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FUTURE GENERATION MEDICATION FOR DIABETES USING NANOTECHNOLOGY

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ABSTRACT

Diabetes mellitus is defined as a group of metabolic disorders characterised by hyperglycaemia. Around 387 million people around the world suffer from it and it is estimated that diabetes mellitus directly is responsible for around 4 million deaths per year. Nanotechnology can play a significant role in monitoring, repairing, control, and even constructing human biological system at cellular level. Medicine specific nanotechnology is commonly referred to as Nano medicine may be the most important part of having diabetes in getting insulin administered in the body. Nano technology is being used in non invasive approaches to insulin deliver and to engineer more effective vaccine cell and gene therapies for type 1 diabetes. In one such famous study insulin is protected with a bio composite consisting calcium phosphate, polyethylene glycol and milk protein. This protects the capsule from harsh GIT environment. Along with the oral route, insulin can be inhaled through the nasal openings using nanotechnology that leads them direct into the blood stream through lungs without degradation. Number of nano particles including calcium phosphate, porous hydroxyapatite and polymer nano particles has been tested for inhalation type insulin delivery with great success. Recent advancement in nano technology researches will surely lead to new ways of fighting the disorder with more success.

KEYWORDS: diabetes mellitus, nanotechnology, oral insulin, inhalable insulin, improved technologies.

Antioxidative Role of Nano Particles in Diabetes

Major problem with diabetes patients is delayed wound healing and still challenging its complete cure. Some of the nano particles now a days are preparing in a manner that act as a free radical scavenger. cerium oxide plays a major role due to its excellent free radical

scavenging potentials. This metal oxide is mono disperse particle with a single crystal and few twin boundaries. Cerium characterised by two oxidative state +4 and +3. the property enhances cerium oxide attractive for wound healing process followed by scavenging properties. Yttrium oxide is now a day considered most significant due to its highest oxide forming from elemental yttrium. Cerium and yttrium oxide Nano particles are able to rescue cells from oxidative stress induced cell death.

IMPROVED TECHNOLOGIES

1. Glucose Sensors: it is based on the binding of glucose to the sensors to provide a fluorescent readout. Trans cutaneous based glucose sensors are currently being evaluated in clinical trials and early stage data shows that it can produce a reliable output for tracking blood glucose levels.in these devices, when glucose displaces water in a binding pocket on the sensor, there is a shift in electron density that can be measured as a fluorescent output. Glucose binding moieties that have been used for such applications include molecules such as lectins, synthetic molecules such as PBA, and molecularly imprinted polymer hydrogels based on polycryl amides and poly ally amines.

2. Insulin Delivery: The development of non-invasive methods for insulin delivery has the potential to improve patient compliance and reduce complications associated with poor glycaemic control. oral, inhalable, and transdermal delivery can provide painless and simple methods relative to traditional insulin injections. However poor and unpredictable bioavailability has limited the success of insulin delivery through these routes. Nanotechnology has been used to address these challenges and develop non-traditional delivery routes

3. Nano Pumps: Several technologies have been developed to improve patient compliances associated with insulin replacement theory among which one is externally worn pager sized insulin pumps that contain a replaceable depot of insulin connected to a subcutaneously implanted cannula. The pager can be programmed to deliver a basal level of insulin throughout the day as well as bolus insulin dosages on demand for meals through continuous insulin infusion. Most recently, micro computer controlled closed loop insulin delivery systems are being developed, where CGMs are used in conjunction with insulin pumps to automatically calculate and inject appropriate doses of insulin. The goal of this technology is to provide a "patient intervention free" insulin replacement therapy.

4.Nanomedical Devices: Mauro Ferrari from Ohio state university and Tejas Desai from Boston university have created what could be considered one of the earliest therapeutically useful Nano medical devices. They created a tiny silicon box that contains beta cells taken from animals. The box is surrounded by a material with a very specific Nano pore size. These pores are big enough to allow the passage for glucose and insulin but small enough to impede the passage of much larger immune system molecules.

These boxes can be implanted under the skin of patient. This could temporarily restore the body's delicate glucose control feedback loop without the need of powerful immunosuppressant's.

CONCLUSION

The expectation from nanotechnology in medicine is high and the potential benefits are endlessly listed, it shows great potential for the future diabetic management. We envision promising oppurtunities in the development of glucose sensors and insulin delivering nano particle formulation. In summary we expect nanotechnology to play an important role in improving the management of diabetes in the next decade. The emergence of FDA approved nanotechnology formulation coupled with the clinical success off insulin delivering technologies through the pulmonary route is encouraging.