Nanotechnology advances for Type 2 Diabetes Mellitus (T2DM) treatment

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BACKGROUND

International Diabetes Federation estimates that in the next 20 years 642 million worldwide will have diabetes mellitus. Current T2DM drugs present several drawbacks that can affect the course of treatment. These disadvantages are mainly depicted in the low bioavailability and the immediate release of the drug, generating the need for an increase in frequency of dosing. In conjugation with the manifestation of adverse side effects, patient compliance to therapy is reduced.

AIM

We present here two major applications of nanotechnology for the development of high efficiency innovative T2DM drugs. The **first** one aims to overcome the instability of incretin mimetics/ analogues (GLP-1 analogues) in the gastrointestinal tract, their poor absorption efficiency, and their rapid degradation by the DPP4 enzyme. The **second** one specializes in the encapsulation of drugs into nanoparticles.

METHODS

Pubmed, Google Scholar and Scopus databases were searched for nano-based T2DM drugs (excluding insulin) studies which were supported by *in vivo* mouse/rat models of glucose homeostasis.

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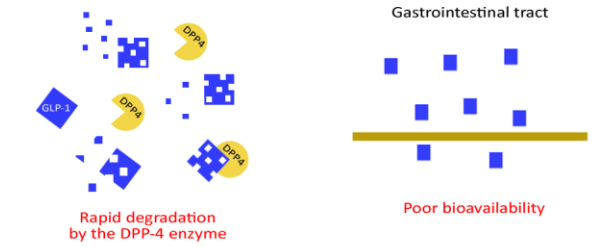
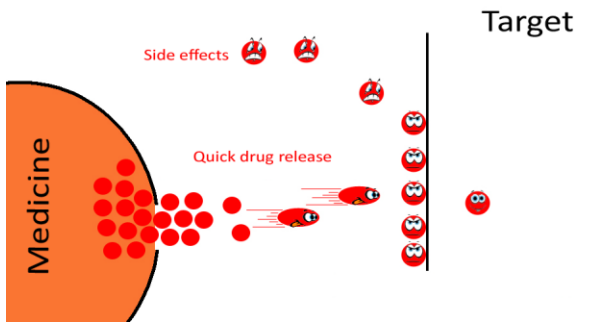
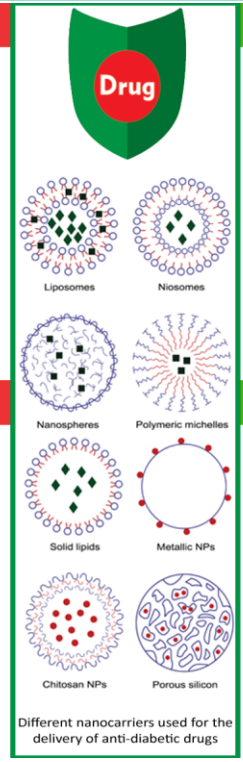
RESULTS

GLP-1 analogues

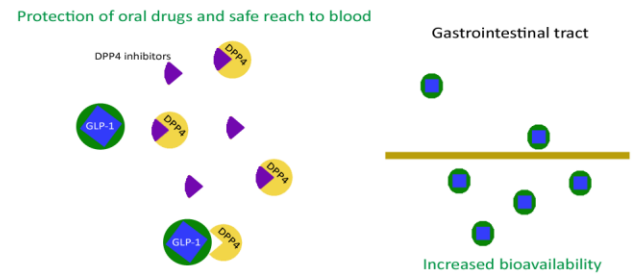


Drugs

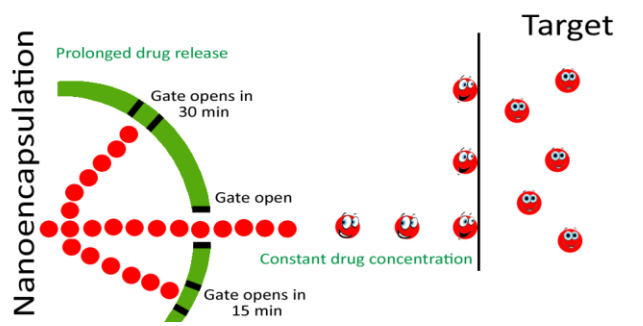




GLP-1 based nanomaterials



Nano-drug carriers



The nano-drugs: **1.** Increase bioavailability by protecting oral drugs and ensuring safe reach to blood circulation from initial absorption in the gastrointestinal tract e.g. protection of GLP1 from enzymatic digestion (DPP4 enzymes) **2.** Prolong drug release: (a) Maintain constant drug concentration; (b) Reduce frequency of dosing and therefore; (c) Improve patient compliance and **3.** Reduce drug's potential side effects (combination of 1 + 2) such as hyperglycemia, weight gain, increase in insulin resistance, β-cells destruction, renal and cardiovascular complications.

CONCLUSION

Nanotechnology touch in medicine/biotechnology looks promising. An optimal therapeutic profile of a nanodrug should aim to maintain glucose levels as close to normal as possible for an extended period. This task is extremely difficult in diabetes due to the clearance of the drug from circulation. It is anticipated that novel approaches, which will fully exploit the progress of nanotechnology in the fight against the increasing prevalence of T2DM, are around the corner.

REFERENCES

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