Study of Magnesium Based Migraine Therapeutics

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Migraines are one of the most common causes of headaches and their prevalence has been increasing immensely over the last few years due to increased technology use and the ongoing pandemic. During a migraine, headaches can be accompanied by nausea, vomiting, and increased nociceptive sensitivity to light and sound. Magnesium deficiency is seen in almost half of the patients presenting with migraines. Currently, magnesium-based therapeutics such as magnesium citrate, magnesium oxide, and magnesium sulfate is used to relieve migraines; however, they have several disadvantages, including low bioavailability, low absorption rate, and poor targeted drug delivery, resulting in several side effects. In this study, a potent magnesium therapeutic was designed by attaching a citrate ligand and a betaine capping agent with the goal of improving its permeability through the blood-brain barrier. Using chemDoodle, a molecular design software, a viable molecular structure was formulated. Magnesium citrate powder was mixed with betaine to produce crystallized flakes, which were characterized using Fourier Transform Infrared Spectroscopy (FTIR). FTIR determined specific wavelength ranges, stretching, bond types, and bond lengths of not only the synthesized magnesium citrate and betaine compound, but also magnesium oxide and magnesium sulfate for comparison. Analysis of the characterization data concluded that magnesium bonded to the citrate ligand and betaine capping agent satisfied the molecular conditions that were hypothesized. In the future, the ability of the novel magnesium-based therapeutic to pass through the blood-brain barrier and easily dissociate upon entering the brain will be tested via nerve cell stimulation.