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## Pulse modulated 900 MHz radiation induces hypothyroidism and apoptosis in thyroid cells: a light, electron microscopy and immunohistochemical study.

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### Abstract

**PURPOSE:** In the present study we investigated the possible histopathological effects of pulse modulated Radiofrequency (RF) fields on the thyroid gland using light microscopy, electron microscopy and immunohistochemical methods.

**MATERIALS AND METHODS:** Two months old male Wistar rats were exposed to a 900 MHz pulse-modulated RF radiation at a specific absorption rate (SAR) of 1.35 Watt/kg for 20 min/day for three weeks. The RF signals were pulse modulated by rectangular pulses with a repetition frequency of 217 Hz and a duty cycle of 1:8 (pulse width 0.576 ms). To assess thyroid endocrine disruption and estimate the degree of the pathology of the gland, we analysed structural alterations in follicular and colloid diameters and areas, colloid content of the follicles, and height of the follicular epithelium. Apoptosis was confirmed by Transmission Electron Microscopy and assessing the activities of an initiator (caspase-9) and an effector (caspase-3) caspases that are important markers of cells undergoing apoptosis.

**RESULTS:** Morphological analyses revealed hypothyrophy of the gland in the 900 MHz RF exposure group. The results indicated that thyroid hormone secretion was inhibited by the RF radiation. In addition, we also observed formation of apoptotic bodies and increased caspase-3 and caspase-9 activities in thyroid cells of the rats that were exposed to modulated RF fields.

**CONCLUSION:** The overall findings indicated that whole body exposure to pulse-modulated RF radiation that is similar to that emitted by global system for mobile communications (GSM) mobile phones can cause pathological changes in the thyroid gland by altering the gland structure and enhancing caspase-dependent pathways of apoptosis.

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