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Effects of the Natural Compound on SARS-CoV-2 Spike Protein-Mediated Metabolic Alteration in THP-1 Cells Explored by the ^{1}H-NMR-Based Metabolomics Approach

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Abstract : Context: Coronavirus disease 2019 (COVID-19) is a severe respiratory illness caused by the SARS-CoV-2 virus. One of the hallmarks of COVID-19 is a change in metabolism, which can lead to increased severity and mortality. The mechanism of SARS-CoV-2-mediated perturbations of metabolic pathways has yet to be fully understood. Research Aim: This study aimed to investigate the metabolic alteration caused by SARS-CoV-2 spike protein in Phorbol 12-myristate 13-acetate (PMA)-induced human monocytes (THP-1) and to examine the regulatory effect of natural compounds like Antcins A on SARS-CoV-2 spike protein-induced metabolic alteration. Methodology: The study used a combination of proton nuclear magnetic resonance (1H-NMR) and MetaboAnalyst 5.0 software. THP-1 cells were treated with SARS-CoV-2 spike protein or control, and the metabolomic profiles of the cells were compared. Antcin A was also added to the cells to assess its regulatory effect on SARS-CoV-2 spike protein-induced metabolic alteration. Findings: The study results showed that treatment with SARS-CoV-2 spike protein significantly altered the metabolomic profiles of THP-1 cells. Eight metabolites, including glycerol-phosphocholine, glycine, canadine, sarcosine, phosphoenolpyruvic acid, glutamine, glutamate, and N, N-dimethylglycine, were significantly different between control and spike-protein treatment groups. Antcin A significantly reversed the changes in these metabolites. In addition, treatment with antacid A significantly inhibited SARS-CoV-2 spike protein-mediated up-regulation of TLR-4 and ACE2 receptors. Theoretical Importance The findings of this study suggest that SARS-CoV-2 spike protein can cause significant metabolic alterations in THP-1 cells. Antcin A, a natural compound, has the potential to reverse these metabolic alterations and may be a potential candidate for developing preventive or therapeutic agents for COVID-19. Data Collection: The data for this study was collected from THP-1 cells that were treated with SARS-CoV-2 spike protein or a control. The metabolomic profiles of the cells were then compared using 1H-NMR and MetaboAnalyst 5.0 software. Analysis Procedures: The metabolomic profiles of the THP-1 cells were analyzed using 1H-NMR and MetaboAnalyst 5.0 software. The software was used to identify and quantify the cells' metabolites and compare the control and spike-protein treatment groups. Questions Addressed: The question addressed by this study was whether SARS-CoV-2 spike protein could cause metabolic alterations in THP-1 cells and whether Antcin A can reverse these alterations. Conclusion: The findings of this study suggest that SARS-CoV-2 spike protein can cause significant metabolic alterations in THP-1 cells. Antcin A, a natural compound, has the potential to reverse these metabolic alterations and may be a potential candidate for developing preventive or therapeutic agents for COVID-19.

Keywords : SARS-CoV-2-spike, ^{1}H-NMR, metabolomics, antcin-A, taiwanofungus camphoratus
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