

Effect of electromagnetic waves on brain tissue in adult female albino rats

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Abstract

70 days old adult Female albino rats weighing about 50-60gms adult Female albino rats were used for this present study. Animals were divided into two groups as control and experimental. Experimental group of rats were subjected to electromagnetic wave signals coming out from cell phone which was placed inside the cage in silent mode. The experiment was carried out for 8 weeks and the rats were subjected to electromagnetic waves by giving continuous call to the mobile phone fixed inside. Brain tissue was removed and subjected to staining with H&E and observed for histological variations. There is no significant variation in body weight, neuronal pattern of pyramidal cells and stellate cells showed few changes in the historical pattern of brain cells.

Keywords: Cell phones, Electromagnetic waves, Brain tissue-body weight, Albino rats

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Introduction

Use of cellular phones are believed to be carcinogenic due to its electromagnetic waves and seems to be scary in this techno world. In spite of that we all are used to the use of mobile phones due to its vast benefit in communication in any case of emergency to any place. But it is found to be potential hazards always. Ipsilateral use of a cellular telephone increased the risk of tumors in the temporal, temporo-parietal and occipital areas (Johansen c et.al, 2001). It is also proved that ipsilateral use of an analogue cellular phone yielded an increased risk for malignant brain tumors (Hardell et.al, 2002). Keeping these aspects in mind and through various review of literature, the present work has been carried out to find out the effect of electromagnetic waves from mobile phones and its impact on the histological pattern of brain tissue in adult female albino rats.

Materials and Method

Adult female albino rats weighing about 50-60 gms were used for the study. All the animals were maintained under normal atmospheric condition with food & water ad libitum. And Temperature was maintained at room condition. Animals were purchased after getting approval from Institutional Animal Ethical Committee at PSGIMS&R, Coimbatore. Animals were divided into two groups of 6 each as control and experimental. Both the groups were maintained at the same condition. The Experimental group of animals were maintained in a specially designed cage. The cage was fixed with a mobile phone inside the cage with an antenna. This mobile phone was given a ring intermittently from another cell-phone. In order avoid external disturbances as noise stress, the mobile was kept in silent and vibrate mode in order to produce effective electromagnetic waves. The experiment was continued for 8 weeks. After the experimental period all

the animals were sacrificed using sodium pentobarbital anaesthesia. Animals were decapitated, perfused and fixed. Calvaria was opened and brain was dissected out. Parietal and temporal lobes of both sides of the brain was dissected out and separated. Brain tissues were processed, sectioned at 5 μ thickness and stained with Heamatoxylin & Eosin stain.

Stained slides were subjected to histological and histomorphometrical studies using ocular and stage micrometer. Observations made were tabulated and discussed.

Results

Observations were made on the following parameters

1. Total body weight of the animals
2. Histology of brain tissue
3. Volume of pyramidal and stellate cells in temporal and parietal region.

Body weight: The body weight of the control and experimental groups of animals was recorded using weighing machine. There is no significant changes in the body weight between the control and experimental groups. (Table 1)

Histology of Brain tissue: The grey matter of the cerebrum consists of neuronal cell bodies, neuroglia and blood vessels. Basically the neocortex of the pallium is made up of superimposed laminae from outside inwards named as molecular layer (Lamina I), outer granular layer (Lamina II) outer pyramidal (Lamina III), inner granular (Lamina IV), inner pyramidal (Lamina V) and polymorphous layer (Lamina VI).

The neo-cortical grey matter consists of four types of cortical neurons – pyramidal, stellate cells of martinotti and horizontal cells of Cajal. Mostly, the pyramidal cells are seen more in lamina III & V, stellate or granular cells are seen in laminae II & IV cells, cells

of martinotti are seen in lamina VI and horizontal cells are seen in lamina I.

Frontal type with more pyramidal neurons and parietal type with numerous stellate neurons were observed in this body.

Table 1: Body Weight (in grams)

| S. No | Control | Experimental |
|-------|---------|--------------|
| 1. | 170 | 175 |
| 2. | 205 | 200 |
| 3. | 175 | 185 |
| 4. | 180 | 200 |
| 5. | 200 | 205 |
| 6. | 190 | 200 |

Table 2: Volume of pyramidal cells in parietal lobe of cerebral cortex Values expressed in μm^3 as Mean & SD

| Pyramidal Cells | | |
|-----------------|--------------|--------------|
| S. No. | Control | Experimental |
| 1. | 0.190 ± 0.07 | 0.235 ± 0.11 |
| 2. | 0.205 ± 0.12 | 0.246 ± 0.14 |
| 3. | 0.203 ± 0.11 | 0.251 ± 0.16 |
| 4. | 0.208 ± 0.09 | 0.243 ± 0.19 |
| 5. | 0.198 ± 0.11 | 0.239 ± 0.18 |
| 6. | 0.202 ± 0.14 | 0.258 ± 0.12 |

Table 3: Volume of stellate cells in parietal lobe of cerebral cortex Values expressed in μm^3 as Mean & SD

| Stellate Cells | | |
|----------------|---------------|---------------|
| S. No. | Control | Experimental |
| 1. | 0.114 ± 0.051 | 0.156 ± 0.048 |
| 2. | 0.102 ± 0.042 | 0.151 ± 0.042 |
| 3. | 0.098 ± 0.031 | 0.149 ± 0.054 |
| 4. | 0.121 ± 0.036 | 0.153 ± 0.046 |
| 5. | 0.116 ± 0.048 | 0.148 ± 0.052 |
| 6. | 0.118 ± 0.042 | 0.157 ± 0.054 |

Table 4: Volume of pyramidal cells in temporal lobe of cerebral cortex Values expressed in μm^3 as Mean & SD

| Pyramidal Cells | | |
|-----------------|--------------|--------------|
| S. No. | Control | Experimental |
| 1. | 0.201 ± 0.09 | 0.277 ± 0.15 |
| 2. | 0.211 ± 0.11 | 0.265 ± 0.19 |
| 3. | 0.220 ± 0.08 | 0.301 ± 0.17 |
| 4. | 0.217 ± 0.13 | 0.295 ± 0.13 |
| 5. | 0.206 ± 0.08 | 0.300 ± 0.11 |
| 6. | 0.219 ± 0.12 | 0.286 ± 0.20 |

Table 5: Volume of stellate cells in temporal lobe of cerebral cortex Values expressed in μm^3 as Mean & SD

| Stellate Cells | | |
|----------------|---------------|---------------|
| S. No. | Control | Experimental |
| 1. | 0.096 ± 0.054 | 0.194 ± 0.069 |
| 2. | 0.098 ± 0.036 | 0.182 ± 0.052 |
| 3. | 0.109 ± 0.042 | 0.176 ± 0.048 |
| 4. | 0.101 ± 0.038 | 0.188 ± 0.071 |
| 5. | 0.099 ± 0.046 | 0.172 ± 0.063 |
| 6. | 0.116 ± 0.050 | 0.168 ± 0.056 |

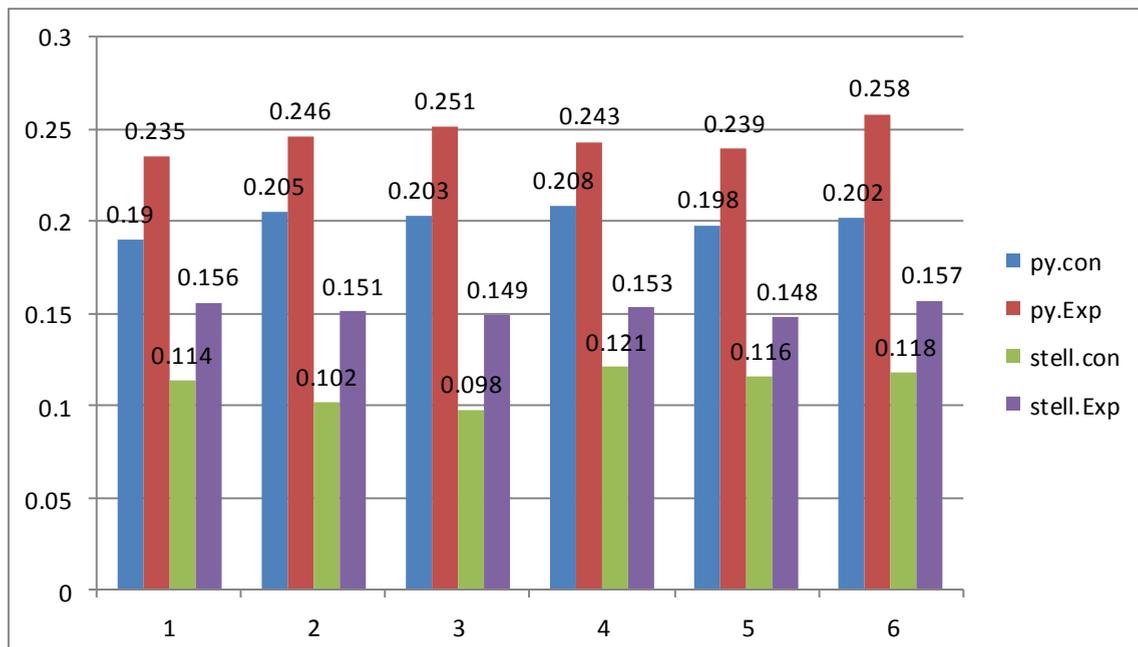


Fig. 1: Volume of pyramidal & stellate cells in parietal lobe of cerebral cortex

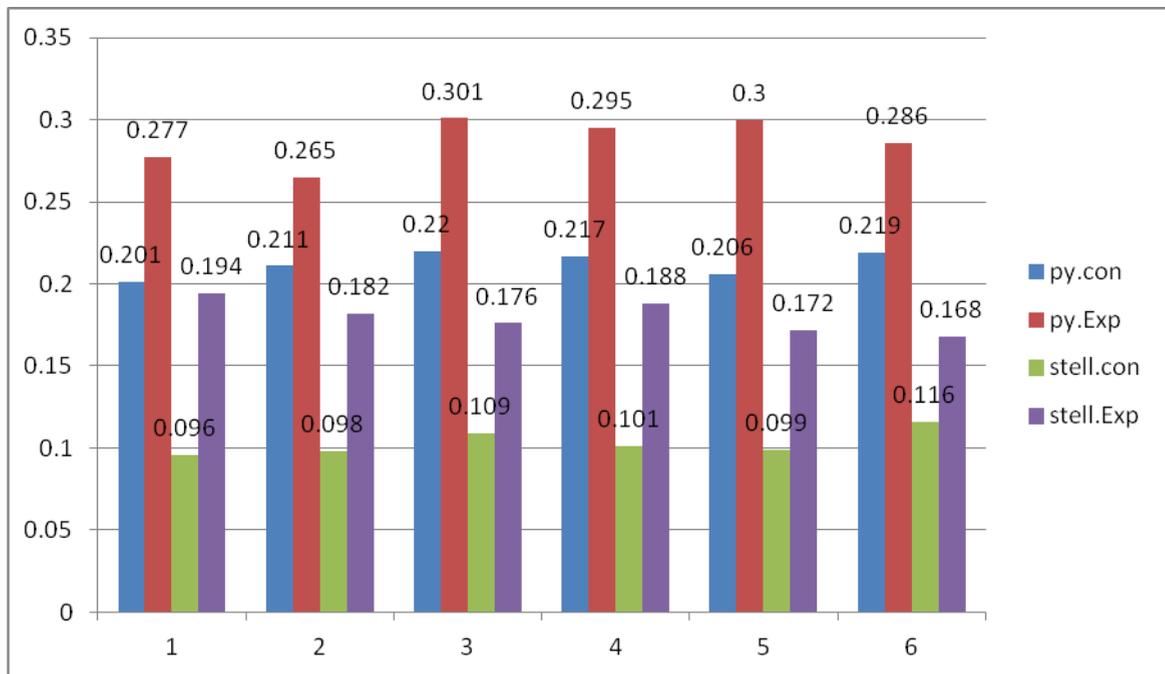


Fig. 2: Volume of pyramidal & stellate cells in parietal lobe of cerebral cortex

Volume of cortical neurons in parietal & temporal region of the cerebral cortex: Pyramidal neurons with single cell body giving rise to single apical and multiple basal dendrites were found in outer and inner pyramidal layers. Little difference in size of the pyramidal and stellate cells in different regions of the cortex was observed. When compared with parietal region (Table 2, 4; Fig. 1) the cells in the temporal are showed significant increase in their volume. In Lamina II the large pyramidal cells in the experimental group when compared to control group. Stellate cells with small cell bodies were found numerous in Lamina IV. The effect of electromagnetic radiation showed increase in the volume of the stellate cells. (Table 3, 5; Fig. 2)

Discussion

In the present study, it was observed that the exposure to electromagnetic waves especially on parietal and temporal lobes were found to be minimal on histo-architectural changes which is in agreement with Johenson et.al (2002). Lai et.al (1996) have observed DNA damage in the brain cells of live rats after two hours of relatively low level microwave exposure. The body weight of the experimental group showed no significant change when compared to the control group which is in coherence with work done by Richter ED, Berman T, Levy O (2002).

Conclusion

From the above discussion comparing the present work and other researchers work, it was concluded that the histological and morphometric readings proved that there is minimal change with the pyramidal and stellate cells in the parietal and temporal cortex of the brain

tissue. When the changes were significant under acute stress condition, definitely there would be more significant changes observed under chronic exposure to the electromagnetic waves.

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