

Innate Immune Competence of Persons with SARS-CoV-2 Infection during the Fifth Wave in Québec City

Hend Jarras¹, Wilfried W. Bazié^{1,2}, Isalie Blais¹, Benjamin Goyer¹, Julien Boucher¹, Henintsoa Rabezanaahary¹, Mathieu Thériault¹, Kim Santerre¹, Marc-André Langlois³, Jean-François Masson⁴, Joelle Pelletier⁵, Nicholas Brousseau⁶, Denis Boudreau⁷, Sylvie Trottier^{1,8}, Mariana Baz^{1,8} and Caroline Gilbert^{1,8}

1. Axe de Recherche Maladies Infectieuses et Immunitaires, Centre de Recherche du CHU de Québec-Université Laval, Québec, Canada; 2. Programme de Recherche sur les Maladies Infectieuses, Centre Muraz, Institut National de Santé Publique, Bobo-Dioulasso, Burkina Faso; 3. Department of Biochemistry, Microbiology and Immunology, Faculty of Medicine, University of Ottawa, Ottawa, Canada; 4. Department of Chemistry, Quebec Center for Advanced Materials, Regroupement québécois sur les matériaux de pointe et Centre interdisciplinaire de recherche sur le cerveau et l'apprentissage, Université de Montréal, Montréal, Canada; 5. Department of Chemistry, Department of Biochemistry, Université de Montréal, Montréal, and PROTEO – The Québec Network for Research on Protein Function, Engineering, and Applications, Québec, Canada; 6. Institut national de santé publique du Québec, Centre de recherche du CHU de Québec, Université Laval, Québec, Canada; 7. Département de chimie et Centre d'optique, photonique et laser (COPL), Université Laval, Québec, Canada; 8. Département de Microbiologie-Infectiologie et d'immunologie, Faculté de Médecine, Université Laval, Québec, Canada

Introduction

Viral RNA drives an intracellular signaling cascade when recognized by endosomal receptors TLR7/8 and TLR3 in myeloid cells. This innate immune response is common to viral infections and serves as a bridge to adaptive immunity by producing IL-8, which promotes the secretion of other cytokines. The production of these cytokines then orchestrates the onset of the adaptive response.

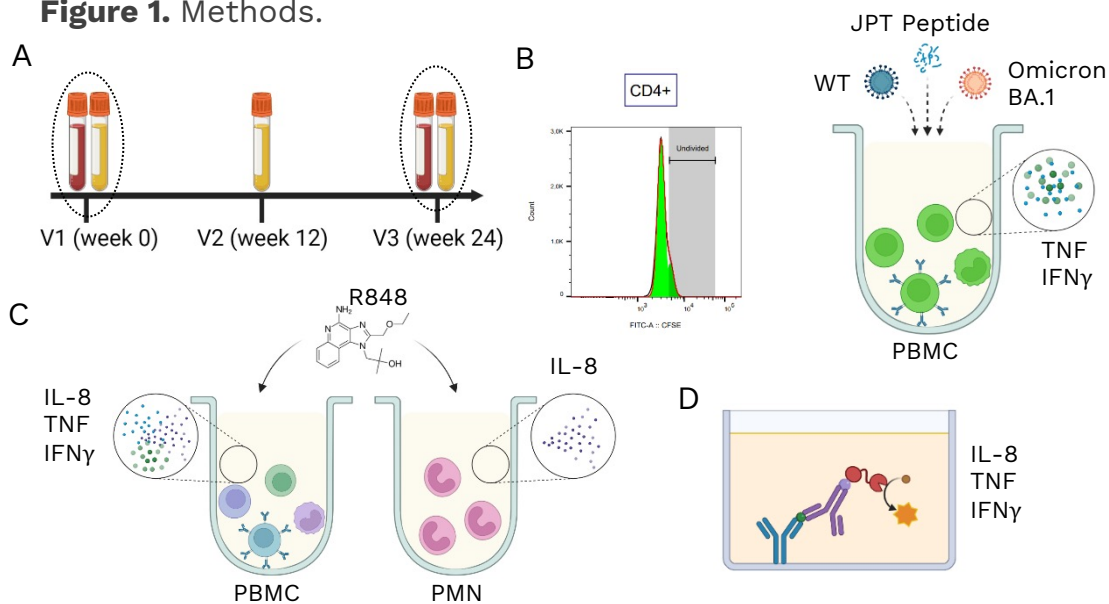
Objective

To determine the link between the innate and specific immune responses in the susceptibility of Omicron infection during the fifth wave.

Methods

Two matched groups of 38 participants were selected from a larger longitudinal study: “non-infected” and “infected” by SARS-CoV-2 during the fifth wave in Quebec.

Figure 1. Methods.



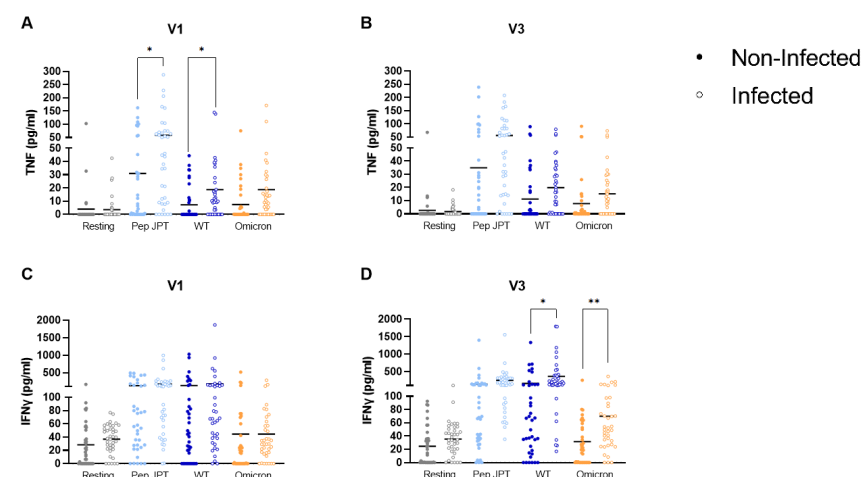
Results – Specific Immunity

Table 1. Proliferation assay p-values summary between non-infected and infected, and between V1 and V3.

Cell Type	Visit	Pep JPT	Virus WT	Virus Omicron	Group	Pep JPT	Virus WT	Virus Omicron
CD4 Total	V1			0.0072	Non-Inf			
	V3				Infected	0.0274	0.0434	
CD4 Low	V1			0.0035	Non-Inf			
	V3	0.0039			Infected			
CD4 High	V1		0.047		Non-Inf			
	V3				Infected		0.0143	
CD8 Total	V1		0.0007		Non-Inf		0.0346	
	V3				Infected		0.0209	
CD8 Low	V1				Non-Inf			
	V3	0.0444		0.0336	Infected		0.0219	
CD8 High	V1	0.0249	<0.0001	0.0002	Non-Inf			
	V3				Infected	0.0433		0.0322
CD4+CD8+	V1				Non-Inf			
	V3			0.0052	Infected			0.0036

Red: decrease
Green: Increase

Figure 2. Levels of cytokines secreted by PBMCs after viral antigenic stimulation.



Innate Immunity

Figure 3. Cytokine production after R848 stimulation of PBMC.

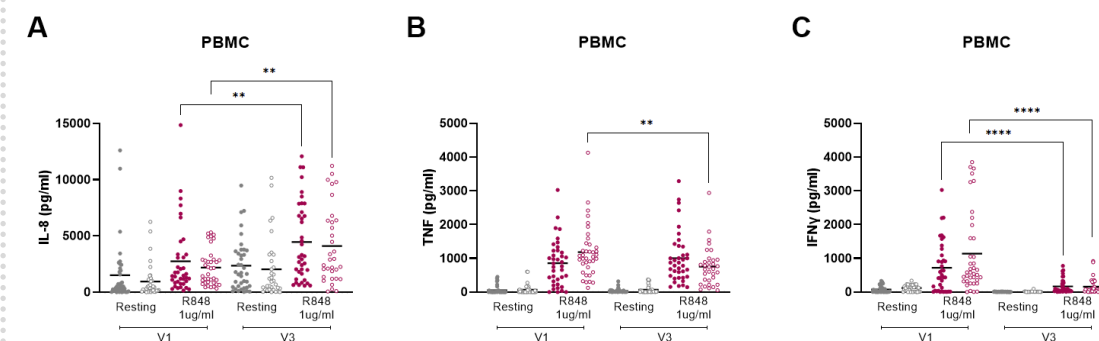
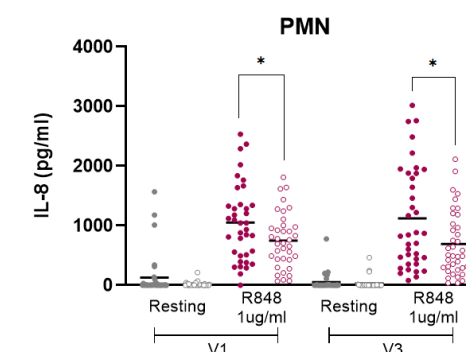


Figure 4. IL-8 production after R848 stimulation of PMN.



Conclusions

This study highlights significant differences between SARS-CoV-2 “infected” and “non-infected” groups regarding innate and specific cellular immune responses before infection.

The results show the importance of better understanding the innate response to RNA viruses that seems to be significantly weaker in PMN from the infected participants.

References

- Wallach, T., Raden, M., Hinkelmann, L., Brehm, M., Rabsch, D., Weidling, H., ... & Lehnardt, S. (2022). Distinct SARS-CoV-2 RNA fragments activate Toll-like receptors 7 and 8 and induce cytokine release from human macrophages and microglia. *Frontiers in Immunology*, 13.
- Fitzgerald, K. A., & Kagan, J. C. (2020). Toll-like receptors and the control of immunity. *Cell*, 180(6), 1044-1066.
- Manik, M., & Singh, R. K. (2022). Role of toll-like receptors in modulation of cytokine storm signaling in SARS-CoV-2-induced COVID-19. *Journal of medical virology*, 94(3), 869-877.