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ORIGINAL ARTICLES

Technosphere® Insulin: Defining the Role of Technosphere Particles at the Cellular Level

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Abstract

Background:

Technosphere® Insulin (TI) is a novel inhalation powder for the treatment of diabetes mellitus. Technosphere Insulin delivers insulin with an ultra rapid pharmacokinetic profile that is distinctly different from all other insulin products but similar to natural insulin release. Such rapid absorption is often associated with penetration enhancers that disrupt cellular integrity.

Methods:

Technosphere Insulin was compared to a panel of known penetration enhancers *in vitro* using the Calu-3 lung cell line to investigate the effects of TI on insulin transport.

Results:

Measures of tight junction integrity such as transepithelial electrical resistance, Lucifer yellow permeability, and F-actin staining patterns were all unaffected by TI. Cell viability and plasma membrane integrity were also not affected by TI. In contrast, cells treated with comparable (or lower) concentrations of penetration enhancers showed elevated Lucifer yellow permeability, disruption of the F-actin network, reduced cell viability, and compromised plasma membranes.

Conclusions:

These results demonstrate that TI is not cytotoxic in an *in vitro* human lung cell model and does not function as a penetration enhancer. Furthermore, TI does not appear to affect the transport of insulin across cellular barriers.

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Abbreviations: (ELISA) enzyme-linked immunosorbent assay, (FDKP) fumaryl diketopiperazine, (LDH) lactate dehydrogenase, (LOQ) limit of quantitation, (MTS) 3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium, inner salt), (P_{app}) apparent permeability, (SD) standard deviation, (TEER) transepithelial electrical resistance, (TI) Technosphere® Insulin

Keywords: Calu-3 cell monolayers, fumaryl diketopiperazine, inhaled insulin, Technosphere Insulin, Technosphere particles, tight junctions

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