Omega-3 polyunsaturated fatty acid-induced vasodilation in mouse aorta and mesenteric arteries is not mediated by ATP-sensitive potassium channels

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Abstract

There is strong evidence that the omega-3 polyunsaturated fatty acids (n-3 PUFAs) docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) have cardioprotective effects. n-3 PUFAs cause vasodilation in hypertensive patients, in part controlled by increased membrane conductance to potassium. As KATP play a major role in vascular tone regulation and are involved in hypertension, we aimed to verify whether n-3 PUFA-mediated vasodilation involved the opening of KATP channels. We used a murine model in which the KATP channel subunit, Kir6.1, is deleted in vascular smooth muscle. The vasomotor response of preconstricted arteries to physiologically relevant concentrations of DHA and EPA was measured using wire myography, using the channel blocker PNU-37883A. The effect of n-3 PUFAs on potassium currents in wild-type native smooth muscle cells was investigated using whole-cell patch clamping. DHA and EPA induced vasodilation in mouse aorta and mesenteric arteries; relaxations in the aorta were sensitive to KATP blockade with PNU-37883A. Endothelium removal didn't affect relaxation to EPA and caused a small but significant inhibition of relaxation to DHA. In the knock-out model, relaxations to DHA and EPA were unaffected by channel knockdown but were still inhibited by PNU-37883A, indicating that the action of PNU-37883A on relaxation may not reflect inhibition of KATP. In native aortic smooth muscle cells DHA failed to activate KATP currents. We conclude that DHA and EPA cause vasodilation in mouse aorta and mesenteric arteries. Relaxations in blocker-treated arteries from knock-out mice demonstrate that KATP channels are not involved in the n-3 PUFA-induced relaxation.

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