

Title: Study of LDL quality from Covid-19 using Z-scan and UV-visible spectroscopy

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Abstract: Many patients with coronavirus disease 2019 (COVID-19) suffer multiple organ dysfunctions [1]. X. Cao and et al. found that the decreased levels of LDL-C correlate with disease severity in COVID-19 patients, indicating pathological interactions between dyslipidemia and vasculopathy in patients with COVID-19. Their studies indicated that TC, HDL-C, and LDL-C levels were significant low in patients with a viral infection, compared to the control [2]. In a 3-6 months follow-up study, Guiling Li et al. found the Improvements of serum cholesterol levels in recovered COVID-19 patients. They showed that LDL-C and HDL-C levels were significantly higher at follow-up than at admission in severe/critical cases. LDL-C levels were significantly higher at follow-up than at admission in mild cases [3]. Considering lipids play a crucial role in the virus life cycle, we investigated whether the quality of the LDL particles from Covid-19 patients changed after they recovered. In order to answer this question, blood samples from 35 Covid-19 group and 33 recovered group were collected from the Central Laboratory at the university hospital (HU). Plasma was centrifuged sequentially to extract LDLs. We examined the nonlinear optical properties of LDL samples using Gaussian laser beams (Z-scan) to verify the oxidative state of these lipoproteins and UV-visible spectroscopy to determine absorbance at wavelength 484 nm (typical from carotenoids). According to the results, there is a significant difference between two groups based on the amplitude of the thermal lens, peak to valley from Z-scan measurements ($p=6.7\times 10^{-7}$) and Maximum absorbance at 484 nm ($p=4.2\times 10^{-6}$). The LDL particle quality has been shown to be worse during the Covid-19 infection, and it has improved once it has been recovered. The results could be explained by the fact that SARS-COV-2 acute inflammation alters lipid metabolism, and lipids are highly vulnerable to free radicals, whose levels are generally elevated in cells infected with the virus [1].

Key-words: Z-scan, Covid-19, SARS-COV-2, UV-visible spectroscopy

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References:

- [1] X. Wei, et al. Hypolipidemia is associated with the severity of COVID-19, *Journal of clinical lipidology* 14(3) (2020) 297-304.
- [2] X. Cao, et al. Cholesterol: A new game player accelerating vasculopathy caused by SARS-CoV-2?, *American Journal of Physiology-Endocrinology and Metabolism* 319 (2020) E197-E202.
- [3] G. Li, et al. Follow-up study on serum cholesterol profiles and potential sequelae in recovered COVID-19 patients, *BMC Infectious Diseases* 21(1) (2021) 1-10.