Metabolic-Associated Steatotic Liver Disease: the role of therapeutic carbohydrate restriction

'The LCHF and 5:2 diets were more effective in reducing steatosis and body weight in patients with NAFLD than [Standard of Care], suggesting dietary advice can be tailored to meet individual preferences.' Holmer et al. (2021)

Nutrition Network

Compiled by

Sarah Rice BSc.(Hons), MCOptom (UK), MHP, NNP

Introduction

Metabolic dysfunction-associated steatotic liver disease (MASLD) is a common (globally affecting ~ 30%) chronic liver disease that is strongly associated with metabolic dysfunction, often occurring with metabolic syndrome, obesity, and type 2 diabetes (Pi et al., 2025). Formerly known as non-alcoholic fatty liver disease (NAFLD), MASLD more accurately captures the core attribute of metabolic dysfunction with the accumulation of fat in the liver (not associated with alcohol consumption). Metabolic dysfunction and visceral adiposity are key features where therapeutic carbohydrate restriction has an established efficacy, with added benefits of nutritional ketosis that may include increased fat oxidation (reduction in liver fat) and improvements in inflammation and oxidative stress. Some studies suggest improvements in fibrosis, but data are limited.

Recent studies

1. Pi, S. et al. (2025) 'Low-carbohydrate diets reduce cardiovascular risk factor levels in patients with metabolic dysfunction-associated steatotic liver disease: a systematic review and meta-analysis of randomized controlled trials', Frontiers in Nutrition, 12. Available at: https://doi.org/10.3389/fnut.2025.1626352.
2. Venkatasubramanian, H. and Chinnathambipalayam Kandaswamy, V. (2025) 'Rapid Hepatic Function Improvement with Culturally Adapted Low-Carbohydrate Paleolithic Diet in South Asian Adults with Metabolic Dysfunction: A 12-Week Prospective Study with Predictive Modeling', *Journal of Clinical Medicine of Kazakhstan*, 22(6), pp. 73–79. Available at: https://doi.org/10.23950/jcmk/17414.
3. Gower, B.A. *et al.* (2025) 'Beneficial Effects of Carbohydrate Restriction in Type 2 Diabetes Can Be Traced to Changes in Hepatic Metabolism', *The*

Journal of Clinical Endocrinology and Metabolism, p. dgaf324. Available at: https://doi.org/10.1210/clinem/dgaf324.

Other studies

These studies build on earlier studies showing the benefits of carbohydrate reduction for fatty livers. In particular, a small study from 2020, Luukkonen et al., demonstrated a remarkable reduction in fatty liver over just 6 days using a ketogenic diet. Other studies show successful implementation of low-carbohydrate approaches in primary care.

1. Vilar-Gomez, E. *et al.* (2019) 'Post hoc analyses of surrogate markers of non-alcoholic fatty liver disease (NAFLD) and liver fibrosis in patients with type 2 diabetes in a digitally supported continuous care intervention: an open-label, non-randomised controlled study', *BMJ open*, 9(2), p. e023597. Available at: https://doi.org/10.1136/bmjopen-2018-023597.
2. Unwin, D. *et al.* (2015) 'A pilot study to explore the role of a low-carbohydrate intervention to improve GGT levels and HbA 1 c', *Diabetes and endocrinology*. Available at: https://doi.org/10.1136/bmjopen-2018-023597.

Adolescents and children

MAFLD is increasing in children and adolescents with overweight and/or obesity, with a global prevalence of 41.2%. Low free-sugar diets and carbohydrate-restricted diets have shown benefit in this population, even without intentional calorie restriction.

1. Goss, A.M. *et al.* (2020) 'Effects of a carbohydrate-restricted diet on hepatic lipid content in adolescents with non-alcoholic fatty liver disease: A pilot, randomized trial', *Pediatric Obesity*, p. e12630. Available at: https://doi.org/10.1111/ijpo.12630.

The role of fructose and sugar-sweetened beverages

The consumption of carbohydrates and insulin resistance contribute to fatty liver via gluconeogenesis and increased de novo lipogenesis. In particular, a high fructose intake promotes excessive liver fat accumulation as it stimulates lipogenesis independently of insulin, rapidly producing substrates for triglyceride synthesis. Sugar-sweetened beverages are associated with MASLD in a dose-dependent manner where high-fructose corn syrup is implicated. Fructose restriction in children has demonstrated improved metabolic parameters.

Individual responses to dietary composition can vary, so appropriate medical monitoring is advised. Patients who are taking medication should consult with their doctor, as the following guidelines (Society of Metabolic Health Practitioners) may need to be considered.