Drug Delivery of Nitric Oxide (NO) in Relation to Diabetes Mellitus

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Approximately 37.3 million Americans suffer from Type Two Diabetes Mellitus (T2DM), a disorder in which the body fails to regulate sugar levels. In T2DM, insulin resistance reduces the availability of Nitric oxide (NO) - a signaling molecule that regulates blood pressure by relaxing the inner muscles of blood vessels - causing the vessels to widen. In patients with T2DM, insulin resistance reduces the availability of NO for endothelial cells, leading to endothelial cell dysfunction and less NO for Smooth Muscle Cells. This study explores effective ways to reliably measure and deliver NO through nanoparticles, which could lead to improvements in T2DM research. Due to their stability, I used NO donors S-Nitrosoglutathione (GSNO) and Sodium Nitroprusside (SNP) to measure NO release. I set up the release by first calibrating the nitric oxide ISO-NOPNM nanosensor to reliably measure NO levels in liquids and examined release profiles of NO from SNP loaded in polymeric nanoparticles. I used encapsulation methods to synthesize drug-infused nanoparticles, and then measured the release of NO nanoparticles over 96 hours. The calibration of the ISO-NOPNM nanosensor compared consistent concentration increments (nM) to unknown sensor readings (pA) for SNP (R2=0.92) and GSNO (R2 =0.75). After an initial rapid release of nanoparticles for 8 hours, the release stabilized. The results from the liquid and nanoparticle release studies suggest that GSNO and SNP effectively calibrate using the ISO-NOPNM sensor and consistently release through nanoparticles. This methodology allows us to understand the most effective way to release NO, offering new avenues for diabetes research.