

Diets for disease

Can what you eat improve the symptoms of a disease? Sophie Tunstall-Behrens investigates

Fats are integral to the normal structure and functioning of our cells and tissues, but can specific fat-based diets have any effect on particular diseases or conditions?

ALD and Lorenzo's oil

Adrenoleukodystrophy (ALD) is an X-linked genetic disease caused by mutations in the ABCD1 gene. When ABCD1 is mutated, the degradation of very-long-chain fatty acids (VLCFAs) is impaired. This causes an abnormal accumulation of these fatty acids throughout the body. In the central nervous system, ALD causes an abnormal immune response that leads to the gradual stripping away of the protective myelin sheath surrounding neurons. The myelin sheath is essential for the conduction of action potentials. ALD, therefore, is characterised by the progressive deterioration of brain signalling and function.

A mixture of oils known as 'Lorenzo's oil', in combination with a diet low in VLCFAs, was first proposed as a dietary treatment for ALD in 1984. The oil contains two specific long-chain fatty acids, isolated from rapeseed oil and olive oil, that competitively inhibit the enzyme that forms VLCFAs in the body. Results from clinical trials testing the benefit of Lorenzo's oil for patients, however, have been mixed. Positive effects on disease progression have been seen only in the early stages of ALD.

There are still several questions to be answered: what is the biological mechanism leading from the build-up of VLCFAs to demyelination? Why have different clinical trials of Lorenzo's oil produced contrasting results?

Mental health and fats

Over time, Western diets have become heavily dominated by processed meat, high-fat dairy products, refined carbohydrates and processed fats. In contrast, we eat relatively little oily fish. As a consequence, our diets have excessive amounts of omega-6 polyunsaturated fatty acids (PUFAs) – found in red meat, chicken and egg yolks – but are relatively deficient in omega-3 PUFAs, which are found in marine fish oil and eggs. (continued)

ABOUT THIS RESOURCE

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Omega-3 and omega-6 PUFAs are components of the brain phospholipids, which give fluidity to the cell membranes in the brain and facilitate the transfer of substances in and out of the cell. Both types of PUFA, in the right balance, are critical for the structure and function of the brain and for good physical and mental health.

People with attention deficit hyperactivity disorder (ADHD) or depression have been found to have low levels of omega-3 PUFAs in their brains. The lack of omega-3 has not been proven to be responsible for the symptoms, but oily fish and other sources of omega-3 PUFAs have been proposed to be protective against these conditions.

For example, a study that involved increasing omega-3 and reducing omega-6 consumption reported improvements in the learning capacity and behaviour of young people with ADHD who were academically underachieving. Another study, however, found no benefit of omega-3 PUFA supplementation in people with the same symptoms. Similarly conflicting findings have been produced by studies investigating depression and age-related cognitive decline.

These mixed results and a lack of understanding about how diet might affect mental health show that more research in this area is needed.

REFERENCES

- [Wikipedia: Lorenzo's oil](#)
- [X-linked adrenoleukodystrophy: pathogenesis and treatment \(2014\)](#)
- [The cell: a molecular approach \(2000\)](#)
- [The genetic landscape of X-linked adrenoleukodystrophy \(2015\)](#)
- [Folate and long-chain polyunsaturated fatty acids in psychiatric disease \(2006\)](#)
- [Omega-3 fatty acids and depression \(2014\)](#)
- [Omega-3 fatty acid and nutrient deficits in adverse neurodevelopment and childhood behaviors \(2014\)](#)
- [Docosahexaenoic acid: an ancient nutrient for the modern human brain \(2011\)](#)
- [Nutritional modulation of cognitive function and mental health \(2013\)](#)
- [Polyunsaturated fatty acids for ADHD \(2012\)](#)
- [Bad Science blog: Omega-3 fish oil pills](#)

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QUESTIONS FOR DISCUSSION

- Interestingly, Lorenzo's oil has not been found to improve any other disorders involving demyelination – why might this be?
- Read the blog post about how one newspaper reported one trial of omega-3 supplements (the bottom reference above). Can you identify three ways in which the blog's author thinks the newspaper story represented the study inaccurately?

FURTHER READING

- [Myelin Project: Lorenzo's oil](#)
- [Stop ALD Foundation: What is ALD?](#)
- [Fats of Life: Health effects of polyunsaturated fatty acids](#)

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