

Raman Microscopic Studies on the Impact of High Glucose Condition on the Endothelial Cells

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An oxidative stress plays a potential pathogenic role in mediating the risk of diabetes and can induce hyperglycemia, understood as a high concentration of glucose in blood plasma.

In this work, an oxidative stress in endothelial cells (ECs) was caused by an elevated glucose levels. The level of glucose higher than 10 mM (*in vitro* or *in vivo*) is regarded as a high glucose (HG) condition [1]. It is known that hyperglycemia affects the functions and structure of the vessel wall, however, the mechanisms of these changes are not fully understood. So far, it has been shown that HG influences the properties of many cells, including the ECs. High glucose concentration induces phenotypic switch and modifies the intracellular signaling in vascular ECs [1]. Cells exposed to HG are in the condition of hyperglycemia and the increased metabolism of glucose in ECs increases the reactive oxygen species (ROS) production, which in turn triggers the apoptosis of ECs [2,3].

In the present work, the impact of HG condition on endothelial cells was studied. The measurements in a form of Raman mappings were collected at the excitation of 532 nm (Witec alpha 300 system). Human Aorta Endothelial Cells (HAoECs) were stimulated with glucose supplemented in a medium (in concentrations of 25 and 5 mM, so at high (HG) and low glucose (LG) condition, respectively) for 24h. The higher content of unsaturated lipids in the cytoplasm was observed in cells exposed to the high glucose concentration, whereas at the LG condition, the cells behaved comparably to the control. An increased production of unsaturated fats in the vicinity of the cell nucleus may be associated with an increased activity of the endoplasmic reticulum. The ratio of the bands at 1656 cm⁻¹ to 1444 cm⁻¹ was calculated ($I_{C=C} / I_{CH_2}$) and shown similarity to α -linolenic acid (LnA, 20: 3). It should be noted, that the LnA (20: 3; ω -6) is not synthesized *de novo* in the cell and is an essential fatty acid and has to be provided with food. However, taking into account this fact, the presence of LnA in the indicated areas of the cytoplasm the signals rather not originates from LnA. It is rather coming from a mixture of lipids with varying degrees of unsaturation.

References

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