The influence of weak EMF at the Schumann Resonance frequency on rat cardiac cell culture

Gal Elhalel[(1)], Colin Price[(1)], Asher Shainberg[(2)]
(1) Faculty of Exact Sciences, Tel Aviv University
(2) Faculty of Life Sciences, Bar Ilan University

Extended Abstract

The Schumann Resonance (SR) are Extremely Low Frequency (ELF) electromagnetic resonances in the earth-ionosphere cavity excited by lightning discharges. The first harmonic is at 7.8Hz with an average magnitude of a few pT, with the following two harmonics around 14 and 21Hz. This natural electromagnetic noise have likely existed on the Earth ever since the Earth had an atmosphere and an ionosphere, hence surrounding us throughout our evolutionary history. The human body produces weak alternating magnetic fields in the ELF range generated by excitable cells; Cardiomyocytes generate ~1Hz rhythm with a magnitude of about 1nT. The purpose of this work was to examine the relation between these two natural, frequency specific, ELF signals; The ELF signals produced rat cardiomyocytes and the SR.

We studied the influence of AC magnetic field in the SR frequency range and magnitude on the spontaneous contractions, calcium transients and Creatine Kinase (CK) release of rat cardiac cell cultures. We show that applying 7.8Hz, 100nT magnetic fields cause a gradual decrease in the spontaneous calcium transients' amplitude, reaching 28% of the initial amplitude after 40 minutes of magnetic field application. The physical spontaneous contractions cease after the SR fields have been applied for more than 30 minutes, when the calcium transients amplitude reached ~60% of its initial value. After the removal of the external field, the spontaneous calcium transients and the physical contractions return after a few minutes, implying a reversible process. The influence was independent of the field magnitude in the range 20pT-100nT, and independent of the external DC field. The effect is frequency dependent; with the described decrease occurring only in the 7.6-8Hz range.

In addition we examined the influence of the SR frequency on CK and LDH release, during normal, hypoxic conditions and oxidative stress induced by 80μM H_2O_2. In Tyrode buffer, applying 7.8Hz, 100nT magnetic field for 1.5 hours, reduced the amount of CK and LDH released to the buffer, implying a protective effect.