

Low dose fish oil increases the omega-3 index improving cycling efficiency and heart rate recovery

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Abstract

Background: Dietary fish oil provides long chain omega-3 polyunsaturated fatty acids (LC n-3 PUFA) eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). The heart (Charnock et al., 1986: Annals of Nutrition and Metabolism, 30, 393-406) and skeletal muscle (Peoples & McLennan, 2010: British Journal of Nutrition, 104(12), 1771-1779) preferentially incorporate DHA and modulates both myocardial (Pepe & McLennan, 2002: Circulation, 105, 2303-2308) and skeletal muscle oxygen consumption translated as improved muscle fatigue resistance (Peoples & McLennan, 2014: British Journal of Nutrition, 111, 996-1004). However, studies of well-trained endurance athletes have used excessive doses of DHA (Peoples et al., 2008: Journal of Cardiovascular Pharmacology, 52, 540-547; Buckley et al., 2009: Journal of Science and Medicine in Sport, 12(4), 503-507). Given that even a very low fish oil supplement maximises membrane incorporation of DHA (Slee et al., 2010: Journal of Lipid Research, 51, 1841-1847) there is strong physiological basis for cyclists to improve oxygen efficiency through a nutritional approach.

Purpose: The current study primarily aimed to establish if provision of a low dose of dietary fish oil in cyclists could convey improved oxygen efficiency in heart and skeletal muscle under conditions of established cycling fatigue and acute recovery.

Methods: Using a double-blind design, trained males (N=26) were supplemented with (2x1g.d-1) soy oil (control n=13) or tuna fish oil (FO n=13) providing LCn-3PUFA, DHA: 560mg and EPA: 140mg (Nu-Mega, Australia) for 8 weeks. Erythrocyte omega-3 index (% EPA+DHA) was measured at baseline at following supplementation. At both time points participants underwent a repeated Wingate cycling protocol (6x30sec / 150seconds recovery) to establish cycling fatigue, immediately followed by a 5min cycling time trial (Wattbike, UK). Upon completion, participants were placed in a supine recovery position for 10mins. Oxygen consumption (O₂), heart rate (HR) and power (W) were continuously monitored.

Results: Erythrocyte omega-3 index at baseline (Control: 4.2±0.2; FO: 4.7±0.2%) was not different between groups. After 8weeks the omega-3 index was unchanged in control (3.9±0.2%) but increased in FO group (6.3±0.3%, P<0.01). There was no effect of FO supplementation on; peak HR (Control: 174±1 FO: 176±1beats.min⁻¹), mean power during Wingate cycling fatigue protocol (Control: 545±28; FO: 511±33W), or cycling time trial performance under established fatigue (Control: 267±19; FO: 253±16W). However, FO supplementation improved oxygen efficiency (delta change) during the cycling time trial (Control: -23±26; FO: -154±59ml O₂/min/100W P<0.05) and accelerated HR recovery (logit half-time) in the supine position immediately afterwards (Control: -0.4±1.2s; FO: -8.0±1.7s, P<0.05). The later was independent of a change in parasympathetic tone and reflective of reduced myocardial oxygen consumption.

Discussion: A low dose fish oil supplement providing DHA increased the omega-3 index in trained cyclists. The improved cycling efficiency is reflective of the oxygen modulation previously demonstrated in rodent skeletal muscle (Peoples & McLennan, 2014), while the faster heart rate recovery without alteration in autonomic tone is supportive of the a reduction in intrinsic beat rate of the SA node following DHA administration (Verkerk, et al., 2009: Heart Rhythm, 6(10), 1485-1492).

Conclusion: Provision of LCn-3 PUFA, DHA, in the form of a low dose fish oil supplement can have profound effects on heart and skeletal muscle incorporation, and as consequence improve cycling efficiency and heart rate recovery, indicative of reduced heart load. As a consequence, the concentrations used in the current study can be modeled for nutritional recommendations of DHA in elite cyclists.

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