INFLUENCE OF GSM MICROWAVE ON THE DENDRITIC DEVELOPMENT OF HIPPOCAMPAL NEURONS IN CULTURE

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Abstract: Global system for mobile communication (GSM) microwave has been proposed to affect central nervous system, especially a developing brain. In the study, we investigated the effects of 1800 MHz GSM microwave on dendritic filopodia, dendritic arborization and spine maturation of developing neurons in culture. The hippocampal neurons were prepared and cultured from the pups at postnatal one day, and co-transfected with F-GFP and GFP-actin at 5 days in vitro (DIV5) to show the subtle structures of dendrites. From DIV6 to DIV14, the neurons were exposed to 1800 MHz microwave modulated with 217Hz at a specific absorption rate (SAR) of 3.5w/kg or 1.0w/kg daily for 15 min. The transfected neurons were imaged through a fluorescent microscope (Nikon TE2000) equipped with a CCD camera (CoolSNAP HQ) and Metamorph imaging software, then the pictures were measured with Metamorph software. We found that at DIV8, for the neurons exposed to microwave (3.5w/kg) for 15 min daily, density of dendritic filopodia decreased by 51¡À5.8% (P<0.005), and the mobility of filopodia (represented by density of mobile filopodia) decreased by 59¡À4.1% (P<0.005) compared to sham exposure. Concomitantly density of mature mushroom-shaped spines showed an overall decrease of 14.3¡À3.7% (P<0.005) at DIV14. In addition, after exposure of 15 min daily for 5 days (DIV10) and 9 days (DIV14) the total lengths of the neurons reduced by 19.6¡À4.6% (P<0.05) and 18.9¡À3.4% (P<0.05), respectively, while no change was observed after exposure of 15 min daily for 3 days (DIV8). However, there were no significant changes in average lengths of dendritic filopodia and total numbers of dendritic branches of hippocampal neurons after exposure. For 1.0w/kg SAR, there were no significant differences in density, length, mobility of filopodia, total length and branching of dendrite, density of spines compared to sham exposure. Our results suggest that 3.5W/kg 1800 MHz GSM microwave may affect the dendritic development of cultured hippocampal neurons and reduce development-dependent formation of excitory synaptic connection, via interfering density and mobility of dendritic filopodia, which has been proposed related with growth of dentrite and formation of spines on dentritic shaft. These aftereffects may lead to reduction of signal communication and interfere overall function of neural network.