Fusion Protein of Aminoacid Mutations in Newcastle Disease Isolated from Swan Goose Caused Resistance to Infection

by Jola Rahmahani

Submission date: 16-Aug-2021 11:41AM (UTC+0800)
Submission ID: 1631864519
File name: Fusion_Protein_of_Aminoacid_Mutations_in_Newcastle_Disease.pdf (657.29K)
Word count: 5259
Character count: 30399

Indian Vet. J., October 2019, 96 (10) : 53 - 55

Fusion Protein of Aminoacid Mutations in Newcastle Disease Isolated from Swan Goose Caused Resistance to Infection

Naimah Putri, Rahaju Ernawati, Suwarno, Jola Rahmahani and Fedik Abdul Rantam[1]

Laboratory of Virology and Immunology Department Microbiology, Faculty of Veterinary Medicine, UniversitasAirlangga, Surabaya, 60115, Indonesia

(Received : December, 2018 **411/18** Accepted : June, 2019)

Abstract

Newcastle disease virus (NDV) cloacal swab were collected from unvaccinated swan goose and isolated by inoculation in Specific Pathogen Free embryonated eggs. Haemagglutination and Haemagglutination inhibition tests were done to identify and the, samples were processed to one step Reverse Transcriptase –Polymerase Chain Reaction using primer that amplified sequences of fusion (F) gene. Deduced amino acid sequence of the cleavage site of fusion (F) protein revealed that all isolates had avirulent motifs. Amino acid mutations that occurred were analyzed to the same reference sequence. The result showed that amino acid mutations was not capable of changing the virulence of the virus.

Key words : Newcastle disease virus (NDV), amino acid, mutations and virulence

Newcastle disease RNA virus (NDV) has ablility to infect over 240 speciesof birds (Umali *et al*., 2014) which possesses approxi-mately 15.000 nucleotides and causes explosive outbreaks among poultry species (Bogoyavlens-kiy *et al*., 2005).

NDV viruses belong to one serotype and there are two classes. The genome of class I viruses consist of 15.198 nucleotides (nt) and the genome of class II viruses consist of 15.186 or 15.192 nt (Czegledi *et al*., 2006) The genome contains six open reading frames (ORF) which encode the nucleoprotein (NP), the phospo-protein (P), the matrix protein (M), the fusion protein (F), the haemagglutinin-neuraminidase (HN) and the large protein (L). At least one additional, non-structural protein (V) and possi-bly a second one (W), are generated by RNA editing during P gene transcription (Steward *et al*., 1993).

Error that may occur during its replica-tion causes RNA virus mutate easily (Jenkins *et al*., 2002). The mutation of amino acid in cleav-age site of fusion protein of Newcastle disease virus leading to changes in their virulence.The analyze amino acid mutations of Newcastle disease virus were analysed in swan goose.

Materials and Methods

The samples from healthy waterfowls in East Java were collected and placed in 1.5 mL centrifuge tubes containing 1.0 mL of transport medium. All samples were isolated by standard virus isolation methods in embryonated chicken eggs (OIE, 2012).

The HA assay was carried as per the World Organization for Animal Health (OIE, *loc cit*). HA positive samples were tested by Haemagglutination Inhibition (HI) test to deter-mine the haemagglutinating agents.

RNA of the viruses was extracted from allantoic fluids using Trizol LS reagen (Invit-rogen, Carlsbad, CA) as per the manufacture's instructions, and is amplified for partial gene F. The primers flanked the region on cleavage site into protein coding gene of NDV.

The PCR products and the target band was purified and sequenced using an automatic ABI 3730 XL DNA Analyzer (Applied Biosystem, Foster City, CA, USA).

Results and Discussion

The samples were collected as per standart collection methods and were inoculated in 9-10 days old specific-pathogen-free (chicken

[1]*Corresponding author*: Email: fedik-a-r@fkh.unair.ac.id

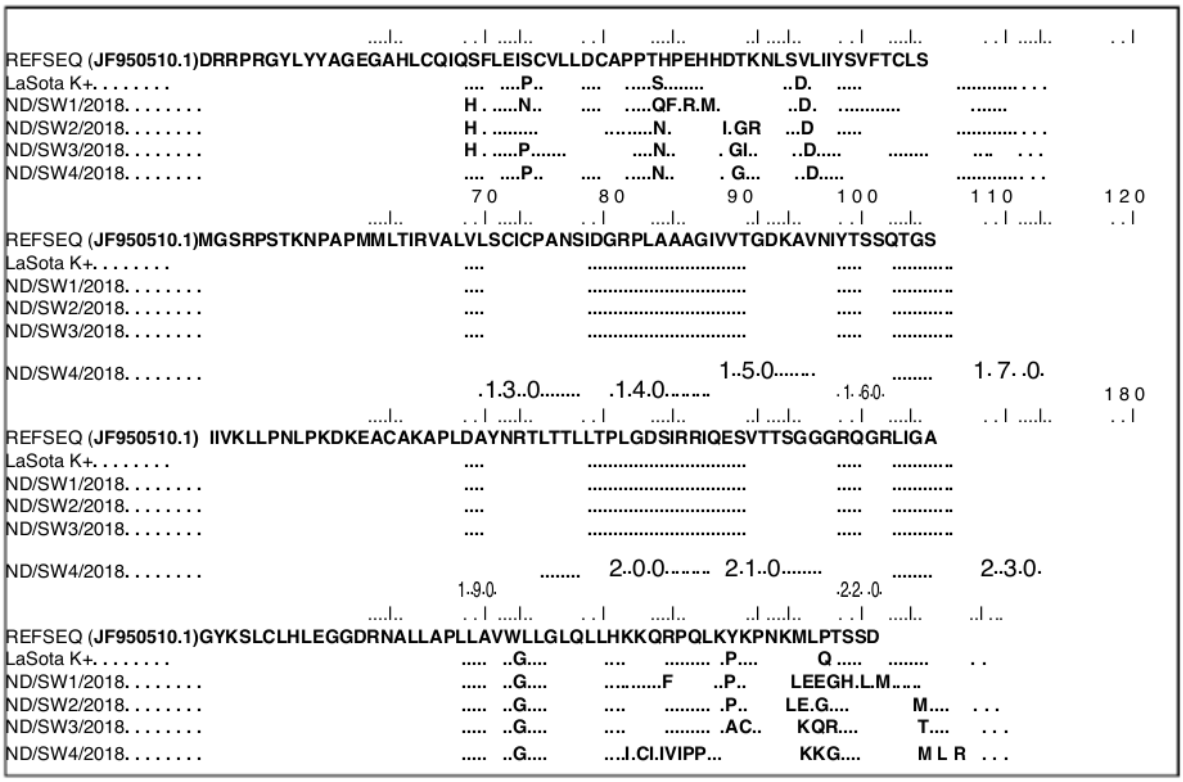

Fig 1 Amino acid mutation of gene codingF protein of Newcastle disease virus (ND)

embryos) for 5 days and Four samples shown positive results of HA, ND/SW1/2018, ND/SW2/2018, ND/SW3/2018 and ND/SW4/2018. Samples with positive HA were confirmed by HI (haemagglutinin inhibition). Growth of NDV in allantoic fluid is known by HA test to see the ability of haemagglutination of erythrocytes in viral envelope capable of agglutating erythrocytes of chickens (Alexander *et al*., 2004) by binding specifically to sialic acid on sensitive cell surface receptors and facilitate the infection process.

The results of multiple alignment the amino acid sequence of the protein coding gene F Newcastle disease (ND) virus showed mutation in several positions (Fig 1). The point shows the similarity of the amino acid sequence and the letters that appear indicate differences in amino acid sequences as the variable sites, which can mutate, leading to multiple alignment. Region that do not changed was called conserved sites.

Amino acid sequences were analyzed in the cleavage site. The lentogenic virus has the motif of single basic amino acid on the F cleavage site 112G/EK/RGG/E-R116 and L (Leucine) at residue 117 and can be cleaved by protease enzymes such as trypsin which can be found in the digestive and respiratory tract (Choi *et al.*, 2010). Based on the amino acid in cleavage site the samples ND/SW1/2018, ND/SW2/2018, ND/SW3/2018, ND/SW4/2018, and LaSota positive isolates have similar cleavage site structure in lentogenic strains.The motif is single basic amino acid 112G/EK/RGG/E-R116 and L (Leucine) at residue 117.

The smallest mutations are point mutations, in which only a single base pair is changed into another base pair. Another kind of mutations called nonsynonymous mutation, in which an amino acid sequence is changed (Alam, 2013). RNA viruses mutate faster than DNA viruses, single-stranded viruses mutate faster than double- strand virus, and genome size appears to correlate negatively with mutation

rate. Viral mutation rates are not merely caused by polymerase errors, but also by the ability of a virus to correct DNA mismatches by proof reading and/or post-replicative repair (Sanjuan andDomingo-Calap, 2016). Polymerase enzyme of RNA virus is characteristically low fidelity leading to easy to mutation. Each mutant in quasispecies is genetically linked (Lauring and Andino, 2010).

Summary

Newcastle disease virus (NDV) isolated from swan goose have some aminoacid mutations. These mutation in the virus cannot change their virulence.

Acknowledgement

The authors would like to thank the Ministry of Research, Technology and Higher Education of the Republic of Indonesia (Kemenristekdikti RI) through Master Degree to Doctorate for Superior Scholarship Program (PMDSU).

References

Alam, S.A.A. (2013) Characterization of Pathogenic mutations in Kinase domain [Thesis]. Master Science in Bioinformatics. Institute of Biomedical Technologi. University of Tampere. Finland.

Alexander, D.J., Bell, J.G., and Alders, R.G. (2004) A Technol-ogy Review: Newcastle Disease, with Special Emphasis on Its Effect on Village Chickens. 1th Edition. Food and Agricul - ture Organization on The United Nations. Rome. Chapter **2** : 161-166.

Bagoyavlenskiy, A., Berezin, V., Prilipov, A., Usachev, E., Lyapina, O., Levandovskaya, S., Korotetskiy, I., Tolmacheva, V., Makhmudova, N., Khudyakova, S., Tustikbaeva, G., Zaitseva, I., Omirtaeva, E., Ermakova, O., Daulbaeva, K., Asanova, S., Kydyrmanov, A., Sayatov, M., and King, D., (2005) Molecular characterization of virulent Newcastle disease virus isolates from chickens during the 1998 NDV outbreak in Kazakhstan. *Virus Genes.*, **31**: 13-20 doi: 10.1007/s11262-004-2195-2.

Choi, K.S., Lee, E.K., Jeon, W.J., and J.H Kwon. (2010) Antigenic and Immunogenic Investigation of the Virulence Motif of the Newcastle Disease Virus Fusion Protein. *J. Vet. Sci.*, **11** (3): 205–211 doi: 10.4142/jvs.2010.11.3.205.

Czegledi, A., Ujvari, D., Somogyi, E., Werner, O., and Lomniczi, B. (2006) Third genome size category of avian paramyxovirus serotype 1 (Newcastle disease virus) and evolutionary implications. *Virus Res.*, **120**: 36-48 doi: 10.1016/j.virusres.2005.11.009.

Jenkins, G.M., Rambaut, A., Pybus, O.G., and Holmes, E.C. (2002) Rates of Molecular Evolution in RNA Viruses : A Quantitative Phylogenetic Analysis. *J Mol Evol.*, **54** : 156 – 165 doi: 10.1007/s00239-001-0064-3

Lauring, A. and Andino, R. (2010) Quasispecies Theory and the Behaviour of RNA Virus. *PLoS Pathog.*,**6** :1-8 doi: 10.1371/journal.ppat.1001005.

OIE (Offi ce International des Epizooties). (2012) Newcastle Disease. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. Chapter **2.3** (14) : 576-589.

Sanjuan, R and Domingo -Calap, P. (2016) Mechanism of viral mutation. *Cell. Mol. Life Sci* ., **73**: 4433-4448 doi: 10.1007/ s00018-016-2299-6

Steward, M., Vipond, I.B., Millar, N.S., and Emmerson, P.T. (1993) RNA editing in Newcastle disease virus. *J Gen Virol.*,**74**: 2539-2547 doi: 10.1099/0022-1317-74-12-2539.

Umali, D.V., Ito, H., Katoh, H., and Ito, T., (2014) Surveillance of avian paramyxovirus in migratory waterfowls in the San-in region of western Japan from 2006 to 2012. *J.Vet.Med.Sci.*, **76**: 423-430 doi: 10.1292/jvms.13-0539.

THE INDIAN VETERINARY JOURNAL

Vol. 96 October 2019 No. 10

AUTHOR INDEX

THE INDIAN VETERINARY JOURNAL

Vol. 96 October 2019 No. 10

SUBJECT INDEX

REVISED GUIDELINES TO AUTHORS

1. **THE INDIAN VETERINARY JOURNAL** (Official organ of the Indian Veterinary Association) publishes papers of original work as full papers, clinical articles and short communications on Veterinary, Animal Husbandry and Fishery Sciences. It also serves as a medium of news regarding the veterinary profession and deals with issues of professional importance from time to time through its editorial columns.
2. **Manuscripts are accepted for publication on the clear understanding that** :
   a) They have neither been published nor been sent for publication elsewhere. All the authors should sign a certificate to this effect in respect of each manuscript sent for publication. Names, qualifications, full addresses and Email ID of all authors must be provided while submitting the manuscripts. Details of the corresponding author with contact phone and the address of the place with PIN code where the work has been carried out must be clearly mentioned.
   b) The research work has been carried out with the approval of the Institutional Ethics Committee as per the laws in force in the country in which it has been conducted. A certificate to this effect should be signed by all authors. The authors should get written permission from concerned authorities for publishing manuscripts on emerging and exotic diseases.
   c) All authors are jointly and severally responsible to the various authorities for the contents of the manuscripts. The Editorial Committee shall not be held responsible in any manner whatsoever to the contents of the manuscript and the views and interpretations expressed by the authors in the manuscripts. All disputes regarding any legal proceeding pertaining to the journal shall be within the jurisdiction of the High Court of Judicature at Chennai.
3. ***A processing fee of each `. 200/- for Indian and US$ 20 for foreign manuscript*** **must be sent along with the manuscript in the form of a DD or International Cheque drawn in favour of *The Editor, Indian Veterinary Journal, payable at Chennai. Payment of processing fee will not ensure publication of the manuscript.* On acceptance of the manuscript for publication, a Publication Charge (`. 700/- for an Indian manuscript and US$ 200 for a foreign manuscript) must be sent to The Editor.**
4. **It is mandatory that each Indian author should be a subscriber to the *print or online version* and a foreign author, to the online version of the Journal. The annual subscription fee is `. 700/- for the Indian subscriber and US$ 200 for the foreign subscriber for the *print or online version* of the Journal.**
5. **Manuscript should be typed in A 4 size paper in double space with 12 pt size Times Roman font as per the Indian Veterinary Journal format. Only two hard copies must be sent to *the Editor, Indian Veterinary Journal, 11/7, Pasumpon Muthuramalinga Thevar Road (Chamiers Road), Nandanam, Chennai – 600035, India.* Clear prints of figures and photographs in duplicate if any must be sent in glossy print of maxi size. The full postal address with posted pin code of the actual place where the work was carried out, along with the contact phone number of the corresponding author should be provided below the names of author(s) in the articles submitted.**
6. ***The decision of the Editor is final in all matters pertaining to the publication of the manuscripts*****. Editor has the right to do editorial revision of the accepted manuscripts, restriction of number of pages, tables and figures. No reason shall be given for the non-acceptance of the manuscript. Manuscript once received will not be returned to the author under any circumstances. The copy right shall rest with the Journal and no part of any manuscript shall be reproduced without specific permission of the Editor.**
7. **Each manuscript received will be allotted a *Registration Number*. The authors, while sending the revised version of the manuscript based on the comments of the referee, should submit the revised manuscripts in two forms, one hard copy and other one soft copy in CD. This should be as per IVJ format and return the original version along with original comments to the Editor for reference and records. The revised manuscripts should be submitted to the IVJ office within 90 days of receipt, failing which the article will not be considered for publication.**
   A demand letter will be sent to the corresponding author for payments such as processing fee (if not already paid), publication charges and arrears of subscription fees. *Only on receipt of full clearance of all the payments and the soft copy in CD, the concerned article will be taken up for publication* and the author will be informed accordingly.
8. **After publication of an article the original / revised copy of the article will be retained at the IVJ office only for a period of 12 months after which the article will be disposed off, since the published version will be available in print and degitized form.**
9. **Indian Veterinary Journal Format:**
   a) **Title; Author(s); Place of work with full address and pin code.**
   b) **Full papers: Abstract (not more than 100 words), Keywords (not more than 4 words), Introduction (with no subtitle), Materials and Methods, Results and Discussions, Summery, Acknowledgement (optional) and References (not exceeding 15). The full papers should not exceed 4 printed pages.**
   c) **Clinical articles : Abstract (not more than 100 words), Keywords (not more than 4 words), Introduction (with no subtitle), Case History and Observations, Treatment and Discussion, Summary, Acknowledgement (optional) and References (not exceeding 15). The Clinical articles should not exceed 3 printed pages.**
   d) **Short Communications: There is no specific format for Short Communication. Articles which do not comply to either Full Papers or Clinical Articles either on quality basis or on page-wise basis will be allotted under Short Communication.**
   e) **The page limits are inclusive of figures, photographs and tables.**
   f) **All tables should be numbered with upper case roman numericals (I, II...) and all figures should be numbered with arabic numericals (1, 2, 3...).**
9. **Citing references: In the text, references should be cited by names of the authors followed by the year of publication in parenthesis. In case of more than two authors, the name of the first author must be followed by *et al.* For the references repeated in the text, the year must be replaced by *loc cit.* in successive references. At the end of the text, the references must be furnished in alphabetical order. Each author's name must be followed by initials. Before the name of the last author, the word 'and' must be included. The year of publication must be in parenthesis. The title of the referred article must be given in full. The Journal's name must be in approved abbreviated form and must be in italics. The volume number of the journal must be given in bold letters. It should be followed by a colon and the starting and ending page numbers. While citing books, the Title of the book, Year, Publisher, Place of Publication, Number of the Edition and the relevant page number(s) must be provided. Website, 'in press' and 'personal communication' should be avoided as references.**
10. **All correspondence regarding the status of the articles must be made with The Editor, Indian Veterinary Journal at the Official Address of the Journal.**

Reg. No. TN/CC (S) DN/194/15-17 WPP. No. TN/PMG(CCR)/WPP-677/15- 17 Registered with Registrar of Newspapers for India No. 1125 / 57 Published on 1st of Every Month

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Krishi Bhawan, New Delhi - 110 001

ICAR Awards - 2019

The Indian Council of Agricultural Research, New Delhi announces the following ICAR Awards

- **Sardar Patel Outstanding ICAR Institution Award 2019**
- **Chaudhary Devi Lal Outstanding All India Coordinated Research Project Award 2019**
- **Pandit Deen Dayal Upadhyay Krishi Vigyan Protshahan Puraskar (National & Zonal) 2019**
- **Atal Bihari Vajpayee ICAR Challenge Award 2019**
- **Rafi Ahmed Kidwai Award for Outstanding Research in Agricultural Sciences 2019**
- **Jawaharlal Nehru Award for P.G. Outstanding Doctoral Thesis Research in Agricultural and Allied Sciences 2019**
- **Panjabrao Deshmukh Outstanding Woman Scientist Award 2019**
- **Vasantrao Naik Award for Outstanding Research Application in Dry Land Farming Systems 2019**
- **Bharat Ratna Dr C. Subramaniam Award for Outstanding Teachers 2019**
- **Lal Bahadur Shastri Outstanding Young Scientist Award 2019**
- **Swami Sahajanand Saraswati Outstanding Extension Scientist Award 2019**
- **NASI-ICAR Award For Innovation and Research on Farm Implements 2019**
- **Fakhruddin Ali Ahmed Award for Outstanding Research in Tribal Farming Systems 2019**
- **Dr Rajendra Prasad Puruskar for technical books in Hindi in Agricultural and Allied Sciences 2019**
- **Nanaji Deshmukh ICAR Award for Outstanding Interdisciplinary Team Research in Agricultural and Allied Sciences 2019**
- **Chaudhary Charan Singh Award for Excellence in Journalism in Agricultural Research and Development 2019**
- **Jagjivan Ram Abhinav Kisan Puruskar /Jagjivan Ram Innovative Farmer Award (National/Zonal) 2019**
- **N.G. Ranga Farmer Award for Diversified Agriculture 2019**
- **Pandit Deen Dayal Upadhyay Antyodaya Krishi Puruskar 2019 (National & Zonal)**
- **Haldhar Organic Farmer Award 2019**
- **ICAR - Cash Awards, 2019**

The prescribed eligibility criteria, the guidelines and the pro-forma for applying for these awards may be downloaded from the ICAR's website **(www.icar.org.in)**. The applicants are required to submit their application in PDF format (in concise form not exceeding 30 pages- highliting the significant achievements, citation (where applicable) awards/recognitions earned and other important details as required as per the application format) on our dedicated ICAR Award email : **(icar-award2018@gov.in)**. In addition, **two hard copies** of the application form may also be submitted. In case of farmer applicants, not able to submit the applications electronically, may submit **two copies** of applications duly forwarded and recommended by the appropriate forwarding / nominating authority. The application(s) with complete documents sent through email, duly forwarded and recommended by the appropriate authority should be sent to **Dr. Shiv Prasad Kimothi, Assistant Director General (Coordination), ICAR, Room No. 204A, Krishi Bhawan, Dr.Rajendra Prasad Road, New Delhi-110 001** so as to reach him on or before **31.12.2019.** The last date for receiving the hard copy of applications duly forwarded and recommended by the appropriate authority for applicants in the Andaman and and Nicobar Islands, Lakshadweep, States/Union Territory in the North Eastern Region, Ladakh Division of J&K State and Sikkim is **15.01.2020**. **The candidates should also clearly mention their contact details (mobile No. and e-mail) along with Bank Account No., Bank Address, IFSC Code and PAN No and attach a copy of cancelled cheque.** The Council will retain the award winning applications/thesis for the record.

Each candidate will be judged on the basis of the originality and/or the applied value of the research work / investigations as revealed in the documents submitted by him/her/them. **In all matters relating to the award, the decision of the Council shall be final and no correspondence on this account will be entertained.** For details visit : http://www.icar.org.in/.

Edited and Published by Dr S. Sukumar, No.11, Muthuramalinga Thevar Salai (Chamiers Road), Nandanam, Chennai -600035.
Printed by Ln. N. Sathiyaseelan, Angel Printing House, 11 - Muthaiyal St. Purasawalkam, Chennai - 600007.

Indian Vet. J., October 2019, 96 (10) : 53 - 55

Fusion Protein of Aminoacid Mutations in Newcastle Disease Isolated from Swan Goose Caused Resistance to Infection

Naimah Putri, Rahaju Ernawati, Suwarno, Jola Rahmahani and Fedik Abdul Rantam[1]

Laboratory of Virology and Immunology Department Microbiology, Faculty of Veterinary Medicine, UniversitasAirlangga, Surabaya, 60115, Indonesia

(Received : December, 2018 **411/18** Accepted : June, 2019)

Abstract

Newcastle disease virus (NDV) cloacal swab were collected from unvaccinated swan goose and isolated by inoculation in Specific Pathogen Free embryonated eggs. Haemagglutination and Haemagglutination inhibition tests were done to identify and the, samples were processed to one step Reverse Transcriptase –Polymerase Chain Reaction using primer that amplified sequences of fusion (F) gene. Deduced amino acid sequence of the cleavage site of fusion (F) protein revealed that all isolates had avirulent motifs. Amino acid mutations that occurred were analyzed to the same reference sequence. The result showed that amino acid mutations was not capable of changing the virulence of the virus.

Key words : Newcastle disease virus (NDV), amino acid, mutations and virulence

Newcastle disease RNA virus (NDV) has ablility to infect over 240 speciesof birds (Umali *et al*., 2014) which possesses approximately 15.000 nucleotides and causes explosive outbreaks among poultry species (Bogoyavlenskiy *et al*., 2005).

NDV viruses belong to one serotype and there are two classes. The genome of class I viruses consist of 15.198 nucleotides (nt) and the genome of class II viruses consist of 15.186 or 15.192 nt (Czegledi *et al*., 2006) The genome contains six open reading frames (ORF) which encode the nucleoprotein (NP), the phosphoprotein (P), the matrix protein (M), the fusion protein (F), the haemagglutinin-neuraminidase (HN) and the large protein (L). At least one additional, non-structural protein (V) and possibly a second one (W), are generated by RNA editing during P gene transcription (Steward *et al*., 1993).

Error that may occur during its replication causes RNA virus mutate easily (Jenkins *et al*., 2002). The mutation of amino acid in cleavage site of fusion protein of Newcastle disease virus leading to changes in their virulence.The analyze amino acid mutations of Newcastle disease virus were analysed in swan goose.

Materials and Methods

The samples from healthy waterfowls in East Java were collected and placed in 1.5 mL centrifuge tubes containing 1.0 mL of transport medium. All samples were isolated by standard virus isolation methods in embryonated chicken eggs (OIE, 2012).

The HA assay was carried as per the World Organization for Animal Health (OIE, *loc cit*). HA positive samples were tested by Haemagglutination Inhibition (HI) test to determine the haemagglutinating agents.

RNA of the viruses was extracted from allantoic fluids using Trizol LS reagen (Invitrogen, Carlsbad, CA) as per the manufacture's instructions, and is amplified for partial gene F. The primers flanked the region on cleavage site into protein coding gene of NDV.

The PCR products and the target band was purified and sequenced using an automatic ABI 3730 XL DNA Analyzer (Applied Biosystem, Foster City, CA, USA).

Results and Discussion

The samples were collected as per standart collection methods and were inoculated in 9-10 days old specific-pathogen-free (chicken

[1]*Corresponding author* : Email: fedik-a-r@fkh.unair.ac.id

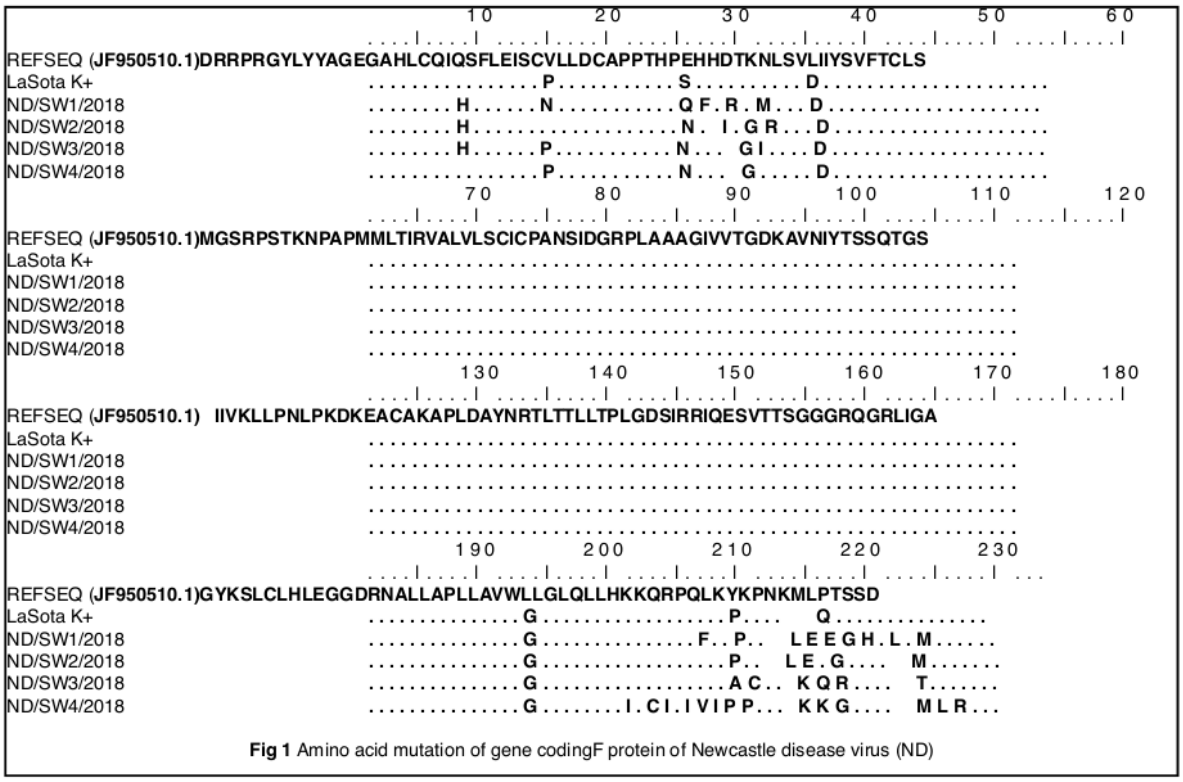

Fig 1 Amino acid mutation of gene codingF protein of Newcastle disease virus (ND)

embryos) for 5 days and Four samples shown positive results of HA, ND/SW1/2018, ND/SW2/2018, ND/SW3/2018 and ND/SW4/2018. Samples with positive HA were confirmed by HI (haemagglutinin inhibition). Growth of NDV in allantoic fluid is known by HA test to see the ability of haemagglutination of erythrocytes in viral envelope capable of agglutating erythrocytes of chickens (Alexander *et al*., 2004) by binding specifically to sialic acid on sensitive cell surface receptors and facilitate the infection process.

The results of multiple alignment the amino acid sequence of the protein coding gene F Newcastle disease (ND) virus showed mutation in several positions (Fig 1). The point shows the similarity of the amino acid sequence and the letters that appear indicate differences in amino acid sequences as the variable sites, which can mutate, leading to multiple alignment. Region that do not changed was called conserved sites.

Amino acid sequences were analyzed in the cleavage site. The lentogenic virus has the motif of single basic amino acid on the F cleavage site 112G/EK/RGG/E-R116 and L (Leucine) at residue 117 and can be cleaved by protease enzymes such as trypsin which can be found in the digestive and respiratory tract (Choi *et al*., 2010). Based on the amino acid in cleavage site the samples ND/SW1/2018, ND/SW2/2018, ND/SW3/2018, ND/SW4/2018, and LaSota positive isolates have similar cleavage site structure in lentogenic strains.The motif is single basic amino acid 112G/EK/RGG/E-R116 and L (Leucine) at residue 117.

The smallest mutations are point mutations, in which only a single base pair is changed into another base pair. Another kind of mutations called nonsynonymous mutation, in which an amino acid sequence is changed (Alam, 2013). RNA viruses mutate faster than DNA viruses, single-stranded viruses mutate faster than double- strand virus, and genome size appears to correlate negatively with mutation

rate. Viral mutation rates are not merely caused by polymerase errors, but also by the ability of a virus to correct DNA mismatches by proof reading and/or post-replicative repair (Sanjuan andDomingo-Calap, 2016). Polymerase enzyme of RNA virus is characteristically low fidelity leading to easy to mutation. Each mutant in quasispecies is genetically linked (Lauring and Andino, 2010).

Summary

Newcastle disease virus (NDV) isolated from swan goose have some aminoacid mutations. These mutation in the virus cannot change their virulence.

Acknowledgement

The authors would like to thank the Ministry of Research, Technology and Higher Education of the Republic of Indonesia (Kemenristekdikti RI) through Master Degree to Doctorate for Superior Scholarship Program (PMDSU).

References

Alam, S.A.A. (2013) Characterization of Pathogenic mutations in Kinase domain [Thesis]. Master Science in Bioinformatics. Institute of Biomedical Technologi. University of Tampere. Finland.

Alexander, D.J., Bell, J.G., and Alders, R.G. (2004) A Technology Review: Newcastle Disease, with Special Emphasis on Its Effect on Village Chickens. 1th Edition. Food and Agriculture Organization on The United Nations. Rome. Chapter **2** : 161-166.

Bagoyavlenskiy, A., Berezin, V., Prilipov, A., Usachev, E., Lyapina, O., Levandovskaya, S., Korotetskiy, I., Tolmacheva, V., Makhmudova, N., Khudyakova, S., Tustikbaeva, G., Zaitseva, I., Omirtaeva, E., Ermakova, O., Daulbaeva, K., Asanova, S., Kydyrmanov, A., Sayatov, M., and King, D., (2005) Molecular characterization of virulent Newcastle disease virus isolates from chickens during the 1998 NDV outbreak in Kazakhstan. *Virus Genes.*, **31**: 13-20 doi: 10.1007/s11262-004-2195-2.

Choi, K.S., Lee, E.K., Jeon, W.J., and J.H Kwon. (2010) Antigenic and Immunogenic Investigation of the Virulence Motif of the Newcastle Disease Virus Fusion Protein. *J. Vet. Sci.*, **11** (3): 205–211 doi: 10.4142/jvs.2010.11.3.205.

Czegledi, A., Ujvari, D., Somogyi, E., Werner, O., and Lomniczi, B. (2006) Third genome size category of avian paramyxovirus serotype 1 (Newcastle disease virus) and evolutionary implications. *Virus Res.*, **120**: 36-48 doi: 10.1016/j.virusres.2005.11.009.

Jenkins, G.M., Rambaut, A., Pybus, O.G., and Holmes, E.C. (2002) Rates of Molecular Evolution in RNA Viruses : A Quantitative Phylogenetic Analysis. *J Mol Evol.*, **54** : 156 – 165 doi: 10.1007/s00239-001-0064-3

Lauring, A. and Andino, R. (2010) Quasispecies Theory and the Behaviour of RNA Virus. *PLoS Pathog.*,**6** :1-8 doi: 10.1371/journal.ppat.1001005.

OIE (Office International des Epizooties). (2012) Newcastle Disease. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. Chapter **2.3** (14) : 576-589.

Sanjuan, R and Domingo-Calap, P. (2016) Mechanism of viral mutation. *Cell. Mol. Life Sci* ., **73**: 4433-4448 doi: 10.1007/s00018-016-2299-6

Steward, M., Vipond, I.B., Millar, N.S., and Emmerson, P.T. (1993) RNA editing in Newcastle disease virus. *J Gen Virol.*,**74**: 2539-2547 doi: 10.1099/0022-1317-74-12-2539.

Umali, D.V., Ito, H., Katoh, H., and Ito, T., (2014) Surveillance of avian paramyxovirus in migratory waterfowls in the San-in region of western Japan from 2006 to 2012. *J.Vet.Med.Sci.*, **76**: 423-430 doi: 10.1292/jvms.13-0539.

Fusion Protein of Aminoacid Mutations in Newcastle Disease Isolated from Swan Goose Caused Resistance to Infection

ORIGINALITY REPORT

19%	15%	12%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	docplayer.net Internet Source	3%
2	tampub.uta.fi Internet Source	2%
3	ivj.org.in Internet Source	1%
4	www.pubmedcentral.nih.gov Internet Source	1%
5	pubmed.ncbi.nlm.nih.gov Internet Source	1%
6	L. M. Kim, D. J. King, P. E. Curry, D. L. Suarez et al. "Phylogenetic Diversity among Low-Virulence Newcastle Disease Viruses from Waterfowl and Shorebirds and Comparison of Genotype Distributions to Those of Poultry-Origin Isolates", Journal of Virology, 2007 Publication	1%
7	mafiadoc.com Internet Source	1%

8	www.frontiersin.org Internet Source	1 %
9	www.abacademies.org Internet Source	1 %
10	maksimekin.github.io Internet Source	1 %
11	www.ncbi.nlm.nih.gov Internet Source	1 %
12	"Notes for Contributors", Photochemistry and Photobiology, 6/1974 Publication	1 %
13	www.veterinaryworld.org Internet Source	1 %
14	Runjun Dowarah, A. P. S. Sethi. "Various dietary levels of protein and energy interaction on growth performance of white plumage japanese quails", Veterinary World, 2014 Publication	<1 %
15	www.freepatentsonline.com Internet Source	<1 %
16	Gaikwad, Satish, Ji-Ye Kim, Hyun-Jeong Lee, Suk Chan Jung, and Kang-Seuk Choi. "Genetic characterization and evolutionary analysis of Newcastle disease virus isolated from domestic duck in South Korea", Gene, 2016.	<1 %

	Publication	
17	"Emerging and Re-emerging Infectious Diseases of Livestock", Springer Science and Business Media LLC, 2017 Publication	<1 %
18	Hualei Liu, Zhiliang Wang, Yangong Wu, Yang Wu, Chengying Sun, Dongxia Zheng, Tiangang Xu, Jinming Li. "Molecular characterization and phylogenetic analysis of new Newcastle disease virus isolates from the mainland of China", Research in Veterinary Science, 2008 Publication	<1 %
19	khartoumspace.uofk.edu Internet Source	<1 %
20	raw.githubusercontent.com Internet Source	<1 %
21	Jemma Bergfeld. "The molecular basis of the pathogenicity of Newcastle disease virus in chickens", 'University of Queensland Library', 2017 Internet Source	<1 %
22	"PLSA on Large Scale Image Databases", 'Institute of Electrical and Electronics Engineers (IEEE)', 2007 Internet Source	<1 %
23	"Instructions for contributors", The Indian Journal of Pediatrics, 1988	<1 %

Publication

24	swipetechnologies.in Internet Source	<1%
25	Cattoli, G., L. Susta, C. Terregino, and C. Brown. "Newcastle disease: a review of field recognition and current methods of laboratory detection", Journal of Veterinary Diagnostic Investigation, 2011. Publication	<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	On		

Fusion Protein of Aminoacid Mutations in Newcastle Disease Isolated from Swan Goose Caused Resistance to Infection

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10