos, T., Nguyen, T., Jong, D., Vijaykrishna, D., Usman, T., Hassan, S., Nguyen, T., Dao, T., Bui, N., Leung, Y., Cheung, C., Rayner, J., Zhang, J., Zhang, L., Poon, L., Li, K., Nguyen, V., Hien, T., Farrar, J., Webster, R., Chen, H., Peiris, J., dan Guan, Y. 2006. Evolution and adaptation of H5N1 influenza virus in avian and human hosts in Indonesia and Vietnam. *Virol. J.* 350(2): 258–268.

Smith, G., Vijaykrishna, D., Lycett, S., Worobey, M., Pybus, O., Ma, S., Cheung, C., Raghwani, J., Bhatt, S., Peiris, J., Guan, Y., dan Rambaut, A. 2009. Origins and evolutionary genomics of the 2009 swine-origin H1N1 influenza A epidemic. *Nature* 459: 1122–1125.

Soonberg, S., Webby, R., dan Webster, R. 2013. Natural history of highly pathogenic avian influenza H5N1. *Virus Res.* 178: 63–77.

Spackman, E., Ip, H., Suarez, D., Slemons, R., dan Stallknecht, D. 2008. Analytical validation of a real-time reverse transcription polymerase chain reaction test for pan-american lineage H7 subtype avian influenza viruses. *J. Vet. Diagn. Invest.* 20: 612–616.

Spackman, E., Gelb, J., Preskenis, L., Ladman, B., Pope, C., Pantin-Jackwood, M., dan McKinley, E. 2010. The pathogenesis of low pathogenicity H7 avian influenza viruses in chickens, ducks and turkeys. *J. Virol*. 7(331): 1–10.

Stallknecht, D., Nagy, E., Hunter, D., dan Slemons, R. 2007. Avian influenza. In Infectious Diseases of Wild Birds, 1st edition, edited by Thomas, N.J., Hunter, D.B. and Atkinson, C.T. Ames, IA: Blackwell Publishing. 108–130.

Stallknecht, D. dan Brown, J. 2009. Tenacity of avian influenza viruses. *Rev. Sci. Tech.* 28(1): 59–67.

Stevens, J., Blixt, O., Paulson, J., dan Wilson, I. 2006. Glycan microarray technologies: tools to survey host specificity of influenza viruses. *Nat. Rev. Microbiol.* 4: 857–864.

Sturm-Ramirez, K., Hulse-Post, D., Govorkova, E., Humberd, J., Seiler, P., Puthavathana, P., Buranathai, C., Nguyen, T., Chaisingh, A., Long, H., Naipospos, T., Chen, H., Ellis, T., Guan, Y., Peiris, J., dan Webster, R. 2005. Are ducks contributing to the endemicity of highly pathogenic H5N1 influenza viruses in Asia. *J. Virol.* 79(17): 11269–11279.

UNIVERSITAS GADJAH MADA
Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Suarez, D. 2008. Influenza A Virus, In: Suarez D.L. (eds), Avian influenza 1st ed. Blacwell Publishing, UK. 3–22.

Suarez, D., Perdue, M., Cox, N., Rowe, T., Bender, C., Huang, J., dan Swayne, D. 1998. Comparisons of highly virulent H5N1 influenza a viruses isolated from humans and chickens from Hong Kong. *J. Virol.* 72: 6678–6688.

Sudiana, L. 2005. Teknologi ilmu jaringan dan imunohistokimia. Sagung Seto. Jakarta. 36–50.

Suzuki, Y., Ito, T., Suzuki, T., Holland, R., Chambers, T., Kiso, M., Ishida, H., dan Kawaoka, Y. 2000. Sialic acid species as a determinant of the host range of influenza A viruses. *J. Virol.* 74: 11825–11831.

Suzuki, Y. 2005. Sialobiology of influenza: molecular mechanism of host range variation of influenza viruses. *Biol. Pharm. Bull.* 28(3): 399–408.

Suzuki, K., Okada, H., Itoh, T., Tada, T., Mase, M., Nakamura, K., Kubo, M., dan Tsukamoto, K. 2009. Association of increased pathogenicity of Asian H5N1 highly pathogenic avian influenza viruses in chickens with highly efficient viral replication accompanied by early destruction of innate immune responses. *J. Virol.* 83: 7475–7486.

Swayne, D. 1997. Pathobiology of H5N2 Mexican avian influenza viruses for chickens. *Vet. Pathol.* 34: 557–567.

Swayne, D. dan Halvorson, D. 2003. Influenza. In: Diseases of Poultry, 11th edition, Editors Saif, Y.M., Iowa State Press, A Blackwell Publishing Company USA. 135–160.

Swayne, D. dan Halvorson, D. 2008. Influenza. In: Saif, Y.M. (editor). Disease of poultry 12th ed. Blackwell Publishing Professional. Ames, Iowa, USA. 153–184.

Swayne, D. dan Jackwood, M. 2008. Pathobiology of avian influenza virus infectious in birds and mammals. Blackwell Publishing Profesional 2121 State Avenue, Ames Iowa 500014. USA. 87–94.

Swayne, D. dan King, D. 2003. Avian influenza and Newcastle disease. *JAVMA*. 222: 1534–1540.

Swayne, D. dan Suarez, D. 2000. Highly pathogenic avian influenza. *Rev. Sci. Tech. Off. Int. Epiz.* 19: 463–482.

Swayne, D., Suarez, D., dan Sims, L. 2013. Influenza. In: Swayne, D., Glisson, J., McDougald, L., Nair, V., Nolan, L., Suarez, D. (Eds.). Diseases of poultry 13th ed. Wiley Blackwell, Ames, Iowa. 181–218.

Tao, Q., Wang, X., Bao, H., Wu, J., Shi, L., Li, Y., Qiao, C., Yakovlevich, S., Mikhaylovna, P., dan Chen, H. 2009. Detection and differentiation of four poultry diseases using asymmetric reverse transcription polymerase chain reaction in combination with oligonucleotide microarrays. *J. Vet. Diagn. Invest.* 21: 623–632.

Tarigan, S., Indriani, R., dan Darminto. 2007. Karakterisasi aktivitas enzimatik neuraminiddase virus avian influenza H5N1. *JITV*. 12(2): 153–159.

UNIVERSITAS GADJAH MADA
Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Tarigan, S. 2015. Infeksi subklinis avian influenza H5N1 pada peternakan ayam yang menerapkan program vaksinasi. *Wartazoa* 25: 75–84.

Taubenberger, J. 2006. The origin and virulence of the 1918 "Spanish" influenza virus. *Proc. Am. Philos. Soc*. 150: 86–112.

Taylor, C., Shi, S., dan Barr, N. 2013. Techniques of immunohistochemistry: principles, pitfalls, and standardization. *Diagnostic Immunohistochemistry* 2: 1–42.

Tjahyowati, G. 2011. Imunohistokimia sebagai uji diagnostik rutin avian influenza. Disertasi. Program Studi Doktoral Ilmu Kedokteran Hewan. Fakultas Kedokteran Hewan. Universitas Gadjah Mada. Yogyakarta.

USDA (United States Department of Agriculture). 2015. Fact sheet: *Avian influenza* testing and diagnostics. Office of Communications, Washington.

Usman, B. dan Diarra, S. 2008. Prevalent diseases and mortality in egg-type layers: An overview. *Int. J. Poult. Sci.* 7(4): 304–310.

Van Noorden, S. 1986. Tissue preparation and immunostaining techniques for light microscopy, in Immunocytochemistry: Modern Methods and Applications, 2nd ed. (Polak, J.M. and van Noorden, S., eds.), Wright, Bristol, UK. 26–53.

Vaskovic, N., Sekler, M., Vidanovic, D., Polacek, V., Kukolj, V., Matovic, K., dan Jovanovic, M. 2011. Pathomorphological lesions and distribution of viral antigen in birds infected with the pathogenic strain of H5N1 avian influenza virus. *Acta Vet. Scand.* 61(5-6): 591–598.

Vines, A., Wells, K., Matrosovich, M., dan Castrucci, M. 1998. The role of influenza A virus hemagglutinin residues 226 and 228 in receptor specificity and host range restriction. *J. Virol.* 72(9): 7626–7631.

Virgin, S. 2007. Pathogenesis of viral infection. In: Knipe DM, Howley PM, editors. Fields Virology. 5th ed. Philadelphia: Lippincott Williams and Wilkins. 329–330.

Wang, L., Pan, C., Severinghaus, L., Liu, L., Chen, C., Pu, C., Huang, D., Lir, J., Chin, S., Cheng, M., Lee, S., dan Wang, C. 2008. Simultaneous detection and differentiation of Newcastle disease and avian influenza viruses using oligonucleotide microarrays. *Vet. Microbiol*. 127: 217–226.

Wang, J., Chen, Z., Li, S., Cao, X., Wang, R., Tang, C., Huang, J., Chang, C., dan Liu, H. 2015. The distribution of sialic acid receptors of avian influenza virus in the reproductive tract of laying hens. *Mol. Cell Probes.* 29(2): 129–134.

Wakamatsu, N., King, D., Seal, B., dan Brown, C. 2007. Detection of Newcastle disease virus RNA by reverse transcription-polymerase chain reaction using formalin-fixed, paraffin-embedded tissue and comparison with immunohistochemistry and in situ hybridization. *J. Vet. Diagn. Invest.* 19: 396–400.

UNIVERSITAS GADJAH MADA
Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi Telur
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Warnke, R. dan Levy, R. 1980. Detection of T and B cell antigens with hybridoma monoclonal antibodies: biotin avidin horseradish peroxidase method. *J. Histochem. Cytochem.* 28: 771–776.

Wasito, R. 1991. Penggunaan imunositokimia untuk diagnosis penyakit infeksi. kursus singkat imunositokimia di PAU bioteknologi. Universitas Gadjah Mada, Yogyakarta.

Wasito, R. dan Wuryastuty, H. 2014. Antibodi dan imunohistokimia. Penerbit Andi. Yogyakarta.

Wasito, R., Wuryastuty, H., Tjahyowati, G, Irianingsih, S., Tyasasmaya, T. dan Maes, R. 2014. Detection and differentiation of pathogenic H5 and H7 influenza a virus subtypes in Indonesian poultry by multiplex reverse transcription-polymerase chain reaction. *Biochem. Biotechnol. Res.* 2(2): 27–31.

Wasito, R., Wuryastuty, H., Tjahyowati, G., Irianingsih, S., dan Tyasasmaya, T. 2014. Multiplex reverse transcriptase-polymerase chain reaction for rapid detection of avian influenza H5N1. *J. Vet.* 16(1): 25–30.

Wasito, R., Wuryastuty, H., Pambudy, R., dan Maes, R. 2016. Clinical signs and pathologic lesions of highly pathogenic avian influenza in Indonesia: A threat to Indonesian poultry. *MRJMBS*. 4: 18–21.

Watanabe, Y., Ibrahim, M., Suzuki, Y. dan Ikuta, K. 2012. The changing nature of avian influenza A virus (H5N1). *Trends Microbiol.* 20(1): 11–20.

Webster, R., Bean, W., Gorman, O., Chambers, T., dan Kawaoka, Y. 1992. Evolution and ecology of influenza A Viruses. *Microbiol. Rev.* 56: 152–79.

Webster, R. dan Govorkova, E. 2006. H5N1 influenza–continuing evolution and spread. *N. Engl. J. Med.* 355: 2174–2177.

Webster, R., Hulse-Post, D., Sturm-Ramirez, K., Guan, Y., Peiris, M., Smith, G., dan Chen, H. 2007. Changing epidemiology and ecology of highly pathogenic avian H5N1 influenza viruses. *Avian Dis.* 51: 269–272.

Whittaker, G. R. 2001. Intracellular trafficking of influenza virus: clinical implications for molecular medicine. *Expert Rev. Mol. Med.* 3(5): 1–3.

Wibawa, H., Apriliana, U.I., Dharmawan R., Pratamasari, D., Suryanto, B.R., Susanta, D.H., Farhani, N.R., Suhardi, Sari, D.P., Kumorowati, E., dan Poermadjaja, B. 2018. Prosiding: Hasil investigasi kasus kematian dan penurunan produksi telur pada sentra peternakan unggas komersial di Jawa Timur, Jawa Tengah dan di Yogyakarta tahun 2018.

Wibawa, H., Bingham, J., Nuradji, H., Lowther, S., Payne, J., Harper, J., Wong, F., Lunt, R., Junaidi, A., Middleton D., dan Meers, J. 2013. The pathobiology of two Indonesian H5N1 avian influenza viruses representing different clade 2.1 sublineages in chickens and ducks. *Comp. Immunol. Microbiol. Infect. Dis.* 36(2): 175–191.

UNIVERSITAS
GADJAH MADA
**Imunohistopatologis Virus Avian Influenza H5N1 pada Paru-Paru Ayam Petelur dengan Penurunan Produksi
Telur**
PRAMITA NINDYA S, Prof. drh. R. Wasito, M.Sc., Ph.D.; Prof. drh. Hastari Wuryastuty., M.Sc., Ph.D.
Universitas Gadjah Mada, 2020 | Diunduh dari http://etd.repository.ugm.ac.id/

Wibawa, H., Henning, J., Wong, F., Selleck, P., Junaidi, A., Bingham, J., Daniels, P., dan Meers, J. 2011. A molecular and antigenic survey of H5N1 highly pathogenic avian influenza virus isolates from smallholder duck farms in Central Java, Indonesia during 2007–2008. *J. Virol.* 8(425): 1–17.

Widyantara, I. dan Ardani, I. 2017. Analisis strategi pemasaran telur ayam (studi kasus di Desa Pesedahan dan Bugbug, Kabupaten Karangasem). E-Jurnal Manajemen 6(7): 3766–3793.

Wilks, S., Graff, M., Smith, D., dan Burke, D. 2012. A review of influenza haemagglutinin receptor binding as it relates to pandemic properties. *Vaccine* 30: 4369–4376.

Wright, P. dan Webster, R. 2001. Orthomyxoviruses. In: Knipe DM, Howley PM, editors. Fields Virology. 4th ed. Philadelphia: Lippincott Williams. 1533–1579.

Wu, W., Chen, Y., Wang, P., Song, W., Lau, S., Rayner, J., Webster, R., Xia, N., Guan, Y., dan Chen, H., 2008. Antigenic profile of avian H5N1 viruses in Asia from 2002 to 2007. *J. Virol*. 82(4): 1798–1807.

Wuryastuty, H. dan Wasito, R. 2012. Avian influenza (H5N1) bentuk pernafasan pada entok (*Cairina moschata*) sehat di Yogyakarta. *J.S.V.* 30: 1–7.

Xu, X., Subbarao, Cox, N., dan Guo, Y., 1999. Genetic characterization of the pathogenic influenza A/Goose/Guangdong/1/96 (H5N1) virus: similarity of its hemagglutinin gene to those of H5N1 viruses from the 1997 outbreaks in Hong Kong. *J. Virol.* 261: 15–19.

Yamamoto, Y., Nakamura, K., Yamada, M., dan Mase, M., 2016. Corneal opacity in domestic ducks experimentally infected with H5N1 highly pathogenic avian influenza virus. *Vet. Pathol*. 53(1): 65–76.

Yao, L., Korteweg, C., Hsueh, W., dan Gu, J. 2008. Avian influenza receptor expression in H5N1 infected and noninfected human tissues. *J.FASEB.* 22(3): 733–740.

Young, S., Carrel, M., Malanson, G., Ali, M, dan Kayali, G. 2016. Predicting avian influenza co-infection with H5N1 and H9N2 in Northern Egypt. *Int. J. Environ. Res. Public Health* 13(886): 1–17.

Yunita, N. 2017. Imunopatologis imunohistokimia streptavidin biotin untuk deteksi avian influenza virus pada unggas petelur dengan gejala klinis torticollis dan curled toe paralysis. Tesis. Program Studi Magister Sain Veteriner. Fakultas Kedokteran Hewan. Universitas Gadjah Mada. Yogyakarta.

Zulfikhar, Z., Wasito, R., dan Wuryastuty, H. 2019. Immunopathological immunohistochemical study of low pathogenic avian influenza virus H5N1 infection in love-birds (*Agapornis* spp.) in Indonesia. *Vet. World* 12(9): 1472–1477.