House of Carbs

A bacterial solution to mitigate hyperglycemic spikes
Hyperglycemia: About the Disease

(Freckmann et al. 2007)
Hyperglycemia: Complications

- Foot ulcer as a complication of diabetic MVD
- Macular edema as a result of diabetic MVD
Hyperglycemia: About the Disease

- Pre-Diabetic US Population
- Diabetic US Population
- Healthy US Population

American Diabetes Association
2010
Hyperglycemia: Current Treatments
Hyperglycemia

Suckale and Solimena, 2008.
Hyperglycemia
Design a living medicine using *E. coli* to uptake simple sugars and polymerize them into high-molecular-weight polymers in the small intestine to reduce the amplitude of hyperglycemic spikes by 50%
The Approach: Sugar Uptake

- **Inner Membrane**
- **Periplasm**
- **Outer Membrane**

Diagram showing sugar uptake and diffusion processes.
Project Aims: Sugar Polymerization

[Diagram showing the polymerization process involving levan, SacB, G1gC, and glycogen, with BBa_K1600002 indicated]
Project Aims: Kill Switch
Project Aims

1. Uptake free glucose and fructose from solution
2. Polymerize glucose into glycogen, fructose into levan
3. Characterize the kill switch mechanism by fructose sensitivity
Aim #1: Uptake Sugar from the Gut

Aim #2: Polymerize Sugars

Glycogen concentration in cells with overexpressed GlgC

Absorbance at 540 nm

- Glucose
- Fructose

(Mass/Volume)
Aim #3: Kill Switch Mechanism

Cell density in cells expressing SacB

<table>
<thead>
<tr>
<th>Fructose</th>
<th>Control</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>1%</td>
<td>5%</td>
<td>10%</td>
<td></td>
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</tbody>
</table>

Absorbance at 600 nm

(Mass/Volume)
Into the Body: Modeling

**Non-Diabetic - [Plasma Glucose]**
- w/o Device
- w/ Device
- w/ Device (high dose)

**Diabetic - [Plasma Glucose]**
- w/o Device
- w/ Device
- w/ Device (high dose)
Safe Bacteria: Policy and Practices

The Human Body and Diabetes

What is Diabetes?

Diabetes is a metabolic disorder in which blood glucose levels remain high over a prolonged period of time. This is caused by the decreased production of insulin by the pancreas or the body’s inability to respond to insulin, which is necessary for the body to use glucose for energy. Over time, the body’s cells are unable to access glucose, leading to high blood sugar levels and complications.

The Diabetes Diet

Guidelines:

1. Choose a diet that is low in fat, sugar, and salt. This can help control blood sugar levels.
2. Eat plenty of fruits and vegetables. These are high in fiber and low in calories.
3. Limit your intake of processed foods and sugars. This can help control blood sugar levels.

Making Smart Food Choices

1. Choose whole grains over refined grains. Whole grains are higher in fiber and provide a slower release of sugar into the bloodstream.
2. Choose lean protein sources like chicken, turkey, and fish. These are lower in fat and provide a slow release of sugar into the bloodstream.

Diabetes Superfoods

The following foods are excellent sources of fiber and can help control blood sugar levels:

- Avocados: high in fiber and healthy fats
- Chia seeds: high in fiber and omega-3 fatty acids
- Spinach: high in fiber and antioxidants
- Oranges: high in fiber and vitamin C

Diabetes and the Human Digestive System

The digestive system is comprised of a series of organs working together to convert food into nutrients that the body can use. One such organ is the pancreas, which produces insulin to help regulate blood sugar levels. When the pancreas is unable to produce enough insulin, or when the body’s cells are unable to respond to insulin, diabetes can result.

Diabetes at the University of Virginia 2015 Human Practices

20 views
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