

Antioxidants like vitamins C and E help counteract insulin resistance caused by excess glucocorticoids

What is this research about?

Glucocorticoids are a group of important steroid hormones naturally produced by the human body, which are involved in the breakdown of glucose (sugar molecules) for energy. Too low or too high blood glucose can cause serious health problems. Insulin is another hormone involved in maintaining blood glucose levels. When cells become “insulin resistant”, they no longer respond to signals telling them to take in glucose, which can cause glucose levels in the blood to increase dangerously. High levels of glucocorticoids, as seen in Cushing’s disease, are associated with insulin resistance and problems with blood glucose levels. Some research has suggested that this insulin resistance might be a result of the glucocorticoids causing oxidative stress in the body, which involves free radicals damaging proteins and other important molecules. Since antioxidants, such as vitamins E and C, can attack free radicals, some scientists think that antioxidants may be able to counteract the effects of glucocorticoids on insulin resistance and the maintenance of blood glucose levels.

What did the researchers do?

Three groups of adult rats were fed the same standard diet for a two week period. One group received injections of dexamethasone (DEX), a synthetic glucocorticoid, for the last five of the fourteen days. A second group received the DEX injections and extra vitamin C and E in their food. After the two weeks, the rats were tested to see how well their body could handle a spike in blood glucose. After a second two-week period of controlled diet and DEX injections, the rats were injected with glucose, after which fat, muscle, and liver tissue samples were taken. For each of these samples, the levels of glucose, insulin, and markers of oxidative stress were measured.

What you need to know:

A diet enriched in the antioxidants vitamins C and E partially counteracted the negative effects of glucocorticoid on glucose tolerance, likely through improvements in fatty acid oxidation. This may mean that a diet rich in these vitamins can be part of an effective approach to treat patients with Cushing’s disease.

What did the researchers find?

Rats injected with DEX, regardless of vitamin supplementation, weighed less and ate less food than the control group of rats. In rats injected with DEX, vitamin supplementation improved fasting glucose levels and glucose intolerance, but not insulin levels or insulin signalling. Markers of oxidative stress were increased in rats injected with DEX, regardless of vitamin supplementation. Although markers of fatty acid oxidation were increased in DEX-injected rats, this effect was diminished in rats receiving extra vitamins C and E.

How can you use this research?

Physicians can use this research to better understand how antioxidants may help to counteract the insulin resistance associated with elevated glucocorticoid levels and Cushing's disease.

Physiologists can further this research by studying how antioxidants are able to counteract insulin resistance and improve glucose tolerance without affecting insulin signalling.

Keywords:

Blood glucose, insulin resistance, glucocorticoids, cortisol, antioxidants, vitamin C, vitamin E

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