

Lake brownification and eutrophication decrease the content of essential fatty acids in fish used in human diets

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Eutrophication and brownification change phytoplankton community structure and decrease the production of essential omega-3 fatty acids in lakes. Perch growing in oligotrophic clear-water lakes contain 1.5-1.9 times more essential omega-3 fatty acids than those grown in eutrophic and brown-water lakes.

Fish are known to be high-quality food for humans because of their high content of [polyunsaturated fatty acids](#), which are essential for human health. The most important and best known polyunsaturated omega-3 fatty acids are EPA and DHA. However, fish are dependent on algae producing the essential omega-3 fatty acids, which are then transferred in the food chain via zooplankton to fish. All algal groups are not capable to synthesise EPA and DHA. Cryptophytes, diatoms, chrysophytes and dinophytes are the most important algal groups producing these essential fatty acids. These algal groups predominate in phytoplankton communities of oligotrophic clear-water lakes.

Eutrophication is mainly due to increasing phosphorus concentration in lakes. Brownification is caused by increased leaching of terrestrial humic matter to aquatic ecosystems. Both these phenomena change lake phytoplankton community composition, and the proportion of EPA and DHA producing algae tends to decline. Especially blue-green and green algae, poor in [omega-3 fatty acids](#), benefit from [eutrophication](#).

A group of scientists from three universities in Finland (University of Eastern Finland, Jyväskylä and Helsinki) and the Finnish Environment Institute (SYKE) found that the EPA and DHA content of phytoplankton decreased along with eutrophication and brownification of lakes.

Accordingly, the EPA and DHA content decreased in the muscle of large piscivorous perch. This is the first time the fatty acid content of phytoplankton is shown to impact the food chain up to predatory fish.

The study was mainly carried out a research consortium of the AKVA programme funded by the Academy of Finland. For research material, 40 different algal taxa were cultured in laboratory and information on their fatty acid content was combined with [phytoplankton community](#) data from more than 700 lakes in Finland, collected by the Finnish Environment Institute. Perch were collected from 14 lakes with different phosphorus concentration and water colour.

Eutrophication is still a great problem in many lakes in Finland. During the last decades, the brownification of lakes has been detected in the whole northern hemisphere. In eutrophic and brown-water lakes, the EPA and DHA content of large perch was 1.5-1.9 times lower than in those from oligotrophic clear-water lakes. Thus, eutrophication and brownification significantly worsen the quality of perch used in human diets.

The results were published in *Environment International*.

More information: S.J. Taipale et al. Lake eutrophication and brownification downgrade availability and transfer of essential fatty acids for human consumption, *Environment International* (2016). [DOI: 10.1016/j.envint.2016.08.018](https://doi.org/10.1016/j.envint.2016.08.018)

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