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References

Abe, Y., Tamura, T., Torii, S., Wakamori, S., Nagai, M., Mitsuhashi, K., Mine, J., Fujimoto, Y., Nagashima, N., Yoshino, F., Sugita, Y., Nomura, T., Okamatsu, M., Kida, H., and Sakoda, Y. 2016. Genetic and antigenic characterization of bovine viral diarrhea viruses isolated from cattle in Hokkaido, Japan. *Journal of Veterinary Medical Science*, 78(1): 61–70.

Abe, Y., Tamura, T., Torii, S., Wakamori, S., Nagai, M., Mitsuhashi, K., Mine, J.,Fujimoto, Y., Nagashima, N., Yoshino, F., Sugita, Y., Nomura, T., Okamatsu, M., Kida, H., & Sakoda, Y. (2016). Genetic and antigenic characterization of bovine viral diarrhea viruses isolated from cattle in Hokkaido, Japan. The Journal of veterinary medical science, 78(1), 61–70. https://doi.org/10.1292/jvms.15-0186

Agapov, E. V., Murray, C. L., Frolov, I., Qu, L., Myers, T. M., and Rice, C. M. 2004. Uncleaved NS2-3 is required for production of infectious bovine viral diarrhea virus. Journal of Virology, 78(5):2414–2425.

Agnello, V., Ábel, G., Elfahal, M., Knight, G.B. and Zhang, Q. X. (1999) Hepatitis C virus and otherFlaviviridae viruses enter cells via low density lipoprotein receptor. Proceed Nat Acad Sci 96:12766–12771.

Aguirreburualde MSP, Gómez MC, Ostachuk A, Wolman F, Albanesi G, Pecora A, Odeon A, ArdilaF, Escribano JA, Dus Santos MJ, Wigdorovitz A (2013) Efficacy of a BVDV subunit vaccine produced in alfalfa transgenic plants. Veterin Immunol Immunopathol 151:315–324.

Ahn, B.C., Walz, P.H., Kennedy, G.A., & Kapil, S. (2005). Biotype, Genotype, and Clinical Presentation Associated With Bovine Viral Diarrhea Virus (BVDV) Isolates From Cattle. *International Journal of Applied Research in Veterinary Medicine, 3*, 319-325.

Akagami, M., Seki, S., Kashima, Y., Yamashita, K., Oya, S., Fujii, Y., Takayasu, M., Yaguchi, Y., Suzuki, A., Ono, Y. and Ouchi, Y., (2020). Risk factors associated with the within-farm transmission of bovine viral diarrhea virus and the incidence of persistently infected cattle on dairy farms from Ibaraki prefecture of Japan. *Res. Vet. Sci., 129,* pp.187-192.

Albrecht, K., Linder, M., Heinrich, A., Höche, J., Beer, M., Gaede, W., & Wernike, K. (2021). Re-Introduction of Bovine Viral Diarrhea Virus in a Disease-Free Region: Impact on the Affected Cattle Herd and Diagnostic Implications. Pathogens (Basel, Switzerland), 10(3), 360.https://doi.org/10.3390/pathogens10030360

Ammari, M., McCarthy, F. M., Nanduri, B., and Pinchuk, L. M. 2010. Analysis of Bovine Viral Diarrhea Viruses-infected monocytes: identification of cytopathic and non- cytopathic biotypedifferences. BMC Bioinformatics, 11(Suppl 6): S9.

Ammari, M., Mccarthy, F., Nanduri, B., Pinchuk, G., and Pinchuk, L. 2012. Understanding the Pathogenesis of Cytopathic and Noncytopathic Bovine Viral Diarrhea Virus Infection

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
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Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Using Proteomics. *Proteomics Application in Biology*, Heazlewood, J. (Ed), InTech, 53-66.

Anonim, 2015, Bovine Viral Diarrhoea, in OIE *Terrestrial Manual*, pp.:1-22.

Bachofen C, Braun U, Hilbe M, Ehrensperger F, Stalder H, Peterhans E (2010) Clinical appearance and pathology of cattle persistently infected with bovine viral Diarrhea virus of diferent genetic subgroups. Vet Microbiol 141:258–267

Bachofen, C., Vogt, H.R., Stalder, H., Mathys, T., Zanoni, R., Hilbe, M., Schweizer, M. and Peterhans, E. (2013) Persistent infections after natural transmission of bovine viral diarrhea virus from cattle to goats and among goats. *Vet. Res*. 44(32): 1-10.

Baker JC. The clinical manifestations of bovine viral diarrhea infection. Vet Clin North Am Food Anim Pract. 1995 Nov,11(3):425-45. doi: 10.1016/s0749- 0720(15)30460-6. PMID: 8581856.

Bashir, S., Kossarev, A., Martin, V. C., & Paeshuyse, J. (2020). Deciphering the Role of Bovine Viral Diarrhea Virus Non-Structural NS4B Protein in Viral Pathogenesis. *Vet. Sci., 7*(4), 169.

Bazzucchi, M., Bertolotti, L., Ceglie, L., Giammarioli, M., Rossi, E., Rosati, S., & De Mia, G. M. (2017). Complete nucleotide sequence of a novel bovine viral diarrhea virus subtype 1 isolate from Italy. *Archives of virology*, *162*(11), 3545–3548. https://doi.org/10.1007/s00705-017-3486-y

Becher, P., Orlich, M., Kosmidou, A., Konig, M., Baroth, M., and Thiel, H. J. 1999. Genetic diversity of pestiviruses: identification of novel groups and implications for classification. *Virology*, 262(1999): 64–71.

Bendfeldt, S., Ridpath, J. F. and Neill, J. D. (2007) Activation of cell signaling pathways is dependant on the biotype of bovine viral diarrhea viruses type 2', *Virus Research,*126(1–2), 96-105.

Bolin, S. R. 2002. Bovine Viral Diarrhea Virus in Mixed Infection. In: *Polymicrobial Diseases*: NCBI Bookshelf (Brogden, K. A., and Guthmiller, J. M., eds.). A service of the National Library of Medicine, National Institutes of Health, ASM Press, Washington, DC. pp: 1-28.

Bolin, S. R., and Ridpath, J. F. 1998. “Prevalence of Bovine Viral Diarrhea Virus Genotypes and Antibody against Those Viral Genotypes in Fetal Bovine Serum.” *Journal of Veterinary Diagnostic Investigation*, 10(2): 135–39.

Bolin, S. R., Matthews, P. J., and Ridpath, J. F. 1991. Methods for detection and frequency of contamination of fetal calf serum with bovine viral diarrhea virus and antibodies against bovine viral diarrhea virus.. *Journal of Veterinary Diagnostic Investigation* 3(1991): 199-203.

Booth, R. E., Thomas, C. J., El-Attar, L. M., Gunn, G., and Brownlie, J. 2013. A phylogenetic analysis of Bovine Viral Diarrhoea Virus (BVDV) isolates from six different regions of the UK and links to animal movement data. *Veterinary Research*, 44(43): 1-14.

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
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Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Brodersen BW. Bovine Viral Diarrhea Virus Infections: Manifestations of Infection and Recent Advances in Understanding Pathogenesis and Control. Veterinary Pathology. 2014, 51(2):453-464. doi:10.1177/0300985813520250.

Brownlie, J., Clarke, M., Howard, C. and Pocock, D. (1987) 'Pathogenesis and epidemiology of bovine virus Diarrhea virus infection of cattle', *Annales de Recherches Veterinaires,* 18(2), 157-166.

Brownlie, J., Hooper, L. B., Thompson, I. and Collins, M. E. (1998) 'Maternal recognition of foetalinfection with bovine virus Diarrhea virus (Bvdv) The bovine *pestivirus*', *Clinical and Diagnostic Virology,* 10(2-3), 141-50.

Burki, F., Konig, H. and Schmid, H.R. (1964) Case report on mucosal disease. Isolation of the virus of bovine viral diarrhea from a typical case. [Case report on mucosal disease. Isolation of the virus of bovine viral diarrhea from a typical case] Switzerland. Arch. Animal Medicine., 106: 473–477.

Callens N, Brügger B, Bonnafous P, Drobecq H, Gerl MJ, Krey T, *et al*. Morphology and molecularcomposition of purified bovine viral diarrhea virus envelope. PLOS Pathog. (2016) 12:e1005476.doi: 10.1371/journal.ppat.1005476.

Cattaneo, R. (2004). Four Viruses, Two Bacteria, and One Receptor: Membrane Cofactor Protein (CD46) as Pathogens' Magnet. *Journal of Virology, 78*, 4385 - 4388.

Cavallaro AS, Mahony D, Commins M, Mahony TJ, Mitter N. Endotoxin-free purification for the isolation of bovine viral Diarrhea virus E2 protein from insoluble inclusion body aggregates. Microb Cell Fact. 2011, 10:57. https://doi.org/10.1186/1475-2859-10-57 PMID: 21787435.

Chase, C. C. L. 2013. The impact of BVDV infection on adaptive immunity. *Biologicals*, 41(1): 52–60.

Chernick, A., & van der Meer, F. (2017). Evolution of Bovine viral diarrhea virus in Canada from 1997 to 2013. Virology, 509, 232–238. https://doi.org/10.1016/j.virol.2017.06.024.

Chernick, A., Ambagala, A., Orsel, K., Wasmuth, J. D., van Marle, G., van der Meer, F. 2018. Bovineviral diarrhea virus genomic variation within persistently infected cattle. Infection, Genetics and Evolution, 58: 218-223.

Chernick, A., Ambagala, A., Orsel, K., Wasmuth, J. D., van Marle, G., van der Meer, F. 2018. Bovineviral diarrhea virus genomic variation within persistently infected cattle. Infection, Genetics and Evolution, 58(2018): 218-223.

Chernick, A., and van der Meer, F. 2017. Evolution of Bovine viral diarrhea virus in Canada from 1997 to 2013. Virology, 509(2017): 232-238.

Chernick, A., and van der Meer, F. 2017. Evolution of Bovine viral diarrhea virus in Canada from 1997 to 2013. Virology, 509(2017): 232-238.

Chi S, Chen S, Jia W, He Y, Ren L, Wang X. Non-structural proteins of bovine viral diarrhea virus. Virus Genes. 2022 May 25:1–10. doi: 10.1007/s11262-022-019148. Epub ahead

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
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Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

of print. PMID: 35614328, PMCID: PMC9131992.

Chiavenna SM, Ostachuk A, Pecora A, Levy S, Dus Santos MJ, Wigdorovitz A (2009) Truncated E2glicoprotein expression in CHO-K1 cells to produce a subunit vaccine against BVDV. VeterinImmunol Immunopathol 128:231.

Childs T. (1946). X Disease of Cattle - Saskatchewan. Canadian journal of comparative medicine and veterinary science, 10(11), 316–319.

Coggins, L., Gillespie, J.H., Robson, D.S., Thompson, J.D., Phillips, W.V., Wagner, W.C., Baker, J.A.Attenuation of virus diarrhea virus (strain oregon c24v) for vaccine purposes. Cornell Vet. 1961, 51, 539–545. [PubMed]

Collen, T., and Morrison, W. I. 2000. CD4(+) T-cell responses to bovine viral diarrhoea virus in cattle. *Virus Research*, 67(1): 67-80.

Collins, M. E., Desport, M., and Brownlie, J. 1999. Bovine viral diarrhea virus quasispecies during persistent infection. *Virology*, 259(1): 85–98.

Collins, M. E., Heaney, J., Thomas, C. J., Brownlie, J. 2009. Infectivity of pestivirus following persistence of acute infection. *Veterinary Microbiology*, 138(2009): 289–296.

Corapi, W. V., Donis, R. O., & Dubovi, E. J. (1988). Monoclonal antibody analyses of cytopathic and noncytopathic viruses from fatal bovine viral diarrhea virus infections. *Journal of virology*, *62*(8), 2823–2827. https://doi.org/10.1128/JVI.62.8.2823-2827.

Curti, E., and Jaeger, J. 2013. Residues Arg283, Arg285, and Ile287 in the nucleotide binding pocket of bovine viral diarrhea virus NS5B RNA polymerase affect catalysis and fidelity. *Journal of Virology*, 87(1): 199–207.

Darweesh, M. F., Rajput, M. K. S., Braun, L. J., Ridpath, J. F., Neill, J. D., and Chase, C. C. L. 2015. Characterization of the cytopathic BVDV strains isolated from 13 mucosal disease cases arising in a cattle herd. Virus Research, 195(2015): 141–147.

Deregt D, van Rijn PA, Wiens TY, van den Hurk J (1998) Monoclonal antibodies to the E2 protein ofa new genotype (type 2) of bovine viral diarrhea virus defne three antigenic domains involvedin neutralization. Virus Res 57:171–181.

Deregt, D. and Prins, S. (1998) A monoclonal Antibody-based immunoperoxidase monolayer (Micro-Isolation) assay for detection of type 1 and type 2 bovine viral diarrhea viruses. *Can.* J. Vet. *Res*., 62(2): 152–155.

Deregt, D., Dubovi, E. J., Jolley, M. E., Nguyen, P., Burton, K. M., and Gilbert, S. A. 2005. Mappingof two antigenic domains on the NS3 protein of the pestivirus bovine viral diarrhea virus. Veterinary Microbiology, 108(2005): 13–22.

Deutskens, F., Lamp, B., Riedel, C.M., Wentz, E., Lochnit, G., Doll, K., Thiel, H.J., Rumenapf, T. Vaccine-induced antibodies linked to bovine neonatal pancytopenia (bnp) recognize cattle major histocompatibility complex class i (mhc i). Vet. Res. 2011, 42, 97.

Dow, N., Chernick, A., Orsel, K., van Marle, G., van der MEer, F. 2015. Genetic Variability of

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
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Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Bovine Viral Diarrhea Virus and Evidence for a Possible Genetic Bottleneck during Vertical Transmission in Persistently Infected Cattle. *PLoS ONE,* 10(7): e0131972.

Dubovi, E. J. 2013. Biologicals Laboratory diagnosis of bovine viral diarrhea virus. *Biologicals*, 41(2013): 8–13.

Dyah R.P., Dhiar, N. L. and Ratu, F. R. Analisis Rumah Tangga Usaha Peternakan di Indonesia Hasil Survei Rumah Tangga Usaha Peternakan 2014 (Analysis of Livestock Farmer Household in Indonesia, Survey of Livestock Farmer Households 2014); Marhaeni, H., Ed.; Badan Pusat Statistik: Jakarta, Indonesia, 2015; p. xvi+98.

El Omari, K., Iourin, O., Harlos, K., Grimes, J. M. and Stuart, D. I. (2013) Structure of a *pestivirus* envelope glycoprotein E2 clarifies its role in cell entry. *Cell Rep*., 3(1): 30–35.

Ellis, J., West, K., Cortese, V., Konoby, C., Weigel, D. Effect of maternal antibodies on induction andpersistence of vaccine-induced immune responses against bovine viral diarrhea virus type ii inyoung calves. J. Am. Vet. Med. Assoc. 2001, 219, 351–356. [CrossRef] [PubMed]

Escribano JM, Wigdorovitz A, Gil F, Ostachuk A, Pérez-Filgueira M, Domínguez J, Serrano C, Dus Santos MJ, Alonso C (2009) Fusion protein that directs vaccine antigens to antigen presentingcells and applications thereof. World Intellectual Property Organization (WIPO) WO/2009/112603.

Firat, I., Bozkurt, H.H., Turan, N. and Bagcigil, F. (2002). Distributionof bovine viral Diarrhea virus (BVDV) in the genital system tissues ofcattle. Vet. Arhiv. 72:35−48.

Fooks, A.R., Banyard, A.C., Horton, D.L., Johnson, N., McElhinney, L.M., Jackson, A.C. Current status of rabies and prospects for elimination. Lancet 2014, 384, 1389– 1399. [CrossRef].

Freuling, C.M., Muller, T.F., Mettenleiter, T.C. Vaccines against pseudorabies virus (prv). Vet. Microbiol. 2017, 206, 3–9. [CrossRef] [PubMed]

Fritzen, J. T. T., Zucoloto, N. Z., Lorenzetti, E., Alfieri, A. F., & Alfieri, A. A. (2024). Outbreak of persistently infected heifer calves with bovine viral diarrhea virus subgenotypes 1b and 1d in a BVDV-vaccinated open dairy herd. *Acta Trop*., 107198.

Fulton, R. W., Whitley, E. M., Johnson, B. J., Ridpath, J. F., Kapil, S., Burge, L. J., Cook, B.J., and Confer, A. W. 2009. Prevalence of bovine viral diarrhea virus (BVDV) in persistently infected cattle and BVDV subtypes in affected cattle in beef herds in south central United States. *Canadian Journal of Veterinary Research*, 73(4): 283–291.

Gao, S., Du, J., Shao, J., Lang, Y., Lin, T., Cong, G., Zhao, F., Belák, S., Liu, L., Chang, H., and Yin, H. 2014. Genome analysis reveals a novel genetically divergent subgenotype of bovine viral diarrhea virus in China. Infection, Genetics and Evolution, 21(2014): 489–491.

Giangaspero M., Harasawa R., Weber L. & Belloli A. 2008. Gene epidemiological evaluation of Bovine viral diarrhea virus 2 species based on secondary structures in the 5’

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
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Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

untranslated region. J. Vet. Med. Sci. 70(6):571-580. http://dx.doi.org/10.1292/jvms.70.571

Gilbert, S., Burton, K. M., Prins, S. E., and Deregt, D. 1999. Typing of Bovine Viral Diarrhea Viruses Directly from Blood of Persistently Infected Cattle by Multiplex PCR Typing of Bovine Viral Diarrhea Viruses Directly from Blood of Persistently Infected Cattle by Multiplex PCR. *Journal of Clinical Microbiology*, 37(6): 2020–2023.

Goens, S. D. 2002. The evolution of bovine viral diarrhea: A review. *Canadian Veterinary Journal*, 43(2002): 946–954.

Goyal, S. M. 2005. Diagnosis. In *Bovine Viral Diarrhea Virus Diagnosis, Management and Control*. (Goyal, S. M. and Ridpath, J. F., eds), 1st Ed. Blackwell Publishing, Iowa, USA, pp.: 197-208.

Gripshover, E. M., Givens, M. D., Ridpath, J. F., Brock, K. V., Whitley, E. M., and Sartin, E. A. 2007. Variation in Erns viral glycoprotein associated with failure of immunohistochemistry and commercial antigen capture ELISA to detect a field strain of bovine viral diarrhea virus. *Veterinary Microbiology*, 125(2007): 11–21.

Grooms DL. Reproductive consequences of infection with bovine viral diarrhea virus. Vet Clin North Am Food Anim Pract. 2004 Mar,20(1):5-19. doi: 10.1016/j.cvfa.2003.11.006. PMID: 15062471.

Grooms, D. L., Bolin, S. R., Coe, P. H., Borges, R. J. and Coutu, C. E. (2007) 'Fetal protection against continual exposure to bovine viral diarrhea virus followingadministration of a vaccine containing an inactivated bovine viral diarrhea virus fraction to cattle, *American Journal of Veterinary Research,* 68(12), 1417- 1422.

Grunberg, Walter. Bovine Viral Diarrhea and Mucosal Disease Complex - Generalized Conditions (2022). *MSD Veterinary Manual*, https://www.msdvetmanual.com/generalized-conditions/bovine-viral- diarrhea/bovine-viral-diarrhea-and-mucosal-disease-complex. Accessed 20 Jan. 2023.

Hall, T.A. (1999) BioEdit: A user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucleic Acids Symp. Ser*., 41: 95–98.

Hietala, S.K., and Crossley, B.M. 2005. Virus Replication. In *Bovine Viral Diarrhea Virus Diagnosis, Management and Control*. (Goyal, S. M. and Ridpath, J. F., eds), 1st Ed. Blackwell Publishing, Iowa, USA, pp.: 81-90.

Hilbe, M., Stalder, H.., Peterhans, E., Haessig, M., Nussbaumer, M.and Egli, C. (2007).Comparison of five diagnostic methods for detectingbovine viral diarrhea virus infection in calves. J. Vet.Diag.Invest.,19:28−34.

Houe H. (1995). Epidemiology of bovine viral diarrhea virus. The Veterinary clinics of North America. Food animal practice, 11(3), 521–547. https://doi.org/10.1016/s0749-0720(15)30465-5

Howard, C.J. 1990. Immunological responses to bovine virus diarrhoea virus infections. *Revue scientifique et technique-Office international des Epizooties,* 1990, 9 (1): 95-103.

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
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Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Hui, H.U.O., Mingfu, W.U., and Junwei, W. 2011. Transient Expression of BVDV Npro Gene in vitro and Distribution of Fusion Protein in Cells. *Journal of Northeast Agricultural University*, 18(March): 2009–2012.

Irianingsih, S.H., Poermadjaja, B., Wuryastuti, H., and Wasito, R (2020). Genetic recombination of bovine viral diarrhea virus subgenotype-1a and-1c in persistently infected dairy cattle. Indones. J. Biotechnol. 25, 120–126. [CrossRef].

Irianingsih, S.H., Poermadjaja, B., Wuryastuti, H., Wasito, R. 2020. Genetic recombination of bovine viral diarrhea virus subgenotype-1a and-1c in persistently infected dairy cattle. Indones. J. Biotechnol. 25, 120–126. [CrossRef].

Irianingsih, S.H., Wuryastuty, H., Wasito, R., Wibawa, H., Rasa, F.T., Poermadjaja, B. Genetic analysis of NS5B gene from bovine viral diarrhea virus-infected cattle in Central and East Java, Indonesia. Vet. World 2019, 12, 1108. [CrossRef]

Isken, O., Langerwisch, U., Schonherr, R., Lamp, B., Schroder, K., Duden, R., Rumenapf, T. H., and Tautz, N. 2014. Functional characterization of bovine viral diarrhea virus nonstructural protein 5A by reverse genetic analysis and live cell imaging. *Journal of Virology*, 88(1): 82–98.

Jenckel, M., Höper, D., Schirrmeier, H., Reimann, I., Goller, K.V., Hoffmann, B., and Beer, M. 2014. Mixed triple: allied viruses in unique recent isolates of highly virulent type 2 bovine viral diarrhea virus detected by deep sequencing. Journal of Virology, 88(12): 6983-92.

Jespersen, M.C., Peters, B., Nielsen, M. and Marcatili, P. (2017) BepiPred-2.0: Improving sequence-based B-cell epitope prediction using conformational epitopes. *Nucleic Acids Res*., 45(W1): W24–W29.

Jordan, R., Wang, L., Graczyk, T. M., Block, T. M., and Romano, P. R. 2002. Replication of a cytopathic strain of bovine viral diarrhea virus activates PERK and induces endoplasmic reticulum stress-mediated apoptosis of MDBK cells. *Journal of Virology*, 76(19): 9588–9599.

Kameyama, K., Sakoda, Y., Tamai, K., Igarashi, H., Tajima, M., Mochizuki, T., Namba, Y., and Kida, H. 2006b. Development of an immunochromatographic test kit for rapid detection of bovine viral diarrhea virus antigen. Journal of Virological Methods, 138(2006): 140–146.

Kameyama, K., Sakoda, Y., Tamai, K., Igarashi, H., Tajima, M., Mochizuki, T., Namba, Y., and Kida, H. 2006b. Development of an immunochromatographic test kit for rapid detection of bovine viral diarrhea virus antigen. Journal of Virological Methods, 138(2006): 140–146.

Kameyama, K., Sakoda, Y., Tamai, K., Nagai, M., Akashi, H., and Kida, H. 2006a. Genetic recombination at different points in the Npro-coding region of bovine viral diarrhea viruses and the potentials to change their antigenicities and pathogenicities. Virus Research, 116(2006): 78–84.

Kameyama, K., Sakoda, Y., Tamai, K., Nagai, M., Akashi, H., and Kida, H. 2006a. Genetic recombination at different points in the Npro-coding region of bovine viral diarrhea

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
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Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

viruses and the potentials to change their antigenicities and pathogenicities. Virus Research, 116(2006): 78–84.

Kampa, J., Ståhl, K., Renström, L. H. M., and Alenius, S. 2007. Evaluation of a commercial E rns - capture ELISA for detection of BVDV in routine diagnostic cattle serum samples. Acta Veterinaria Scandinavia, 7(49): 1–7.

Kapil, S., Walz, P., Wilkerson, M., and Minocha, H. 2005. Immunity and Immunosupression. In *Bovine Viral Diarrhea Virus Diagnosis, Management and Control*. (Goyal, S. M. and Ridpath, J. F., eds), 1st Ed. BlackwellPublishing, Iowa, USA, pp.: 157-170.

Kasonta, R., Sauter-Louis, C., Holsteg, M., Duchow, K., Cussler, K., Bastian, M. Effect of the vaccination scheme on pregsure(r) bvd induced alloreactivity and the incidence of bovine neonatal pancytopenia. Vaccine 2012, 30, 6649–6655. [CrossRef] [PubMed].

Khodakaram-Tafti, A., & Farjanikish, G. H. (2017). Persistent bovine viral diarrhea virus (BVDV) infection in cattle herds. Iranian journal of veterinary research, 18(3), 154–163.

Kim, S. G., & Dubovi, E. J. (2003). A novel simple one-step single-tube RT-duplex PCR method with an internal control for detection of bovine viral diarrhoea virus in bulk milk, blood, and follicular fluid samples. *Biologicals : journal of the International Association of Biological Standardization*, *31*(2), 103–106. https://doi.org/10.1016/s1045-1056(03)00023-x

Knapek, K. J., Georges, H. M., Van Campen, H., Bishop, J. V., Bielefeldt-Ohmann, H., Smirnova, N. P., & Hansen, T. R. (2020). Fetal Lymphoid Organ Immune Responses to Transient and Persistent Infection with Bovine Viral Diarrhea Virus. *Viruses*, *12*(8), 816. https://doi.org/10.3390/v12080816.

Kosakovsky Pond, S.L. and Frost, S.D.W. (2005) Not so different after all: A comparison of methods for detecting amino acid sites under selection. Mol. Biol. Evol., 22(5): 1208–1222.

Kosakovsky, P. and Frost, S.D.W. (2005) Not so different after all: A comparison of methods for detecting amino acid sites under selection. Mol. Biol. Evol., 22(5): 1208–1222.

Krey T, Himmelreich A, Heimann M, Menge C, Thiel HJ, Maurer K, Rümenapf T (2006) Function ofbovine CD46 as a cellular receptor for bovine viral diarrhea virus is determined by complement control protein 1. J Virol 80(8):3912–392.

Krey T, Moussay E, Thiel HJ, Rümenapf T (2006) Role of the low-density lipoprotein receptor in entryof bovine viral diarrhea virus. J Virol 80:10862–10867.

Kuca, T., Passler, T., Newcomer, B. W., Neill, J. D., Galik, P. K., Riddell, K. P., Zhang, Y., Walz, P. H. 2018. Identification of Conserved Amino Acid Substitutions During Serial Infection of Pregnant Cattle and Sheep with Bovine Viral Diarrhea Virus. Frontiers in Microbiology, 9(June2018): 1109.

Kumar, S., Stecher, G., Li, M., Knyaz, C. and Tamura, K. (2018) MEGA X: Molecular evolutionary genetics analysis across computing platforms. *Mol. Biol. Evol*., 35(6): 1547–1549.

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
Sami Ullah Khan, Prof. drh. Hastari Wuryastuty, M.Sc., Ph.D.
Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Lackner, T., Mu, A., Pankraz, A., Becher, P., Thiel, H., Gorbalenya, A.E., and Tautz, N. 2004. Temporal Modulation of an Autoprotease Is Crucial for Replication and Pathogenicity of an RNA Virus. *Journal of Virology*, 78(19): 10765-10775.

Lang, Y., Gao, S., Du, J., Shao, J., Cong, G., Lin, T., Zhao, F., Liu, L. and Chang, H. (2014) Polymorphic genetic characterization of E2 gene of bovine viral diarrhea virus in China. *Vet. Microbiol*., 174(3–4): 554–559.

Lanyon, S. R., and Reichel, M. P. 2014. Bovine viral diarrhoea virus ('pestivirus') in Australia: To control or not to control?. *Australian Veterinary Journal*, 92(8): 277-282.

Li, Y., Wang, J., Kanai, R. and Modis, Y. (2013) Crystal structure of glycoprotein E2 from bovine viral diarrhea virus. *Proc. Natl. Acad. Sci.* U S A, 110(17): 6805–6810.

Li, Y., Wang, J., Kanai, R. and Modis, Y. (2013) Crystal structure of glycoprotein E2 from bovine viral diarrhea virus. *Proc. Natl. Acad. Sci., U S A.*, 110(17): 6805– 6810.

Liang, D., Chen, L., Ansari, I. H., Gil, L. H. V. G., Topliff, C. L., Kelling, C. L., and Donis, R. O. 2009. A replicon trans -packaging system reveals the requirement of nonstructural proteins for the assembly of bovine viral diarrhea virus (BVDV) virion. *Virology*, 387(2): 331–340.

Liang, D., Sainz, I. F., Ansari, I. H., Gil, L. H., Vassilev, V. and Donis, R. O. (2003) 'The envelope glycoprotein e2 is a determinant of cell culture tropism in ruminant pestiviruses', Journal of General Virology, 84(pt 5), 1269-74.

Liebner Tenorio EM. 2005. Pathogenesis. In: SM In: Goyal, e Ridpath Julia F, editors, Bovine viral diarrhea virus: diagnosis, management, and control.Iowa USA, John Wiley & Sons, 1st edition.p. 121–143.

Lindenbach, B. D., Thiel, H.-J., and Rice, C. M. 2007. Flaviviridae: The Viruses and Their Replication. In *Fields Virology*. (Knipe, D. M. and Howley, P. M., eds), 5th Ed. Lippincott-Raven Publishers, Philadelphia, pp.: 1101–1151.

Liu, H., Li, Y., Gao, M., Wen, K., Jia, Y., Liu, X., Zhang, W., Ma, B., and Wang, J. 2012. Complete Genome Sequence of a Bovine Viral Diarrhea Virus 2 from Commercial Fetal Bovine Serum. *Journal of Virology*, 86(18): 10233.

Liu, S. S., Bai, T. T., Que, T. L., Luo, A., Liang, Y. X., Song, Y. X., Liu, T. Y., Chen, J. W., Li, J., Li, N., Zhang, Z. C., Chen, N. N., Liu, Y., Zhang, Z. C., Zhou, Y. L., Wang, X., & Zhu, Z. B. (2024). PI3K/AKT mediated De novo fatty acid synthesis regulates RIG-1/MDA-5-dependent type I IFN responses in BVDV-infected $CD8^+$T cells. *Vet. Microbiolo. 291*, 110034. https://doi.org/10.1016/j.vetmic.2024.110034.

Liu, S. S., Bai, T. T., Que, T. L., Luo, A., Liang, Y. X., Song, Y. X., Liu, T. Y., Chen, J. W., Li, J., Li, N., Zhang, Z. C., Chen, N. N., Liu, Y., Zhang, Z. C., Zhou, Y. L., Wang, X., & Zhu, Z. B. (2024). PI3K/AKT mediated De novo fatty acid synthesis regulates RIG-1/MDA-5-dependent type I IFN responses in BVDV-infected $CD8^+$T cells. *Vet. Microbiolo. 291*, 110034. https://doi.org/10.1016/j.vetmic.2024.110034.

Liu, X., Cheng, Z., Zhang, W., Mao, L., Pan, Z., Yang, L., Liu, M., Long, Y., Bai, J. and Li, W., (2024). Development and evaluation of a monoclonal antibody-based blocking

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
Sami Ullah Khan, Prof. drh. Hastari Wuryastuty, M.Sc., Ph.D.
Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

ELISA to detect antibodies against the E2 protein of bovine viral diarrhea virus-1. *J. Virol. Methods, 323*, 114851.

Ma, Y., Wang, L., & Xu, Y. (2022). Integrative transcriptomics and proteomics analysis provide a deep insight into bovine viral diarrhea virus-host interactions during BVDV infection. *Front. Immunol. 13*, 862828.

Mahlum, C. E., Haugerud, S., Shivers, J. L., Rossow, K. D., Goyal, S. M., Collins, J.E., and Faaberg, K. S. 2002. Detection of bovine viral diarrhea virus by TaqMan reverse transcription polymerase chain reaction. *Journal of Veterinary Diagnostic Investigation*, 14(2): 120–125.

Makoschey, B., van Gelder, P.T., Keijsers, V., Goovaerts, D. Bovine viral Diarrhea virus antigen in foetal calf serum batches and consequences of such contamination for vaccine production. Biologicals 2003, 31, 203–208. [CrossRef]

Mariner, J.C., House, J.A., Mebus, C.A., Sollod, A.E., Chibeu, D., Jones, B.A., Roeder, P.L., Admassu, B., van ‘t Klooster, G.G. Rinderpest eradication: Appropriate technology and social innovations. Science 2012, 337, 1309–1312. [CrossRef] [PubMed]

Mastelic, B., Garcon, N., Del Giudice, G., Golding, H., Gruber, M., Neels, P., Fritzell, B. Predictive markers of safety and immunogenicity of adjuvanted vaccines. Biologicals 2013, 41, 458–468.[CrossRef] [PubMed].

Maurer K, Krey T, Moennig V, Thiel HJ, Rumenapf T (2004) CD46 is a cellular receptor for bovine viral diarrhea virus. J Virol 78:1792–1799.

Maya L, Puentes R, ReoloÂn E, Acuña P, Riet F, Rivero R, *et al*. Molecular diversity of bovine viral diarrhea virus in uruguay. Arch Virol. 2016, 161(3):529±35. https://doi.org/10.1007/s00705- 015 2688-4 PMID: 26597189.

Mirosław, P., and Polak, M. P. (2020). Variability of E2 protein-coding sequences of bovine viral diarrhea virus in Polish cattle. *Virus genes*, *56*(4), 515–521. https://doi.org/10.1007/s11262-020-01756-2

Mishra N, Kalaiyarasu S. Bovine viral diarrhea virus. In: Malik YS, Singh RK, Yadav MP, editors. Recent Advances in Animal Virology. Bhopal: Indian Council of Agricultural Research- National Institute of High Security Animal Diseases (2019). doi: 10.1007/978-981-13-9073- 9_14

Mishra N, Rajukumar K, Pateriya A, Kumar M, Dubey P, Behera SP, *et al*. Identification and molecular characterization of novel and divergent hobi like pestiviruses from naturally infected cattle in India. Vet Microbiol. (2014) 174:239–46. doi: 10.1016/j.vetmic.2014.09.017

Moennig, V., Eicken, K., Flebbe, U., Frey, H.R., Grummer, B., Haas, L., Greiser-Wilke, I., Liess, B. Implementation of two-step vaccination in the control of bovine viral Diarrhea (bvd). Prev. Vet. Med. 2005, 72, 109–114, discussion 215–109. [CrossRef] [PubMed]

Moennig, V.; Becher, P. Control of bovine viral diarrhea. Pathogens 2018, 7, 29. [CrossRef].

Moennig, V.; Becher, P. Control of bovine viral diarrhea. Pathogens 2018, 7, 29. [CrossRef].

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
Sami Ullah Khan, Prof. drh. Hastari Wuryastuty, M.Sc., Ph.D.
Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Myers, T. M., Kolupaeva, V. G., Mendez, E., Baginski, S. G., Frolov, I., Hellen, C. U., and Rice, C. M. 2001. Efficient translation initiation is required for replication of bovine viral diarrhea virus subgenomic replicons. *Journal of Virology*, 75(9): 4226–4238.

Nagai, M., Hayashi, M., Itou, M., Fukutomi, T., Akashi, H., Kida, H., and Sakoda, Y. 2008. Identification of new genetic subtypes of bovine viral diarrhea virus genotype 1 isolated in Japan. *Virus Genes*, 36(1): 135–139.

Nagai, M., Hayashi, M., Sugita, S., Sakoda, Y., Mori, M., Murakami, T., Ozawa, T., Yamada, N. and Akashi, H., 2004. Phylogenetic analysis of bovine viral diarrhea viruses using five different genetic regions. *Virus research*, *99*(2), pp.103-113.

Nam, B., Zheng, Y., Zhang, J., Shuck, K.M., Timoney, P.J, and Balasuriya, U.B.R. 2015. Complete Genome Sequence of Noncytopathic Bovine Viral Diarrhea Virus 1 Contaminating a High- Passage RK-13 Cell Line. Genome Announcements, 3(5): e01115-15.

Neill J. D. (2013). Molecular biology of bovine viral diarrhea virus. Biologicals : journal of the International Association of Biological Standardization, 41(1), 2–7. https://doi.org/10.1016/j.biologicals.2012.07.002

Neill, J. D., Workman, A. M., Hesse, R., Bai, J., Porter, E. P., Meadors, B., Anderson, J., Bayles, D. O., & Falkenberg, S. M. (2019). Identification of BVDV2b and 2c subgenotypes in the United States: Genetic and antigenic characterization. Virology, 528, 19–29. https://doi.org/10.1016/j.virol.2018.12.002

Neill, J.D. (2013) Molecular biology of bovine viral diarrhea virus. *Biologicals*, 41(1): 2–7.

Newcomer, B. W., and Givens, D. 2016. Diagnosis and Control of Viral Diseases of Reproductive Importance Infectious Bovine Rhinotracheitis and Bovine Viral Diarrhea. Veterinary Clinic ofNorth America-Food Animal Practice, 32(2): 425- 441.

Newcomer, B. W., Chamorro, M. F., & Walz, P. H. (2017). Vaccination of cattle against bovine viral diarrhea virus. *Veterinary Microbiology*, *206*, 78–83. https://doi.org/10.1016/j.vetmic.2017.04.003

Newcomer, B. W., Walz, P.H., Givens, M. D. and Wilson, A. E. (2015). Efficacy of bovine viral diarrhea virus vaccination to prevent reproductive disease: A meta- analysis. Theriog., 83 : 360–365.

Newcomer, B.W., Walz, P.H., Givens, M.D., Wilson, A.E. (2015). Efficacy of bovine viral diarrhea virus vaccination to prevent reproductive disease: A meta-analysis. Theriogenology, 83, 360–365. [CrossRef] [PubMed].

Niewiesk, S. 2014. Maternal antibodies: clinical significance, mechanism of interference with immune responses, and possible vaccination strategies. *Frontiers in Immunology,* 5, 446.

O'Rourke, K. Bvdv: 40 years of effort and the disease still has a firm hold. J. Am. Vet. Med. Assoc. 2002, 220, 1770–1773. [PubMed].

OLAFSON, P., MacCALLUM, A. D., & FOX, F. H. (1946). An apparently new transmissible disease of cattle. The Cornell veterinarian, 36, 205–213.

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
Sami Ullah Khan, Prof. drh. Hastari Wuryastuty, M.Sc., Ph.D.
Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Ostachuk A, Chiavenna SM, Gómez C, Pecora A, Pérez-Filgueira MD, Escribano JA, Ardila F, Dus Santos MJ, Wigdorovitz A (2009) Expression of a ScFv-E2T fusion protein in CHO-K1 cells and alfalfa transgenic plants for the selective directioning to antigen presenting cells. Veterin Immunol Immunopathol 128:315.

Ostachuk A, Gil F, Alonso C, Escribano JA, Pérez-Filgueira MD, Wigdorovitz A, Domínguez J, Nuñez C, Dus Santos MJ (2009) Proteína de fusión con direccionamiento de antígenos vacunales a células presentadoras de antígeno y sus aplicac iones. Instituto Nacional de la Propiedad Industrial (INPI) P080101073

Ostachuk A. (2016). Bovine viral diarrhea virus structural protein E2 as a complement regulatory protein. *Archives of virology*, *161*(7), 1769–1782. https://doi.org/10.1007/s00705-016-2835-6

Ostachuk A., Bovine viral diarrhea virus structural protein E2 as a complement regulatory protein. Arch Virol. (2016) 161:1769–82. doi: 10.1007/s00705-016- 2835-6

Ostachuk A., Bovine viral diarrhea virus structural protein E2 as a complement regulatory protein. Arch Virol. (2016) 161:1769–82. doi: 10.1007/s00705-016- 2835-6.

Pecora A, Aguirreburualde MSP, Aguirreburualde A, Leunda MR, Odeon A, Chiavenna S, BochoeyerD, Spitteler M, Filippi J, Dus Santos MJ, Wigdorovitz A (2012) Safety and efficacy of an E2 glycoprotein subunit vaccine produced in mammalian cells to prevent experimental infection with bovine viral Diarrhea virus in cattle. Veterin Res Commun 36:157–164.

Pecora A, Malacari DA, Ridpath JF, Aguirreburualde Perez MS, Combessies G, Odeón AC, Romera SA, Golemba MD, Widgorovitz A (2013) First fnding of genetic and antigenic diversity in 1b-BVDV strains from Argentina. Res Vet Sci 96:204–212.

Pecora A, Malacari DA, Ridpath JF, Perez Aguirreburualde MS, Combessies G, Odeon AC, *et al*. Firstfinding of genetic and antigenic diversity in 1b-BVDV isolates from Argentina. Res Vet Sci. (2014) 96:204–12. doi: 10.1016/j.rvsc.2013.11.004.

Pedrera, M., Gomez-Villamandos, J. C., Molina, V., Risalde, M. A., Rodriguez- Sanchez, B. and Sanchez-Cordon, P. J. (2012) 'Quantification and determination of spread mechanisms of bovine viral Diarrhea virus in blood and tissues from colostrum-deprived calves during an experimental acute infection induced by a non-cytopathic genotype 1 strain', *Transboundary and Emerging Diseases,* 59(5), 377-84.

Peterhans, E., and Schweizer, M. 2010. Pestiviruses: How to outmaneuver your hosts. *Veterinary Microbiology*, 142(2010): 18–25.

Peterhans, E., Bachofen, C., Stalder, H., & Schweizer, M. (2010). Cytopathic bovine viral diarrhea viruses (BVDV): emerging pestiviruses doomed to extinction. Veterinary research, 41(6), 44. https://doi.org/10.1051/vetres/2010016

Pinior, B.; Firth, C.L.; Richter, V.; Lebl, K.; Trauffler, M.; Dzieciol, M.; Hutter, S.E.; Burgstaller, J.;Obritzhauser, W.; Winter, P.; *et al*. A systematic review of financial and economic assessmentsof bovine viral diarrhea virus (BVDV) prevention and mitigation activities worldwide. Prev Vet Med. 2017:77–92. 10.1016/j.prevetmed.2016.12.014.

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
Sami Ullah Khan, Prof. drh. Hastari Wuryastuty, M.Sc., Ph.D.
Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Platt, R., Coutu, C., Meinert, T., Roth, J.A. Humoral and t cell-mediated immune responses to bivalentkilled bovine viral diarrhea virus vaccine in beef cattle. Vet. Immunol. Immunopathol. 2008, 122, 8–15. [CrossRef] [PubMed].

Platt, R., Kesl, L., Guidarini, C., Wang, C., Roth, J.A. Comparison of humoral and t-cell-mediated immune responses to a single dose of bovela((r)) live double deleted bvdv vaccine or to a fieldbvdv strain. Vet. Immunol. Immunopathol. 2017, 187, 20–27. [CrossRef] [PubMed].

Postel, A., Austermann-Busch, S., Petrov, A., Moennig, V., Becher, P. Epidemiology, diagnosis and control of classical swine fever: Recent developments and future challenges. Transbound. Emerg. Dis. 2017. [CrossRef] [PubMed]

R Core Team (2021) R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. Available from: https:// www.r-project.org. Retrieved on 25-01-2024.

Ridpath, J.F. (2005) Classification and molecular biology. In: Goyal, S.M. and Ridpath, J.F., editors. Bovine Viral Diarrhea Virus Diagnosis Management and Control. 1st ed. Blackwell Publishing, Iowa, USA, p65–80.

Ridpath, J.F. 2005. Classification and Molecular Biology. In *Bovine Viral Diarrhea Virus Diagnosis, Management and Control*. (Goyal, S. M. and Ridpath, J. F.,eds), 1st Ed. Blackwell Publishing, Iowa, USA, pp.: 65-80.

Rodning, S.P., Marley, M.S., Zhang, Y., Eason, A.B., Nunley, C.L., Walz, P.H., Riddell, K.P., Galik,P.K., Brodersen, B.W., Givens, M.D. Comparison of three commercial vaccines for preventing persistent infection with bovine viral diarrhea virus. Theriogenology 2010, 73, 1154–1163. [CrossRef] [PubMed].

Saepulloh, M., Sendow, I. Identification and characterization of bovine viral diarrhea virus from Indonesian cattle. J. Vet. 2015, 16, 1–7.

Saliki, J. T., Huchzermeier, R. O. Y., and Dubovi, E. J. 2000. Evaluation of a New Sandwich ELISA Kit That Uses Serum for Detection of Cattle Persistently Infected with BVD Virus. Annals of New York Academy of Science, 916(1): 358–363.

Saliki, J. T., Huchzermeier, R. O. Y., and Dubovi, E. J. 2000. Evaluation of a New Sandwich ELISA Kit That Uses Serum for Detection of Cattle Persistently Infected with BVD Virus. *Annals of New York Academy of Science*, 916(1): 358–363.

Saliki, J.T., and Dubovi, E. J. 2004. Laboratory diagnosis of bovine viral diarrhea virus infections. Veterinary Clinics of North America – Food Animal Practice, 20(1): 69–83.

Saliki, J.T., Fulton, R. W., Hull, S. R., and Dubovi, E. J. 1997. Microtiter Virus Isolation and EnzymeImmunoassays for Detection of Bovine Viral Diarrhea Virus in Cattle Serum. Journal of Clinical Microbiology, 35(4): 803–807.

Sato, A., Tateishi, K., Shinohara, M., Naoi, Y., Shiokawa, M., Aoki, H., Ohmori, K., Mizutani, T., Shirai, J., and Nagai, M. 2016. Complete Genome Sequencing of Bovine Viral Diarrhea Virus1, Subgenotypes 1n and 1o. Genome Announcements, 4(1): e01744-15.

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
Sami Ullah Khan, Prof. drh. Hastari Wuryastuty, M.Sc., Ph.D.
Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

Sato, A., Tateishi, K., Shinohara, M., Naoi, Y., Shiokawa, M., Aoki, H., Ohmori, K., Mizutani, T., Shirai, J., and Nagai, M. 2016. Complete Genome Sequencing of Bovine Viral Diarrhea Virus1, Subgenotypes 1n and 1o. Genome Announcements, 4(1): e01744-15.

Schweizer, M., and Peterhans, E. 2001. Noncytopathic Bovine Viral Diarrhea Virus Inhibits Double-Stranded RNA-Induced Apoptosis and Interferon Synthesis Noncytopathic Bovine Viral Diarrhea Virus Inhibits Double-Stranded RNAInduced Apoptosis and Interferon Synthesis. *Journal of Virology*, 75(10): 4692–4698.

Shen, H., Pei, J., Bai, J., Zhao, M., Ju, C., Yi, L., Kang, Y., Zhang, X., Chen, L., Li, Y., Wang, J. and Chen, J. (2011) Genetic diversity and positive selection analysis of classical swine fever virus isolates in south China. *Virus Genes*, 43(2): 234–242.

Stalder H, Bachofen C, Schweizer M, Zanoni R, Sauerländer D, Peterhans E. Traces of history conserved over 600 years in the geographic distribution of genetic variants of an RNA virus: Bovine viral diarrhea virus in Swit`zerland. PLoS One. 2018 Dec 5,13(12):e0207604. doi: 10.1371/journal.pone.0207604. PMID: 30517140, PMCID: PMC6281212.

Stalder, H., Schweizer, M., and Bachofen, C. 2015. Complete Genome Sequence of a Bovine Viral Diarrhea Virus Subgenotype 1e Strain Isolated in Switzerland. Genome Announcements, 3(3):e00636-15.

Stevens, E.T., Zimmerman, A.D., Butterbaugh, R.E., Barling, K., Scholz, D., Rhoades, J., Chase, C.C.The induction of a cell-mediated immune response to bovine viral diarrhea virus with an adjuvanted inactivated vaccine. Vet. Ther. Res. Appl. Vet. Med. 2009, 10, E1–8.

Van Oirschot, J.T., Bruschke, C.J., van Rijn, P.A. Vaccination of cattle against bovine viral Diarrhea.Vet. Microbiol. 1999, 64, 169–183. [CrossRef].

Vilcek, S., Durkovic, B., Kolesarova, M., and Paton, D. J. 2005. Genetic diversity of BVDV: Consequences for classification and molecular epidemiology. *Preventive Veterinary Medicine*, 72(1–2): 31–35.

Vilcek, S., Durkovic, B., Kolesárová, M., Greiser-Wilke, I., & Paton, D. 2004. Genetic diversity of international bovine viral diarrhoea virus (BVDV) isolates: identification of a new BVDV-1 genetic group. Veterinary research, 35(5), 609–615. https://doi.org/10.1051/vetres:2004036

Vilcek, S., Paton, D. J., Durkovic, B., Strojny, L., Ibata, G., Moussa, A., Loitsch, A Rossmanith, W., Vega, S., Scicluna, M.T., and Palfi, V. 2001. Bovine viral diarrhoea virus genotype 1 can be separated into at least eleven genetic groups. *Archives of Virology*, 146(1): 99–115.

Walz, P. H., Chamorro, M. F., M Falkenberg, S., Passler, T., van Der Meer, F., & R Woolums, A. (2020). Bovine viral diarrhea virus: An updated American College of Veterinary Internal Medicine consensus statement with a focus on virus biology, hosts, immunosuppression, and vaccination. J. Vet. Intern. Med., *34*(5), 1690-1706.

Walz, P. H., Chamorro, M. F., M Falkenberg, S., Passler, T., van Der Meer, F., & R Woolums,

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
Sami Ullah Khan, Prof. drh. Hastari Wuryastuty, M.Sc., Ph.D.
Universitas Gadjah Mada, 2024 | Diunduh dari http://etd.repository.ugm.ac.id/

A. (2020). Bovine viral diarrhea virus: An updated American College of Veterinary Internal Medicine consensus statement with a focus on virus biology, hosts, immunosuppression, and vaccination. J. Vet. Intern. Med., *34*(5), 1690-1706.

Walz, P., Grooms, D. L., Passler, T., Ridpath, J. F., Tremblay, R., Step, D., Callan, R.J., and Givens, M.D. 2010. Control of bovine viral diarrhea virus in ruminants. *Journal of Veterinary Internal Medicine,* 24(3), 476–486.

Walz, P.H., Givens, M.D., Rodning, S.P., Riddell, K.P., Brodersen, B.W., Scruggs, D., Short, T., Grotelueschen, D. Evaluation of reproductive protection against bovine viral diarrhea virus andbovine herpesvirus-1 afforded by annual revaccination with modified-live viral or combinationmodified-live/killed viral vaccines after primary vaccination with modified-live viral vaccine. Vaccine 2017, 35, 1046–1054. [PubMed].

Walz, P.H., Grooms, D.L., Passler, T., Ridpath, J.F., Tremblay, R., Step, D.L., Cailan, R.J. and Givens, M.D. (2010) Control of bovine viral diarrhea virus in ruminants. *J. Vet. Int. Med*., 24(3): 476-486.

Wang, F.-I., Deng, M.-C., Huang, Y.L. and Chang, C.Y. 2015. Structures and functions of pestivirus glycoproteins: not simply surface matters. *Viruses,* 7, 3506-3529.

Wei, S. (2024). Detection of BVDV-Comparative Evaluation of RT-qPCR, PCR and RT-LAMP. *Acta. Sci. Vet. 52*

Wiyono, A., Daniels, P., Graydon, R. Serological studies of cattle affected by outbreaks of Diarrheal disease in Kalimantan, Indonesia. In Proceedings of the 7th Congress of the Federation of AsianVeterinary Associations (FAVA), Chonburi, Thailand, 4–7 November 1990

Woolhouse, M.E., Haydon, D.T., Bundy, D.A. The design of veterinary vaccination programmes. Vet. J. 1997, 153, 41–47. [CrossRef]

Workman, A. M., Heaton, M. P., Harhay, G. P., Smith, T. P. L., Grotelueschen, D. M., Sjeklocha, D.,Brodersen, B., Petersen, J. L., and Chitko-McKown, C. G. 2016. Resolving Bovine viral diarrhea virus subtypes from persistently infected U.S. beef calves with complete genome sequence. Journal of Veterinary Diagnostic Investigation, 28(5): 519–528.

Wuryastuti, H., Putro, P.P., Wasito, R., and Maes, R.K. 2015. Genetic Variability of Bovine Viral Diarrhea Virus in Persistently Infected Cattle in Central Java, Indonesia. Merit Research Journal of Microbiology and Biological Sciences, 3(3): 031-036.

Wuryastuti, H., Wasito, R. Application of the immunoperoxidase monolayer assay to characterize non- cytopathic bovine viral diarrhea virus of Indonesian isolates. Indones. J. Biotechnol. 1997, 1, 154–158.

Wuryastuti, H., Wasito, R. Generating a restriction map of the amplified DNA of non-cytopathic bovine viral diarrhea virus of Indonesia isolate. Indones. J. Biotechnol. 1998, 6, 193–198.

UNIVERSITAS
GADJAH MADA
Analisis Genetik Structural Protein E2 Virus Diare Bovine Yang Diisolasi Dari Sapi Perusahaan Yang Terinfeksi Secara Persisten Di Yogyakarta, Indonesia
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Wuryastuti, H., Wasito, R., Sugiyono, S. Genotypes and biotypes variation of bovine viral diarrhea virus from persistently infected dairy cattle in Java, Indonesia. Integr. J. Vet. Biosci. 2018, 2, 1–7. [CrossRef]

Wuryastuty, H., Irianingsih, S.H., Wasito, R. Deteksi Kontaminasi Bovine Viral Diarrhea Virus padaFetal Bovine Serum yang Tersedia Secara Komersial (The Detection of Bovine Viral DiarrheaVirus Contamination in Commercially Available of Fetal Bovine Serum). J. Vet. 2021, 22, 229–236.

Yanhua, H.E., Xusheng, M.A., Huang, X., Sheng, J., Zhong, F., Xinxia, Z.H.A.O., Zhang, Y. and Chuangfu, C.H.E.N., (2020). Detection of BVDV 1q in China: Genetic Characterization and Experimental Infection for the Investigation of its Pathogenicity. *Kafkas Univ. Vet. Fak. Derg.*, *26*(3).

Yesilbag, K., Alpay, G., & Becher, P. (2017). Variability and global distribution of subgenotypes of bovine viral diarrhea virus. Viruses 9 (6), 128.

Yesilbag, K., Forster, C., Ozyiğit, M. O., Alpay, G., Tuncer, P., Thiel, H. J., and Konig, M. 2014. Characterisation of bovine viral diarrhoea virus (BVDV) isolates from an outbreak with haemorrhagic enteritis and severe pneumonia. *Veterinary Microbiology*, 169(1–2): 42–49.

Yeşilbağ, K., Förster, C., Ozyiğit, M. O., Alpay, G., Tuncer, P., Thiel, H. J., & König, M. (2014). Characterisation of bovine viral diarrhoea virus (BVDV) isolates from an outbreak with haemorrhagic enteritis and severe pneumonia. Veterinary microbiology, 169(1-2), 42–49. https://doi.org/10.1016/j.vetmic.2013.12.005

Yin, J., Diao, N., Tian, T., Wang, Q., Ma, S., He, N., Zhou, H., Zhou, Z., Jia, W., Wang, X. and Shi, K., (2024). ARHGEF18 can promote BVDV NS5B activation of the host NF-κB signaling pathway by combining with the NS5B-palm domain. *Vet. Microbio.*, *291*, 109911.

Zhang, S., Tan, B., Ding, Y., Wang, F., Guo, L., Wen, Y., Cheng, S., and Wu, H. 2014a. Complete genome sequence and pathogenesis of bovine viral diarrhea virus JL-1 isolate from cattle in China. *Virology Journal*, 11(1): 67.

Zhang, S., Tan, B., Guo, L., Wang, F., Zhu, H., Wen, Y., and Cheng, S. 2014b. Genetic Diversity of Bovine Viral Diarrhea Viruses in Commercial Bovine Serum Batches of Chinese Origin. *Infection, Genetics and Evolution* 27(Aug 2014): 230–233.