Effects of Niacin Loaded Polymeric Nanoparticles on In Vitro Prostaglandin Expression
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Purpose
Niacin is a naturally occurring b-vitamin shown to positively affect lipoprotein abnormalities. Clinical use of niacin is limited by common flushing side effects induced through increased vasodilatory prostaglandin (PG) expression. Nanoparticles (NPs) are commonly used in development of novel drug delivery systems that act to alter drug release and/or reduce adverse drug related side effects. Previously, our lab developed highly stable niacin-loaded polymeric NPs consisting of polylactic acid (PLA) or polylactic-co-glycolic acid (PLGA) polymers using the stabilizer didodecyldimethylammonium bromide (DMAB). The purpose of this study was to examine in vitro effects of niacin-entrapped polymeric NPs on PG expression in human blood as a model for the PG mediated, niacin induced flushing response.

Methods
Effects of niacin-NP formulation on in vitro PG expression was carried out using human blood samples. Niacin-loaded PLGA or PLA-NP solutions formulated with varying amounts of DMAB (0.1, 0.25, 0.5, and 1 % w/v) were placed in 1 mL human blood at a concentration of 0.5 mM. Blood was vortex mixed for 15 seconds, then incubated 1 hour at room temperature. After incubation, samples were centrifuged 15 minutes at 3,000 g. Supernatant was collected and analyzed for PGE2 expression using an enzyme-linked immunosorbent assay. Plain niacin powder in 1 mL human blood (0.5 mM) was used as reference for niacin induced PGE2 expression. Data comparisons were made among groups using one-way ANOVA and presented as mean ± the standard deviation.

Results
The use of plain niacin resulted in a significant (p = 0.007) increase in blood PGE2 concentrations (804.78 ± 95.16 pg/mL) compared to control (untreated blood) (234.84 ± 73.01 pg/mL). Niacin entrapped PLGA-NPs formulated at 0.25% (389.09 ± 13.93 pg/mL, p = 0.026), 0.5% (291.08 ± 325.94 pg/mL, p = 0.011), and 1% w/v (415.99 ± 4.04 pg/mL, p = 0.034) DMAB demonstrated a significant reduction in PGE2 concentration compared to plain niacin, while NP formulations using PLA polymers showed no significant reduction in PGE2 expression.

Conclusion
The PLGA-NP delivery system can significantly reduce in vitro prostaglandin expression. Our results support a novel method of niacin delivery that may function to reduce niacin associated flushing effects.