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Effect of Alpha-Lipoic Acid on Non-Alcoholic Fatty Liver Disease: A Systematic Review of In Vitro and In Vivo Studies

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ABSTRACT

Introduction: Nonalcoholic fatty liver disease (NAFLD) may lead to a progressive liver disease with the risks for fibrosis and carcinoma. As a natural antioxidant, Alpha-lipoic Acid (ALA) may increase total antioxidant capacity and mitochondrial biogenesis, influencing liver function and possibly NAFLD. This study aimed to systematically review the effects and potential mechanistic pathways of ALA in NAFLD.

Search Strategy: This systematic review was carried out based on the guidelines of the 2010 PRISMA statement. Electronic databases, including PubMed, Web of Science, and Scopus, were searched until June 2024. Original studies published in English-language journals that investigated the effects of ALA on NAFLD were considered. Key search terms were thioctic Acid, alpha-lipoic acid, lipoic Acid, and α-lipoic Acid in combination with liver function tests, liver fat, hepatic steatosis, liver steatosis, liver steatoses, NASH, NAFLD, steatohepatitis, nonalcoholic fatty liver disease, and fatty liver. Two reviewers independently extracted data on study characteristics, methods, and outcomes.

Results: A total of 1297 articles were found in the first phase of the search; from these, 30 met the inclusion criteria: 3 in vitro, 21 animal, and six human studies. All three in vitro studies demonstrated the lowering effects of ALA on fat accumulation in the liver. 18 of 21 animal studies indicated a significant decrease in hepatic steatosis mainly by affecting the hepatic genes such as FOXO1, SREBP1, PPARs α or γ, and FASN, which are involved in the lipolysis and β-oxidation of lipids. However, two animal studies showed a significant increase in hepatic lipids and serum levels of alanine transaminase (ALT) and aspartate transaminase (AST). Half of the clinical trials also detected a significant decrease in hepatic steatosis.

Conclusion and Discussion: The studies showed that ALA might improve body weight, insulin resistance, inflammatory status, oxidative stress, and hepatocellular lipolysis and subsequently relieve NAFLD. Although the experimental evidence supports the positive effects of ALA on hepatic steatosis, further clinical trials focusing on the effects of ALA on fatty liver are warranted.

Keywords: Lipolysis, Non-alcoholic fatty liver disease, Systematic review

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