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NTU scientists develop oral insulin nanoparticles which may be alternative to injections [The Straits Times, Singapore / Asia News Network]

Jan. 18—SINGAPORE (The Straits Times/ANN) — Nanyang Technological University (NTU) scientists have developed insulin nanoparticles that could allow diabetic patients to do away with injections.

Some diabetics do not produce enough insulin, which is necessary for regulating blood sugar levels.

Injections typically put insulin into the blood stream within 30 minutes and

work for up to six hours.

But when the insulin-containing nanoparticles were fed to rats in a pre-clinical study, the insulin entered their blood stream within minutes.

Scientists have long been searching for a way to administer insulin orally rather than via injections, which can be daunting for many diabetics.

Associate Professor Yusuf Ali from the NTU Lee Kong Chian School of Medicine and the co-author of the study noted that taking it orally is better than jabs as it is more comfortable and could lead to improved patient compliance.

But administering oral dosages of insulin has been a challenge as it is a protein and gets broken down in the gastrointestinal tract before it can reach the bloodstream.

NTU researchers aimed to overcome this by designing a nanoparticle that is loaded with insulin at its core followed by alternating layers of insulin and chitosan, a type of natural sugar which controls the release of insulin.

The insulin dosage can be adjusted by controlling the number of layers in the nanoparticle.

Lab experiments using cell cultures and rat models showed that the nanoparticle remained stable as it passed through the stomach into the small intestine with minimal insulin release in the process, eventually penetrating the intestinal walls.

The nanoparticle also closely mimics the route by which natural insulin enters the bloodstream from the pancreas through the liver, an important organ for controlling blood glucose levels.

After leaving the nanoparticles in a fluid that simulates the stomach environment, the team found that 6 per cent of the insulin from the nanoparticle was released in one hour — which is the time taken for food to

pass through the stomach into the small intestine.

The remaining 94 per cent remained encapsulated.

When researchers tested on the human cell line, Caco-2, which is a widely used model for studying the transport of molecules across the intestinal wall, they found that the amount of insulin transported was three times higher when administered through the nanoparticle compared with oral capsules.

When fed to rats orally, the insulin concentration in their blood peaked at the 30-minute mark and was entirely eliminated in four hours.

Dr Huang Yingying from the School of Materials Science and Engineering at NTU and the study's co-lead author said efforts to develop oral products have met with little success as they either come with a safety risk or require frequent dosage due to the insufficient amounts of insulin they contain.

On the other hand, the nanoparticle showed that a large amount of insulin can be carried for the desired therapeutic effect while being small enough to enter the bloodstream.

"This indicates its potential application for oral insulin delivery in humans. We believe that the same concept could be useful for other protein drugs which normally have to be injected," said Dr Huang.

The NTU team is now in talks with a pharmaceutical company to improve how the nanoparticle functions.

Click here to read more from The Straits Times:
https://www.straitstimes.com/singapore/ntu-scientists-develop-oral-insulin-nanoparticles-which-may-be-alternative-to-injections

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