Experimental Design and System

Inulin is known to slow down food intake by stimulating the release of fructose during digestion. Inulin-modified polydextrose has been shown to improve the ability of the gut microbiota to produce short-chain fatty acids, which can help reduce body weight and improve metabolic health.

Model organism

Lactobacillus was chosen as the organism for the project since it is commonly used probiotics in fermented foods and is a natural part of the gut microbiota. However, all our experimental work was done in vitro.

FFT (fructan/fructooligosaccharides) contains the monomeric fructose unit until the fructan, integrating shorter chains of fructose.

Inulin is shown to have beneficial effects onzzzke food intake and improving metabolic disorders. It is also used as a prebiotic in infant foods and probiotics.

SST (succinate-producing bacteria) contains the saccharolytic enzyme which can convert fructose into fructose-1-phosphate.

Characterisation

The use of our modeling was to simulate the behavior of our bacteria as we could convert it into inulin using our construct.

Due to lack of measuring tool, we had to simulate in silico with several assumptions while constructing the model. However, the dynamic behavior and transitions should be valid.

Here we show the dynamic relationship between sucrose consumption and inulin production. If we had more time we could attempt fitting to enzyme kinetics. We hope to run more experiments in order to find a better prediction.

The bottom line of the model works as an inulin generator.

Approach

Because our project has the opportunity to end up as a product on the consumer market there are a lot of aspects to be considered on this point. We decided to approach the project from two different angles: from a scientific point of view where we made hypotheses on the literature and from a marketing perspective.

However introducing a bacteria into the human gut causes some interesting ethical and legal implications. Because of this we decided to do an in-depth research from the ethical aspects and to the regional and international laws on GMOs.

To raise awareness among GMO and EGM in general we decided to make a lot of human outreach work, this included a video cooperation with other universities, working together with Aarhus University in raising public awareness and making students at the universities see seminars.

Conclusion

We wanted to make a system that can microsense sugar from our diet. We called this 'GEM'. We successfully isolated bacteria from the two inulin producing genes from Lactobacillus and cloned them into pE01. Characterization experiments on our bacterial cultures indicated the production of fructose. In parallel with our work we made gene effects within human outreach, all EGM tours SDU Denmark were highly successful.

The human outreach dimension of our project, which among others included a short documentary about the ethics of producing and using GMOs, emphasized the complex nature of developing and promoting genetically modified organisms.

In conclusion we have developed a second exciting genetically modified bacteria that has the potential to help in the fight against obesity.