



Comparative expression analysis of *PTGS2* gene in Gramasree and Tellicherry breeds of chicken across different embryonic stages#

Sajna Salim¹, Sreeja R. Nair^{2*}, Priya P.M.¹, Surya Sankar¹,
 Ambily R.¹ and Elizabeth Kurian⁴

¹Department of Veterinary Microbiology, ⁴Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Mannuthy Thrissur 680651, ²Bioscience Research and Training Centre, Bio360 Life Sciences Park, Thonnakkal, Thiruvananthapuram- 695 317

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Abstract

Newcastle disease (ND), caused by Newcastle disease virus (NDV), is a major viral disease affecting poultry production worldwide. The present study aimed to analyse the comparative expression of prostaglandin-endoperoxide synthase 2 (*PTGS2*) in embryonated chicken eggs of Gramasree and Tellicherry breeds at different stages of embryonic development following NDV infection. A lentogenic F strain NDV vaccine of infectivity titre of 2.34×10^7 EID₅₀/mL was used for experimental infection. Embryonated eggs at 12, 15 and 18 days of incubation were inoculated along with age-matched controls. Total RNA extracted from embryonic tissues was subjected to cDNA synthesis followed by quantitative real-time PCR analysis. The results demonstrated upregulation of *PTGS2* expression following NDV infection, with expression remaining elevated at the later developmental stages. Comparative analysis revealed higher fold changes in Tellicherry embryos than in Gramasree, indicating breed-dependent variation in the inflammatory response to NDV infection.

Keywords: Newcastle disease virus; *PTGS2*; embryonated chicken eggs gene expression; Tellicherry; Gramasree

Newcastle disease (ND), caused by Newcastle disease virus (NDV), is a highly contagious viral disease of poultry with considerable economic impact worldwide (Miller & Koch 2013; Dimitrov et al., 2016). Host responses to NDV infection are mediated by innate immune mechanisms, including activation of inflammatory pathways and induction of antiviral mediators (Karpala et al., 2011). Prostaglandin-endoperoxide synthase 2 (*PTGS2*) is an inducible enzyme involved in prostaglandin synthesis that plays a major role in regulating inflammation during viral infections. Enhanced *PTGS2* expression may contribute to recruitment of immune cells and amplification of antiviral defense mechanisms following NDV infection.

Embryonated chicken eggs represent a suitable model to study early host-virus interactions, as components of the avian immune system become functionally active during later stages of embryonic development (Rue et al., 2011). Indigenous chicken breeds such as Tellicherry and Gramasree differ in immune responsiveness; however, data

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*Corresponding author : sreejar@kvasu.ac.in Ph: 9447021182

on *PTGS2* expression across embryonic stages following NDV infection remain limited. The present study evaluated *PTGS2* expression in embryonated eggs of these breeds at 12, 15 and 18 days of development following NDV infection. A lentogenic F strain NDV vaccine virus (titre of 2.34×10^7 EID₅₀/mL) was used to infect embryonated eggs of Gramasree and Tellicherry breeds (n = 6 each) at 12, 15 and 18 days of incubation via the allantoic route. Age-matched uninfected eggs served as controls for each group. Embryos were harvested at 72 h post-infection corresponding to embryonic day 12, 15 and 18, respectively and pooled tissues were collected for gene expression analysis. Total RNA was extracted by TRIzol method and reverse transcribed to cDNA using the GoScript™ Reverse Transcriptase kit (Promega, India). Quantitative real-time PCR was performed to determine *PTGS2* mRNA expression with *GAPDH* was used as the reference gene because of its stable expression. Relative expression was calculated using the $2^{-\Delta\Delta Ct}$ method. Statistical analysis was performed using SPSS (version 24). Differences in relative expression between infected and control groups were analyzed using an independent t-test. Comparisons across developmental stages were conducted using one-way ANOVA followed by Duncan's multiple range test as a post hoc analysis.

NDV infection resulted in upregulation of *PTGS2* expression in embryos of both breeds. Expression of *PTGS2* was higher at 15 and 18 days than at 12 days, with no significant difference between 15 and 18 days. Tellicherry embryos showed higher fold changes of 112.68 and 254.19 at 15 and 18 days, respectively, whereas Gramasree embryos exhibited comparatively lower fold changes of 18.66 and 24.79. Lower expression was observed at 12 days in both breeds. Comparative relative expression of *PTGS2* in Gramasree and Tellicherry chicken embryos following NDV infection is shown in Table 1 and Fig. 1.

The up regulation of *PTGS2* is consistent with its role in mediating inflammatory responses during viral infection. The increase in expression across developmental stages suggests enhanced immune competence with advancing embryogenesis (Deist et al., 2018; Rue et al., 2011). Higher *PTGS2* expression in Tellicherry embryos suggests a comparatively stronger inflammatory response to NDV infection. Similar up regulation of immune-related genes following NDV infection has been reported previously (Takeuchi and Akira, 2009; Kapczynski et al., 2013; Wang et al., 2020).

Table 1. Relative expression ($2^{-\Delta\Delta Ct}$) of *PTGS2* in NDV-infected chicken embryos across developmental stages

Day	Tellicherry	Gramasree
12	1.79 ^a	5.67 ^{a*}
15	112.68 ^{b***}	18.67 ^{b***}
18	254.20 ^{b***}	24.79 ^{b*}

Values represent fold change ($2^{-\Delta\Delta Ct}$), normalised to *GAPDH* and calculated relative to the control group. Data are presented as mean values derived from ΔCt analysis. Superscript a, b within a column indicate differences across developmental stages ($p < 0.05$). Asterisks indicate differences between infected and corresponding control groups at each stage. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ns = non-significant. (Mean $\Delta Ct \pm$ SE value at 12, 15 and 18 days of embryonation of Tellicherry breed are 6.96 ± 0.57 , 6.59 ± 0.15 and 3.81 ± 0.14 , respectively and of Gramasree breed are 10.55 ± 0.41 , 8.16 ± 0.23 and 10.97 ± 0.64 , respectively).

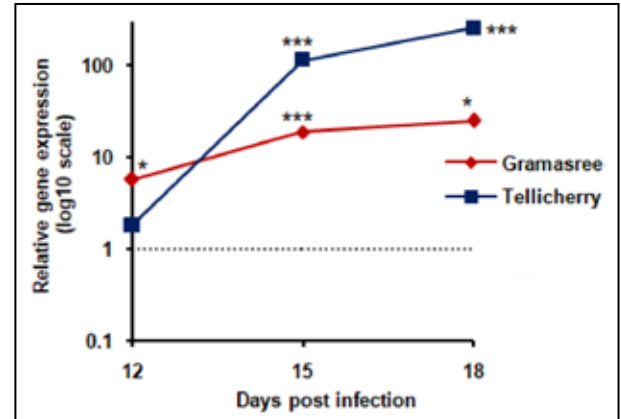


Fig. 1: Relative mRNA expression of *PTGS2* in Gramasree and Tellicherry chicken embryos following NDV infection at embryonic days 12, 15 and 18.

Gene expression levels were calculated using the $2^{-\Delta\Delta Ct}$ method with *GAPDH* as the reference gene and are presented on a log₁₀ scale relative to the uninfected control. Values are expressed as mean $\pm$ SE. The dotted line represents baseline expression. Statistical significance is indicated as * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.

Summary

The present study demonstrated upregulation of *PTGS2* expression in embryonated chicken eggs following NDV infection. Expression of *PTGS2* was significantly higher at 15 and 18 days of embryonic development than at 12 days, with no significant difference between 15 and 18 days. Tellicherry embryos exhibited higher expression levels than Gramasree embryos, indicating a stronger breed-specific innate inflammatory response.

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Conflict of interest

The authors declare no conflict of interest.

References

- Deist, M. S., Gallardo, R. A., Bunn, D. A., Kelly, T. R., Dekkers, J. C., Zhou, H., & Lamont, S. J. (2018). Novel analysis of the Harderian gland transcriptome response to Newcastle disease virus in two inbred chicken lines. *Scientific Reports*, 8(1), 6558. [10.1038/s41598-018-24830-0](https://doi.org/10.1038/s41598-018-24830-0)
- Dimitrov, K. M., Lee, D. H., Williams-Coplin, D., Olivier, T. L., Miller, P. J., & Afonso, C. L. (2016). Newcastle disease viruses causing recent outbreaks worldwide show unexpectedly high genetic similarity to historical virulent isolates from the 1940s. *Journal of Clinical Microbiology*, 54(5), 1228–1235. [10.1128/JCM.03044-15](https://doi.org/10.1128/JCM.03044-15)
- Kapczynski, D. R., Afonso, C. L., & Miller, P. J. (2013). Immune responses of poultry to Newcastle disease virus. *Developmental & Comparative Immunology*, 41(3), 447–453. [10.1016/j.dci.2013.04.012](https://doi.org/10.1016/j.dci.2013.04.012)
- Karpala, A. J., Stewart, C., McKay, J., Lowenthal, J. W., & Bean, A. G. (2011). Characterization of chicken MDA5 activity: Regulation of IFN- β in the absence of RIG-I functionality. *Journal of Immunology*, 186(9), 5397–5405. <https://doi.org/10.4049/jimmunol.1003712>
- Miller, P. J., & Koch, G. (2013). Newcastle disease. In D. E. Swayne, J. R. Glisson, L. R. McDougald, L. K. Nolan, D. L. Suarez, & V. L. Nair (Eds.), *Diseases of poultry* (13th ed., pp. 89–107). Wiley-Blackwell.
- Rue, C. A., Susta, L., Cornax, I., Brown, C. C., Kapczynski, D. R., Suarez, D. L., King, D. J., Miller, P. J., & Afonso, C. L. (2011). Virulent Newcastle disease virus elicits a strong innate immune response in chickens. *Journal of General Virology*, 92(4), 931–939. <https://doi.org/10.1099/vir.0.025486-0>
- Takeuchi, O., & Akira, S. (2009). Innate immunity to virus infection. *Immunological Reviews*, 227(1), 75–86. <https://doi.org/10.1111/j.1600-065X.2008.00737>
- Wang, C., Wang, T., Hu, R., Dai, J., Liu, H., Li, N., Schneider, U., Yang, Z., & Wang, J. (2020). Cyclooxygenase-2 facilitates Newcastle disease virus proliferation and is a target for canthin-6-one antiviral activity. *Frontiers in Microbiology*, 11, 987. <https://doi.org/10.3389/fmicb.2020.00987> ■