

Multiple Simultaneous Exposures to Electromagnetic Signals Induce Changes in Heat Shock Proteins and Caspase-3 on the Rat Brain Hemispheres.

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The objective of this study was to investigate the effects of multiple signal electromagnetic field in rat brain at 900 and 2450 MHz and their combination. Induction of cytoprotective heat shock proteins (HSPs) or pre-apoptotic proteins in response to stress as the source electromagnetic field may suggest that they shift cellular equilibrium towards survival or initiating alterations in cell physiology.

To carry out this experimental study 60 rats were radiated in a GTEM cavity with a certain level of input power (PTR), dividing them into 4 different groups (15 rats in each group) according to the following experimental scheme: Group I: Irradiation at 900MHz (PTR = 2 or 4 W). Group II: Irradiation at 2450MHz (PTR = 2 or 4 W). Group III: Simultaneous irradiation at 900MHz (PTR = 1 or 2W) and 2450MHz (PTR = 1 or 2 W). In addition, one control group was included in the study: Group IV comprised 15 rats that were not irradiated.

The experimental system comprised a GTEM (gigahertz TEM) chamber connected to two vector signal generators, a signal mixer and amplifier, a directional coupler, a spectrum analyzer and a power meter. The rat is immobilized in a plexiglass holder (RH) that is placed in the region of maximum field uniformity.

The rectal temperatures were measured in order to evaluate how radiation may trigger thermal stress. After radiation, we use the Enzyme-Linked Immuno Sorbent Assay (ELISA) technique, we studied cellular stress levels of heat shock protein (HSP) 90, 70 and pre-apoptotic activity caspase-3-dependent on brain. This technique was revealed using luminescence to obtain higher resolution.

Measurement of rectal temperatures indicated significant differences after radiation between groups III and IV ($p = 0.025$).

Animals, placed in the position of the dome with $h = 0.215$ m, were exposed to radiation with PTR = 2 or 4 W. The values of field strength (V/m) on both sides of the head of the animal presented differences, (left/right side), with power of 2W: I (49,8/36,5), II (49,5/40,1), III(40,4/30,5); and with power of 4W: I (55,7/47,1), II (67/62,7), III (59,4/42).

Twenty-four hours after irradiation, a significant differences levels in protein HSP 90, 70 and caspase-3 in animals exposed to one or more frequencies (groups I;II;III) between both hemispheres (right and left) on the rat brain cortex were found. Multifrequency radiation causes acute changes on the brain therefore it is necessary to investigate whether it can have an impact on health.