Fasting diet regenerates diabetic pancreas

The pancreas can be triggered to regenerate itself through a type of fasting diet, say US researchers.

Restoring the function of the organ - which helps control blood sugar levels - reversed symptoms of diabetes in animal experiments.
The study, **published in the journal Cell**, says the diet reboots the body.

Experts said the findings were "potentially very exciting" as they could become a new treatment for the disease.

People are advised not to try this without medical advice.

In the experiments, mice were put on a modified form of the "fasting-mimicking diet".

It is like the human form of the diet when people spend five days on a low calorie, low protein, low carbohydrate but high unsaturated-fat diet.

It resembles a vegan diet with nuts and soups, but with around 800 to 1,100 calories a day.

Then they have 25 days eating what they want - so overall it mimics periods of feast and famine.

Previous research has suggested it can slow the pace of ageing.

Diabetes therapy?

But animal experiments showed the diet regenerated a special type of cell in the pancreas called a beta cell.

These are the cells that detect sugar in the blood and release the hormone insulin if it gets too high.

Dr Valter Longo, from the University of Southern California, said: "Our conclusion is that by pushing the mice into an extreme state and then bringing them back - by starving them and then feeding them again - the cells in the pancreas are triggered to use some kind of developmental reprogramming that rebuilds the part of the organ that's no longer functioning."

There were benefits in both type 1 and type 2 diabetes in the mouse experiments.

Type 1 is caused by the immune system destroying beta cells and type 2 is largely caused by lifestyle and the body no longer responding to insulin.

Further tests on tissue samples from people with type 1 diabetes produced similar effects.

Dr Longo said: "Medically, these findings have the potential to be very important because we've shown - at least in mouse models - that you can use diet to reverse the symptoms of diabetes.

"Scientifically, the findings are perhaps even more important because we've shown that you can use diet to reprogram cells without having to make any genetic alterations."

What's it like?

BBC reporter Peter Bowes took part in a separate trial with Dr Valter Longo.

He said: "During each five-day fasting cycle, when I ate about a quarter of the average person's diet, I lost between 2kg and 4kg (4.4-8.8lbs).

"But before the next cycle came round, 25 days of eating normally had returned me almost to my original weight.

"But not all consequences of the diet faded so quickly."

His blood pressure was lower as was a hormone called IGF-1, which is linked to some cancers.

He said: "The very small meals I was given during the five-day fast were far from gourmet cooking, but I was glad to have something to eat"

Peter Bowes: Fasting for science
Peter Bowes: Intermittent fasting and the good things it did to my body

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Separate trials of the diet in people have been shown to improve blood sugar levels. The latest findings help to explain why.

However, Dr Longo said people should not rush off and crash diet.

He told the BBC: "It boils down to do not try this at home, this is so much more sophisticated than people realise."

He said people could "get into trouble" with their health if it was done without medical guidance.

Dr Emily Burns, research communications manager at Diabetes UK, said: "This is potentially very exciting news, but we need to see if the results hold true in humans before we'll know more about what it means for people with diabetes.

"People with type-1 and type-2 diabetes would benefit immensely from treatments that can repair or regenerate insulin-producing cells in the pancreas."

Many of the changes in my body when I took part in the clinical trial of an intermittent fasting diet were no surprise. Eating very little for five days each month, I lost weight, and I felt hungry. I also felt more alert a lot of the time, though I tired easily. But there were other effects too that were possibly more important.

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But not all consequences of the diet faded so quickly.

"What we are seeing is the maintenance of some of the effects even when normal feeding resumes," explains Dr Valter Longo, director of USC's Longevity institute, who has observed similar results in rodents.

Peter Bowes: Intermittent fasting

- The popularity of intermittent fasting has grown over the past year or so. The 5:2 diet, which involves dramatically reducing your calorific intake on certain days of the week, is one example. But **more clinical data is needed** to confirm the benefits of such regimes.
- **I love to eat**. I enjoy a big, healthy breakfast, exercise a lot and - left to my own devices - snack all day before digging in to a hearty evening meal.

Does intermittent fasting work?
Sitting out hunger pangs on a five-day fast

"That was very good news because that's exactly what we were hoping to achieve."

Clinical tests showed that during the diet cycles my systolic blood pressure dropped by about 10%, while the diastolic number remained about the same. For someone who has, at times, had borderline hypertension, this was encouraging. However, after the control period (normal diet), my blood pressure, like my weight, returned to its original - not-so-healthy - state.

The researchers will be looking at whether repeated cycles of the diet could be used to help manage blood pressure in people over the longer term.

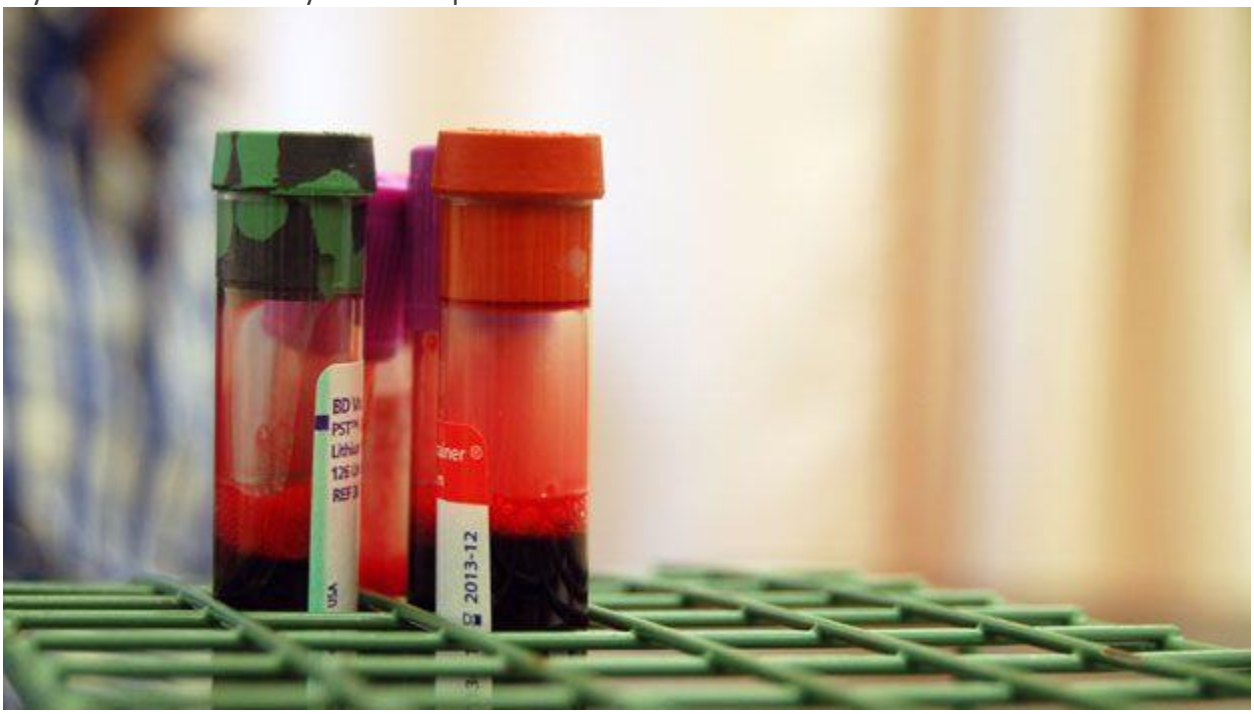
Arguably, the most interesting changes were in the levels of a growth hormone known as IGF-1 (insulin-like growth factor). High levels of IGF-1, which is a protein produced by the liver, are

believed significantly to increase the risks of colorectal, breast and prostate cancer. Low levels of IGF-1 reduce those risks.

"In animals studies we and others have shown this to be a growth factor that is very much associated with ageing and a variety of diseases, including cancer," says Longo.

Studies in mice have shown that an extreme diet, similar to the one I experienced, causes IGF-1 levels to drop and to stay down for a period after a return to normal eating.

My data showed exactly the same pattern.



"You had a dramatic drop in IGF-1, close to 60% and then once you re-fed it went up, but was still down 20%," Longo told me.

Such a reduction could make a significant difference to an individual's likelihood of developing certain cancers, he says. A study of a small population of people in Ecuador, who have much lower levels of IGF-1, because they lack a growth hormone receptor, showed that they rarely develop cancer and other age-related conditions.

Insulin-like growth factor 1

- IGF-1 is a protein produced by the liver when it is stimulated by growth hormone circulating in the blood
- It plays a role in the growth of muscle, bones and cartilage throughout the body, and is critical to growth and development during childhood

- Lower levels of IGF-1, induced by calorie restriction, have been shown in rodents to slow the ageing process and protect against cancer

- IGF-1 levels in adult humans vary according to age and gender

My blood tests also revealed that the major inhibitor of IGF-1, which is called IGFBP-1, was significantly up during the fasting period. Even when I resumed a normal diet, the IGFBP-1 level was elevated compared with my baseline. It is, according to Longo, a sign that my body switched into a mode that was much more conducive to healthy ageing.

Data from other participants in the study is still being analysed, but if they also show lower levels of IGF-1 and higher levels of IGFBP-1, it could help scientists develop an intermittent fasting regime that allows people to eat a normal diet for the vast majority of the time, and still slow down the ageing process.

One idea being explored by Longo is that a five-day intervention every 60 days may be enough to trigger positive changes in the body.

"This is exactly what we have in mind to allow people, for let's say 55 every 60 days, to decide what they are going to eat with the help of a good doctor, and diet in the five days. They may not think it is the greatest food they have ever eaten, but it's a lot easier, let's say, than complete fasting and it's a lot safer than complete fasting and it may be more effective than complete fasting."

My levels of IGF-1 during the trial

- At start: **119**ng/ml (nanograms per milli-liter)
- Immediately after five-day fasting diet: **49**ng/ml
- One week after five-day fasting diet: **97**ng/ml
- Normal range for men 51-60 years old is **68-245**ng/ml

The very small meals I was given during the five-day fast were far from gourmet cooking, but I was glad to have something to eat. There are advocates of calorie restriction who promote complete fasting.

My blood tests also detected a significant rise in a type of cell, which may play a role in the regeneration of tissues and organs.

It is a controversial area and not fully understood by scientists.

"Your data corresponds to pre-clinical data that we got from animal models that shows that cycles of fasting could elevate this particular substance, considered to be stem cells," said Dr Min Wei, the lead investigator.

The substance has also been referred to, clumsily, as "embryonic-like".

"At least in humans we have a very limited understanding of what they do. In animal studies they are believed to be 'embryonic-like' meaning... they are the type of cells that have the ability to regenerate almost anything," says Longo.

It would be highly beneficial if intermittent fasting could trigger a response that enhances the body's ability to repair itself, but much more research is required to confirm these observations.

This diet is still at the experimental stage and data from the trial are still being studied. Other scientists will eventually scrutinize the findings independently, and may attempt to replicate them.

"We generally like to see not only an initial discovery in a trial but we like to see confirmatory trials to be sure that in the broadest kind of sense, in the general population that these findings are going to be applicable," says Dr Lawrence Piro, a cancer specialist at The Angeles Clinic and Research Institute.

"I do believe fasting to be a very effective mechanism. They are pieces of a puzzle, that puzzle is not fully revealed yet, the picture isn't clear yet but there's enough of the picture clear. I think we can be really excited that there is some substantial truth here, some substantial data coming forward and something that we can really be hopeful about."

Future clinical trials will focus on "at-risk" members of community - those who are obese - to gauge their response to a severely restricted diet.

But if this diet, or another intermittent fasting diet, is eventually proven be effective and sustainable, it could have profound implications for weight loss and the way doctors fight the diseases of old age.