

DIETITIANS' NEWS

Alpha-Linolenic Acid Affects Cardiac Rhythm by Inhibiting the Sodium–Calcium Exchanger

By Diane H. Morris

A study conducted by Bradley Ander and his colleagues at the Canadian Centre for Agri-Food Research in Health and Medicine in Winnipeg, Manitoba, found that alpha-linolenic acid (ALA) demonstrated a potential role in maintaining the heart's natural rhythm by inhibiting the sodium (Na^+)–calcium (Ca^{2+}) exchanger (NCX).¹ Furthermore, the researchers observed that in HEK293 cells ALA was not converted to its long-chain metabolites eicosapentaenoic acid (EPA) or docosahexaenoic acid (DHA), suggesting that ALA takes an active role in cardiac function and does not need to be elongated to EPA or DHA to produce an important biologic effect.

The NCX is a membrane protein that moves sodium and calcium ions into and out of cells. In heart cells (cardiomyocytes), the NCX maintains calcium homeostasis by controlling the movement of calcium across the cell membrane. The movement of calcium out of heart cells (called "forward mode") contributes to relaxation during each heart beat; its movement into heart cells (called "reverse mode") results in contraction.² The NCX appears to play an important role in cardiac pacemaking³ and in the pathology of hypertension and heart failure.⁴

The researchers were interested in knowing whether ALA affected two isoforms of NCX. Isoform NCX1.1 is found in heart cells. The vascular NCX1.3 isoform is found in smooth muscle and kidneys. The researchers studied NCX isoforms that were inserted into HEK293 cells and also NCX1.1 and NCX1.3 activity in rat heart cells and rabbit aortic smooth muscle cells.

In HEK293 cells, ALA inhibited both forward and reverse mode NCX activity, with the vascular/kidney NCX1.3 isoform being roughly six times more sensitive to ALA than the heart NCX1.1 isoform. ALA also inhibited reverse mode sodium–calcium exchange in rat heart cells. Compared with other fatty acids, both ALA and EPA inhibited forward and reverse modes of NCX1.1 activity in heart cells, whereas oleic acid and linoleic acid had no effect. However, for the vascular isoform of NCX1.3, ALA, EPA, oleic acid and linoleic acid all inhibited forward and reverse modes of the sodium–calcium exchanger.

Because NCX inhibitors may restore cardiac function, they may be useful in treating arrhythmia and heart failure.¹ In this study ALA, which is found abundantly in flax, inhibited the sodium–calcium exchanger, thus underscoring its potential role in maintaining the heart's natural rhythm.

References

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