

# Could oral insulin signal the end of daily injections?



Thanks to synthetic insulin, millions of diabetics are able to lead independent lives. Scientists are now looking for ways to administer the hormone without syringes – and an insulin pill could make life even easier for many patients.

A diabetic who relies on insulin requires several injections each day. Long-acting insulin, which is injected into subcutaneous fatty tissue, covers their daily requirement. Before every meal, a patient checks their blood sugar level and administers accurately dosed rapid-acting insulin, preventing blood sugar spikes. However, this essential routine can disrupt a patient's everyday life – particularly when they're traveling. As well as a glucometer, they need to carry an insulin pen and a sufficient quantity of active agent, cannulas and test strips with them. What's more, they must carry the medicine in a cool bag because liquid insulin is perishable and extremely sensitive to temperature. At anything below 2 degrees Celsius and above 40, the amino acids are destroyed and the insulin becomes ineffective. When traveling by air, patients also need a medical certificate to show that they are allowed to carry medicine and syringes with them.

## DIABETES: A WIDESPREAD DISEASE

More and more people are being diagnosed with diabetes mellitus. According to the World Health Organization, the number of diabetics has quadrupled during the past 35 years and now stands at 420 million people. The International Diabetes Federation expects 640 million individuals to be living with the disease by 2040. Increasing wealth, obesity, and demographic changes are turning diabetes into a widespread disease, with numbers growing in emerging countries, in particular.

Insulin is produced in the pancreas. It enables cells to absorb sugar – their most important energy supply. In people with diabetes, this metabolic process is disturbed. In particular, type 1 diabetics rely on insulin syringes. The injections have a bioavailability of 100 percent, meaning the whole amount of insulin reaches the bloodstream. This means that the active agent's dosage can be precisely controlled. However, inserting the syringe into subcutaneous fatty tissue does entail some risks. If the patient accidentally hits a muscle or blood vessel, it can cause life-threatening hypoglycemia. Furthermore, every application requires a new and clean cannula to prevent infection. Overall, unless the patient has the means to continuously cool the insulin, meet the necessary hygiene requirements, and administer the medicine properly, things could get dicey.

## GRADUAL INSULIN RELEASE

Since insulin was first discovered, physicians have been looking for a way to administer the hormone without the use of a syringe. No idea has been followed with greater interest than the insulin pill. Its key advantage is that, once it has entered the system, orally administered insulin would undergo a similar process as the hormone in a healthy body, traveling from the portal vein to the liver. However, in reality, the swallowed pro-

tein would not survive its previous journey through the digestive tract – gastric acid would attack it before the pill reaches the small intestine. However, a special coating could protect it.

The insulin pill's restricted bioavailability of approximately 40 to 70 percent is problematic, too: to ensure that enough insulin reaches the bloodstream, a greater amount of the active agent must be administered. Additionally, a further challenge is to release the insulin at the correct rate. If too high a concentration reaches the bloodstream in one go, the patient's blood sugar level could descend and cause life-threatening complications.

At present, several pharmaceutical companies are working on producing an insulin pill. Initial tests suggest that it can control blood sugar level just as effectively as an injection – which means self-injections could soon be a thing of the past.

## DIABETES

Approximately four percent of all diabetics suffer from the autoimmune disease type 1 diabetes, a total lack of insulin.

Type 2 diabetes is the most common type of diabetes worldwide, making up nearly 90 percent of cases.

Unlike type 1, type 2 is not a congenital disease. Instead, a number of lifestyle factors are known to increase predisposition. In particular, people with an unhealthy diet or who don't exercise are at risk.

Gestational diabetes is a metabolic disorder that occurs during pregnancy and, in most cases, disappears after delivery. It affects one in six expectant mothers worldwide.

