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Inhibition of *Salmonella typhi* Growth by Using Extremely Low Frequency Electromagnetic (ELF-EM) Waves at Resonance Frequency

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Typhoid is a serious disease difficult to be treated with conventional drugs. The aim of the present work was to demonstrate a new method for the control of *S.typhi* growth, through the interference with the bioelectric signals generated from the microbe during cell division by extremely low frequency electromagnetic waves (ELF-EMW) at resonance frequency. Isolated *S.typhi* was subjected to square amplitude modulated waves (QAMW) with different modulation frequencies from two generators with constant carrier frequency of 10 MHz, amplitude of 10 Vpp, modulating depth $\pm$ 2Vpp and constant field strength of 200 V/m at 37 °C. Both the control and exposed samples were incubated at the same conditions during the experiment. The results showed that there was highly significant inhibition effect for *S.typhi* exposed to 0.8 Hz QAMW for a single exposure for 75 min. Furthermore, *S.typhi* became more resistant to the used antibiotics; amikacin, tetracycline, ciprofloxacin and trimethoprim–sulfamethoxazole after exposure to 0.8 Hz QAMW for 75 min. Dielectric relaxation, TEM and DNA results indicated highly significant changes in the molecular structure of the DNA and cellular membrane resulting from the exposure to the inhibiting EM waves. It was concluded that this new non-invasive technique for treatment of bacterial infections is of considerable interest for the use in medical and biotechnological applications.