Effects of LC *n*-3 PUFA Supplementation on Muscle Pain, Function, and Damage Markers in Healthy Young to Middle-Aged Adults Following Acute or Chronic Exercise: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Abstract: Supplementation with long-chain omega-3 polyunsaturated fatty acids (LC n-3 PUFAs), particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), may reduce exercise-induced muscle damage (EIMD) and enhance post-exercise recovery. However, existing systematic reviews and meta-analyses are limited and do not provide clear dosing recommendations. This systematic review and meta-analysis evaluated the effects of LC n-3 PUFA supplementation on post-exercise recovery outcomes, including muscle soreness, muscle function, and muscle damage biomarkers in healthy adults.

Following PRISMA guidelines, PubMed, Scopus, and clinical trial registries were searched up to January 2025. Eligible studies underwent methodological quality assessment using established tools. Data were analysed using random-effects models, with effect sizes reported as Hedges' g and 95% confidence intervals (CIs). Heterogeneity was assessed using the I^2 statistic.

Of 2539 records identified, 43 studies met the inclusion criteria for the systematic review, and nine were included in the meta-analysis. Overall findings were equivocal, with notable methodological limitations across the literature. However, meta-analysis of nine placebo-controlled eccentric exercise trials showed that LC n-3 PUFA supplementation significantly reduced delayed onset muscle soreness (DOMS) (Hedges' g = -0.75; 95% CI: -1.14 to -0.36), creatine kinase (CK) (Hedges' g = -0.40; 95% CI: -0.70 to -0.10), and muscle swelling (Hedges' g = -0.45; 95% CI: -0.83 to -0.07). Supplementation also significantly improved muscle strength (Hedges' g = 0.45; 95% CI: 0.07 to 0.83) and range of motion (ROM) (Hedges' g = 0.93; 95% CI: 0.33 to 1.53) at peak impairment compared with placebo.

LC n-3 PUFA supplementation may support recovery from EIMD, but methodological limitations prevented effective dosing recommendations. Future studies should investigate dose–response relationships, supplementation duration, omega-3 status biomarkers, and standardized compliance measures.

Keywords: long-chain omega-3 polyunsaturated fatty acids; eicosapentaenoic acid; docosahexaenoic acid; exercise-induced muscle damage; recovery; muscle soreness.

Biography: Elham Yaghoobi is a PhD candidate at the Institute for Physical Activity and Nutrition, Deakin University. Her research focuses on nutritional strategies to enhance recovery from exercise and optimise human health and performance, with particular emphasis on the role of long chain n-3 polyunsaturated fatty acids in muscle recovery following muscle-damaging exercise in healthy adults. She has contributed to nine publications in the field of clinical nutrition. Through her doctoral work, she has developed a strong interest in the physiological mechanisms underlying exercise-induced muscle damage and recovery, and the potential for targeted nutritional interventions to improve outcomes in healthy and clinical populations. Alongside her PhD, she works as a sessional academic at Deakin University, supporting teaching and student learning activities. A key highlight of her research to date was presenting the first stage of her PhD at the International Sport + Exercise Nutrition Conference in Manchester in 2025.

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