

Meltdown

Fats can be used as fuel

When we burn fat, we must first convert it from stored fat sitting in our adipose tissues into a form that can be respired. How do we do that? In adipocytes, the fat is stored as chemically unreactive triglycerides, each composed of three fatty acid chains bonded to a glycerol molecule (see [‘Storing fat’](#) for how they form).

The first step is the hydrolysis (breaking) of the bonds between the fatty acids and glycerol, which is carried out by hydrolytic enzymes called lipases. The free glycerol and fatty acid molecules are then transported to other tissues and incorporated into the process of cellular respiration. Glycerol is converted to triose phosphate and enters the glycolysis pathway. Fatty acids undergo beta-oxidation and are split by enzymes into (2-carbon) acetyl CoA molecules, which enter the Krebs cycle.

At this point lipids, like sugars, become fuel for aerobic respiration in the mitochondria. Respiring a gram of fat releases more energy than a gram of carbohydrate. This is because fatty acids are oxidised completely. The hydrogen ions are picked up by NAD and FAD and fed into the electron transport chain.

While respiring fat releases a lot of energy (see our [‘Fat by numbers’ infographic](#)), it also produces chemicals called ketones, which can be dangerous at high levels. This can happen in people with diabetes who are short of insulin. A lack of insulin means that they can’t get enough sugar into their cells, so they break down fat instead. The build-up of ketones can lead to vomiting, hyperventilation and one rather strange symptom: breath that smells like pear drops. People suffering from starvation or on low-carb diets may also taste pear drops, because ketones are sweet-smelling, sweet-tasting molecules.

REFERENCES

- [‘The Molecular Biology of the Cell’ by B Alberts et al.](#)
- [Triacylglycerol lipase family](#)

[continued]

ABOUT THIS RESOURCE

This resource first appeared in ‘Fat’ in December 2015. Published by the Wellcome Trust, a charity registered in England and Wales, no. 210183.

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- [University of Maryland Medical Center: Lipase](#)
- [Lipolysis – a highly regulated multi-enzyme complex mediates the catabolism of cellular fat stores \(2011\)](#)
- [Diabetes.co.uk: Diabetic ketoacidosis \(DKA\)](#)
- [BBC: What's going on inside David Blaine's body?](#)

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