Diet and fat: How can we live a healthy life?

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What is the problem?

Obesity is a major health problem in our society and recent statistics suggest that Scotland's obesity rate is only second to that of the United States.

One major problem of being overweight or obese is that it is a number one risk factor for development of other serious health conditions such as diabetes, high blood pressure, heart failure and even cancer.

While we all know that eating less and exercising more is the best way to stay lean and fit, there are many reasons why people, even after months or years of dieting, gain the weight back. Very often they weigh more than before they starting dieting in the first place.

In our laboratory, we have been studying why and how diets rich in fat (high-fat diets) lead to the development of obesity and how these impact on important hormones, and particularly on insulin and leptin.

What are we interested in?

Insulin is a hormone produced by our pancreas in response to glucose (food consumption). It helps dispose of glucose and get stored as glycogen, which we need when we exercise. In obesity, due to constantly high glucose and insulin levels (secreted to help maintain high glucose), a state of "insulin resistance" develops. Therefore, insulin can no longer work and diabetes develops.

Leptin is a so-called "satiety" hormone and is produced in our fat tissue. After we have eaten (it takes at least 10 minutes), it gets secreted and travels up to the brain to tell the body to stop eating. This is why we are always told to "eat slowly", as it takes time for leptin to do its job! In obese people, due to too much fat tissue, there is a lot of leptin production. Rather than being able to do its job and tell the brain that we've had enough and to stop eating, another state of "leptin resistance" develops. Thus this important signal is taken away.

What are we doing to try and solve the problem?

Our lab is trying to improve both insulin sensitivity and leptin sensitivity. To do this, we have to understand how cells speak to each other and how they send signals up and down the body. One molecule that we work on that does this excellent job is called PTP1B.

When this molecule is blocked (inhibited), a high-fat diet cannot increase body weight and diabetes cannot develop. The aim of this project was to understand how exactly this may happen.

What did we find?

We established first that the enzyme called PTP1B was either present or absent in fat tissue by performing a molecular biology technique, called PCR (polymerase chain reaction). This allowed us to obtain DNA and examine the genes in it.

After we established whether PTP1B was present or absent in the fat tissue, we processed the fat tissue biochemically, using a technique called Western blotting. We then added leptin to the fat, expecting that, if leptin can do its job properly, the signal (the black band) would increase in intensity. Indeed, in the tissue where we had no PTP1B in fat, we obtained a much better signal. This meant that this fat was "leptin sensitive" (good!).

Figure 1: Results of the PCR on DNA isolated from fat tissue, demonstrating the existence or not of the enzyme PTP1B.

Figure 2: Results of the western blotting, demonstrating that absence of PTP1B in fat tissue leads to leptin increasing the signal in the fat tissue and therefore subsequently being able to signal up to the brain.

What does it mean?

PTP1B inhibitors are drugs which are currently being tested as possible anti-diabetic therapy and our study has contributed towards the hypothesis that inhibiting this enzyme would be beneficial for health.

Who am I?

I am in my final year of a Biomedical Sciences degree at the University of Aberdeen. I undertook my Vacation Scholarship in the summer of 2013. This allowed me to explore the fascinating and exciting field of medical research, gave me experience of using biomolecular techniques used in a wide range of disciplines and greater awareness of the effect research can have on our understanding and awareness of diseases. I am hoping to pursue a career in clinical research.

Armin was supervised for his Vacation Research Scholarship project, *"Understanding the link between inflammation and type 2 diabetes"*, by Dr Mirela Delibegovic.