50GHz Microwave Exposure Effect of Radiations on offspring and rats Brain

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ABSTRACT

In this paper, we have discussed the non-thermal effect of 50GHz radiation on whole body exposure. 60 days old animals were exposed 2 h a day for 45 days continuously at power density 0.1 mW/cm^2 (SAR= 0.3 W/kg). We observed that reproductive and brain systems are affected by 50 GHz microwave radiations. The chances were observed in progeny and DNA double strand break in Brain cells.

INTRODUCTION & BACKGROUND

The effect of microwave radiations on biological systems is primarily due to an increase in temperature i.e. thermal (Stuchley 1988), though non-thermal effects have also been identified (Paulraj et al. 2004). Many studies have reported that microwave radiation can have adverse effects on reproduction (Khillare, Behari, 1998). Ji-Geng et al, (2007) has been also observed that carrying the mobile phones near reproductive organs for longer time may have negative effects on the sperm motility and male fertility. This study measured the DNA double strand break in the brain cells and number of off-springs and weight of rats exposed to 50 GHz electromagnetic fields. Lai and Singh observed the DNA strand breaks in rat brain cells when exposed to 2.45 GHz continuous and pulsed RF radiation for 2 hour a day and found DNA single and double-strand breaks (Lai and Singh, 1996). Previous reports from our laboratory have showed that these radiations affect cholenergic systems, brain Na+- K+ ATPase activity (Behari et al. 1998, Paulraj et al. 1999), protein kinase C activity (Paulraj and Behari 2004), single strand DNA breaks in brain cells (Paulraj and Behari 2006) and reduced infertility (Behari and Kesari 2006) in rat.

METHODS

In present investigations, the animals were exposed 2 h a day for 45 days continuously at power density 0.1 mW/cm^2 (SAR= 0.3 W/Kg). A total number of 16 rats were divided in Experimental and Sham exposed. After the exposure period the rats were sacrificed, DNA double strand break in brain was performed. The protocols for animal experimentation described in this study were approved by the Institutional Animal Ethical Committee (IAEC) and Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA). All subsequent animal experiments adhered to the 'Guidelines for Animal Experimentation' of the University.

DNA strand break estimation

In the present investigations, comet assay (also referred as single cell gel electrophoresis) is used to determine DNA damage (DNA strand break). Presently assay was performed according to Singh (2003). The following steps such as agarose slide preparation, cell lysing, gel electrophoresis run, neutralizing and finally staining with ethedium bromide (EtBr) slide were followed as per Singh (2003). All the experiments were performed in double blind mode. The images of double strand DNA break in brain cells were recorded with fluorescence microscope.

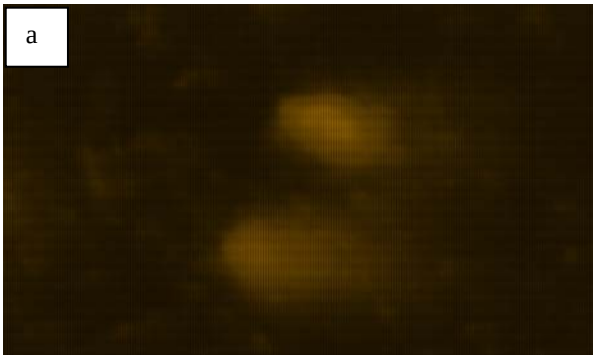
Estimation of population and weight of progeny:

Eighteen Wistar rats (12 female and 6 male; weight range 180g) were separated and divided into two groups, a sham exposed (SE) group (n=3) for male rats n=6 for female rats) and an experimental (Ex) group (n=3 for male rats, n=6 for female rats). Animals were kept for breeding in the group of (i) exposed female with exposed male and (ii) control female with control male.

RESULTS

DNA double strand break

In the qualitative picture of DNA strand break, it is shown that more diffusion and migration taken place in exposed brain (fig 1a) as compared to control (fig 1b). This result conveys more DNA strand break in case of exposed sperm sample than control one.



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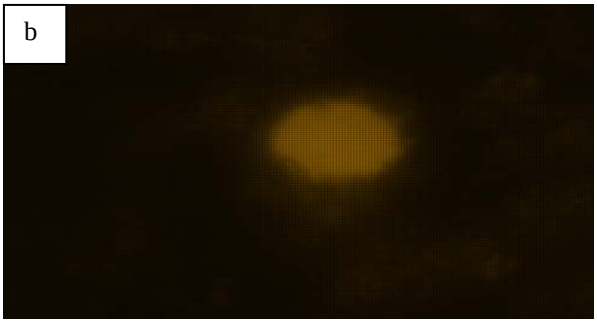

Fig:1- shows exposed group of brain shows DNA double strand break (figure a) and no any Strand break (figure b) was seen in control group on fluorescent microscope at 40X.

Estimation of population and weight of progeny:

We observed that the number of offspring was decreased in exposed group 10.06±1.38 ($p< 0.04$) as compared to control 13.52±0.90 and less body weight was recorded in exposed group 12.1±0.73 ($p<0.03$) as compared to control 14.1±1.10 group of animals (fig -2). Number of offspring mentioned in graph was carried out per animal as well as in weight.

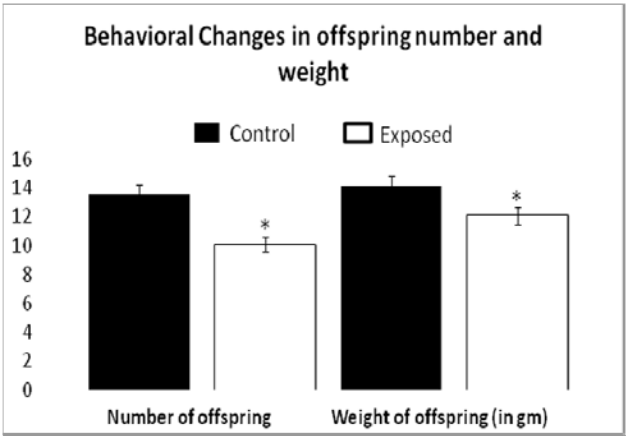

Fig 2- Difference between number of offspring and their body weight, where $p< 0.05$ as indicated significant shown as *.

DISCUSSION

The present study evaluated biological effects of 50 GHz microwave radiation on behavioral changes and DNA double strand break in brain cells. Recently from our laboratory (Behari and Kesari, 2006; Kesari and Behari, 2008) reported an increase in DNA double strand breaks in brain and sperm cells due to microwave radiation. Earlier Lai and Singh (1996) also reported these effects on brain cells at 2.45 GHz microwave exposure. DNA damage in cells indicates an important implication on health because they can be cumulative. Normally, DNA is capable of repairing itself efficiently through a homeostatic mechanism, cells maintain a delicate balance between spontaneous and induced DNA damage. DNA damage accumulates if such a balance is altered. Most cells have considerable ability to repair DNA strand breaks; for example, some cells can repair as many as 200,000 breaks in one hour. Cumulative damages in DNA may in turn affect cell functions. DNA damage that accumulates in cells over a period of time may be the cause of onset of diseases, such as cancer. One of the popular hypotheses for cancer development is that DNA damaging agents induce mutations in DNA, leading to expression of certain genes and suppression of other genes resulting in uncontrolled cell growth. Thus, damage to cellular DNA or lack of its repair could be an initial event in developing a tumor. However, when too much DNA damage is accumulated over time, the cell will die. Cumulative damage in DNA in cells also has been shown during aging. We also observed that the 50GHz radiation may also affect the next generation of rats on their progeny.

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