Effect of extremely low frequency electromagnetic fields on levels of intracellular reactive oxygen species and gene expression profile in MCF10A cells

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Abstract **- Part I: The aim of this study was to investigate whether extremely low frequency magnetic fields (ELF-MF) (60 Hz) exposure has effects on reactive oxygen species (ROS) formation in human breast epithelial cells (MCF10A). In this study, MCF10A cells were exposed to 60 Hz ELF radiation at 1 mT for 4 hours. During the exposure time, the temperature in the chamber was maintained isothermally by circulating water within the cavity of chamber. After ELF-MF exposure, reactive oxygen species and antioxidant enzyme activity were measured. Positive control group was exposed to 2 and 4 Gy doses of ionization radiation (IR). IR-exposed positive control groups showed morphological change of cells, the increase of the senescence associated β-gal staining (SA- β gal) and ROS production, antioxidant enzyme (SOD) activity, and the decrease of the oxidized glutathione levels. In contrast to IR-exposed group, ELF-MF exposed groups showed no significant differences in cell morphology, ROS production and activity of antioxidant enzymes. Therefore, we could conclude that ELF-MF exposure did not induce alteration of intracellular ROS level in MCF10A in our exposure condition.**

Part II : Even a number of studies have been conducted to elucidate whether extremely low frequency magnetic field (ELF-MF) could induce alterations in various cell physiological processes, the issue has not to be answered yet. To investigate the effects of ELF-MF on gene expression profile, we conducted ELF-MF exposure with a magnetic flux density of 1 mT at 60 Hz to MCF10A cells for 4 and 16 hours, and analyzed gene expression profiling with Illumina HumanHT-12 v3 Expression BeadChip. We did not found any gene which showed statistically significant alteration (> 1.2 folds) in its expression level. Next, to confirm our results of chip analysis, we selected 8 genes which altered their expression (< 1.2 folds) without statistical significance, such as Interleukin 10 (IL-10), Coagulation factor III (F3), Interferon-induced protein with tetratricopeptide repeats 3 (IFIT3), ARP3 actin-related protein 3 homolog (ACTR3), Cyclin H (CCNH), DEAD (Asp-Glu-Ala-Asp) box polypeptide 17 (DDX17), Protein kinase, cAMP-dependent, regulatory, type I, alpha (PRKAR1A) and NEDD8 activating enzyme E1 subunit 1 (NAE1) We are currently analyzed their expression changes by reverse-transcription polymerase chain reaction (RT-PCR) after ELF-MF exposure.