



The UK Superfund Research Center supports biomedical and environmental science research to improve health by preventing exposures to environmental pollutants and promoting healthful lifestyles.

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Polychlorinated Biphenyls, Nutrition, and Diabetes

Diabetes affects 285 million people worldwide, and is increasing hand-in-hand with the growing epidemic of obesity. Evidence suggests that environmental toxins, specifically polychlorinated biphenyls (PCBs), link harmful factors in the environment to the development of type 2 diabetes (T2D). PCBs are a class of environmental toxins that are highly lipophilic, which makes them concentrate to tissues high in fat content. Thus, obese subjects have increased levels of PCBs stored in their fat tissue. We have found that PCBs of a specific class impair the ability of insulin to promote glucose uptake by fat cells, resulting in insulin resistance. Insulin resistance is a hallmark of T2D, and causes blood glucose levels to rise which is harmful to various cell types throughout the body. This effect of PCBs is especially problematic as these toxins are stored in a tissue (fat) that expands with obesity and is heavily implicated in insulin resistance and the development of T2D. We have also found that when obese mice exposed to PCBs were made to lose weight, the beneficial effects of weight loss to improve T2D were blunted. Our results suggest that upon liberation of fat lipids with weight loss, PCBs are also released and can negatively influence fat cell function. This is significant, as 65% of the overweight population strives to lose weight, and liberated PCBs may be a mechanism impairing the benefits of weight loss. We also found that a natural polyphenol, resveratrol, can abolish the harmful effects of PCBs to impair glucose handling by fat cells.

Our results are of direct relevance to human health, where harmful toxins in our environment may contribute not only to the development of T2D, but also by blunting beneficial effects of weight loss as a lifestyle approach to improve diabetes. Also, ingesting bioactive nutrients during weight loss may help limit the harmful effects of PCBs and improve weight loss benefits.



Take Home Message:

Many environmental pollutants are stored in fat, and large amounts may be released during rapid weight loss. Eating diets high in antioxidant and anti-inflammatory bioactive nutrients may buffer the body against toxic insult during this susceptible time.