



Effect of electromagnetic radiation on thyroid glands of rats

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ABSTRACT

GSM stands System for Mobile communications. This is a digital mobile telephone system used in most part of the world. The tremendous growth of telecommunication industry results in increase in the number of handset user's everyday which has created a matter of concern in the scientist community. Exposure to electromagnetic radiation from mobile phones can cause harmful effect on cell, tissues and chromosomes. The rapid growth in use of this device has led to widespread concern for the safety of this device in long term exposure to the microwave radiation of low intensity. In this paper, we examined the anatomical (microscopic) and physiological effect (hormonal) of mobile phone radiations on thyroid gland to know its effect. However only on the basis of one or two parameters any conclusion cannot be justified, however it requires future comparative investigations to proof. Here in our study we found that with increase in the doses of radiation and increase in duration of time the microscopic anatomy of thyroid gland showed appreciable changes, also when the hormonal analysis was done the level of thyroid hormone was found disturbed. This is a matter of concern and need further more studies to see whether other endocrine glands are also effected or not by the radiations being emitted by the handsets.

Key words: Electromagnetic radiations, mobile phones radiation, Rats, Thyroid gland

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INTRODUCTION

From the last few decades a new kind of pollution in the form of electromagnetic radiation also called as “Dirty pollution” is growing leaps and bounds. Sources are electric power lines, cordless phones, AM/FM radio, T.V broadcasting stations, MRI machines etc. With the advent of mobile phone this dirty pollution has increases in many folds. The concern generated by these mobile phones radiations became evident, when there was sudden global disappearance of house sparrow, bats, birds & honey bees been attributed to the radiation coming from cellphones towers [1-5]. The popularity of these phones & elaboration of their service network all around the world have drastically increased the amount of EMW exposure in our daily life. Various ill effects of these radiations has already been reported by different scientist. For example, the microwave emitted by mobile phones have been linked to several genetic defects [6]. It has also been suggested that these radiations can even induce chromosomal abnormalities & can increase the chances of cancer [7].

Even the question was been raised on the role of these radiations in infertility drawing a tremendous attention [8]. Due to the production of glandular secretions in the internal membrane system, glands are highly sensitive to these radiations. If the damage is too severe, the whole gland may lose its normal functioning. Although it has been reported that a short term exposure to these radiations may stimulate the glandular secretions but in long term it is always harmful. A good example to this is thyroid gland, which is in quiet exposed position due to its location (in front and at the sides of trachea opposite 5th, 6th, 7th cervical & 1st thoracic vertebrae) in front of neck. Here in our study we have tried to look upon the effect of electromagnetic radiations emitted from the mobile phones on the anatomy as well the physiology of thyroid gland. The objective is to study the effect of electromagnetic radiation being emitted by mobile phone radiation on the thyroid gland of rats with respect to anatomy as well as physiology of the gland.

MATERIAL AND METHODS

The present study was conducted in the Department of Anatomy & Pharmacology and Subharti Medical College, Meerut.

Inclusion Criteria:

- GSM model with frequency bandwidth of 900 MHz, power of 2 watt & SAR value of 0.38 W/Kg.

- Normal tissues procured from animal model.
- Male rats
- Weight:-150-200gms.

Exclusion Criteria:

- Tissues with known pathologies.
- Female rats.
- Rats with weight more than 200gms.
- Experiment was carried out on rats (Sprague Dawley). Rats after their procurement underwent the process of acclimatization in which for one week they were fed with normal pellet diet with water ad libidum and a day and night cycle of 12 hrs was maintained at temperature of around 22-27 degree.
- Ethical clearance was taken by the institutional ethical committee of central animal research house and research council of the college.
- Rats were divided into two groups. Each of the group were having six rats. Group-I was the control one and Group-II was the one which underwent exposure to the radiation.
- Group A which consist of control group of rat were well maintained under the required condition and were given the same environment as that of experimental except the exposure of radiation. They were kept in separate room to avoid the exposure.
- Group II rats received the electromagnetic radiation via mobile phone which was kept inside the cage.

Method of exposure

- Mobile phones was kept in the side of cage compartment which has a thermocol base and was sectioned for maximum exposure to radiation.
- Mobile phone was at answering mode for 3hrs a day at a duration of 1hrs.
- After one month 2 rats from each group were sacrificed to study the effect while rest of them keep on receiving the radiation in same manner for one more month.
- After the completion of 2nd month 2 more rats were sacrificed and were studied histo pathologically while the remaining continued to receive the radiation for next one more month.
- After the completion of 3rd month remaining rats were sacrificed and were studied accordingly.
- The rats as well as the tissues procured were subjected for histological study by slide preparation. Further blood samples were collected from the experimental models for

the study of hormonal assay to find the changes if any.

Hormonal Analysis: After anesthetizing the rat with chloroform the anterior wall of the thorax was open and blood was directly collected from the heart of the rat. The sample collected was sent immediately for hormonal analysis.

Microscopic Analysis: The tissues of the organs to be studied was collected in 10% of formalin & was processed using routine tissue processing method and were stained with Hematoxylin & Eosin. A compare of control versus experimental was reported as result.

RESULTS

Once the experiment was completed the results which was obtained is summarized as follows:-

- a) Microscopically there was not much changes after the first month of exposure (Fig IV & table I), however during the second month many of the follicles were empty looking or having less colloid. (FigV & Table I)
- b) Distortion of septa are also observed at some places.(Fig V)

After the 3rd month of exposure a much distorted picture of gland was observed. Septas were incomplete, the number of empty looking follicles or follicles having less colloid were increased & nuclei were very prominent & dark stained. (Fig VI & table I). As far as the hormonal analysis was concerned the value of thyroid stimulating hormones were increasing with exposure (table II) & T3 was decreasing with exposure. (table –II).

DISCUSSION

Studies by various researchers has already suggested that some biological changes are occurring in animals because of electromagnetic radiations. Examples are increased blood brain barrier permeability & changed gene expression in rats [9] enlarged adrenals, altered adrenal hormones, altered ECG, disturbed carbohydrate metabolism, structural changes in liver, spleen, testes & brain in white rats [10] due to exposure to RF radiations. Short term effect of these radiations

as suggested by field studies on people living within the range of 300 meters of cell phone tower could be sleep disturbances, depression, headache, nausea, agitation [11,12], but these may be symptoms due to some other cause as well. Some of them however has shown the long term exposure may cause cancer [13, 14], brain tumors [15, 16] etc. It has already been proved by various scientist that the mobile phone are having drastic results in more or less every body parts.

Here in our study we investigated the effect of potentially harmful radiation emitted by mobile phone operating at 900 MHz upon one of the quiet important endocrine gland that is thyroid gland over a period of 90 days in daily use of 1 hour calling then kept in standby position afterwards. Rajkovic et al.(2003) [17] showed that after 3 month of exposure to power line frequencies, the thyroid glands of rats showed visible signs of deteriorations. even the hormones secreted by the gland was altered. Esmekaya et al. (2010) [18]found a similar visible deterioration of the thyroid gland in rats exposed to simulate d 2G cell phones radiation for 20 minutes a day for 3 weeks. Eskander et al. (2012) [19] found that people living 6 years within 100 meters of a cell phone base station showed a significant reduction in the release into blood of number of hormones including ACTH from pituitary, cortisol from adrenal glands, prolactin & testosterone from organ elsewhere. However the most highly significant loss was in their ability to produce thyroid hormones.

CONCLUSION

The results that was obtained from our experiment showed a very harmful effect on the anatomy & physiology of thyroid gland but to highlight the uncertainty regarding the ongoing concerns about the safety of radiations emitted by mobile phones, the future comparative investigations are required for thyroid glands. These investigations concerned should also be conducted using different protocols that may vary in, dose, and duration of mobile phones radiations. Other factors like lifestyles, occupation, and radiation exposure from other sources should also be considered before concluding any final reports as far as human beings are concerned.

Microscopic analysis (Table-I)

Gland	Control	1 st month (Experimental)	2 nd month (Experimental)	3 rd month (Experimental)
Thyroid gland	<p>Presence of variable size follicles.</p> <p>Filled with acidophilic colloid. Follicles are lined by simple cuboidal epithelium.</p> <p>Presence of connective tissue septa extending into the substance of gland & dividing the interior of gland into lobules is seen.</p> <p>Presence of numerous blood vessels can be seen in the septa.</p>	<p>Not much appreciable change seen histologically.</p>	<p>Many of the follicles are empty looking or having less colloid.</p> <p>Distortion of septa are also observed at some places.</p>	<p>Distorted picture of gland is observed.</p> <p>Septa are incomplete</p> <p>The number of empty looking follicles or follicles having less colloid has increased.</p> <p>Nuclei are very prominent & dark stained.</p>

HORMONAL ANALYSIS (Table-II)

Hormones	Value 1 st month		Value of 2 nd month		Value of 3 rd month	
	Control	Experimental	Control	Experimental	Control	Experimental
TSH (μ l/ml) (0.35-2.94)	2.02	2.89	2.49	4.90	2.81	5.39
T3 (ng/dl) (58-159)	86.32	58	81.02	50.02	79.59	42.03



Fig I:- Photograph Showing Arrangement Of Mobile Phone In Cage.



Fig II:- Photograph Showing Drawing Of Blood From The Heart Of Rat.

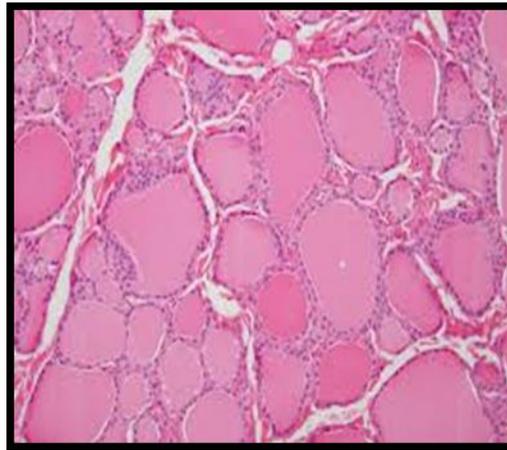


Fig III:- H& E stained (10 x)Photomicrograph of thyroid gland of control group of rat.

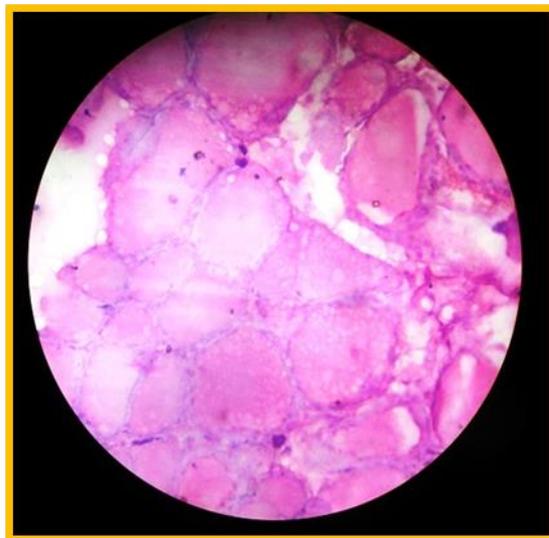


Fig IV:- H& E stained (10 x) Photomicrograph of thyroid gland of experimental group of rat after 1st month of exposure.

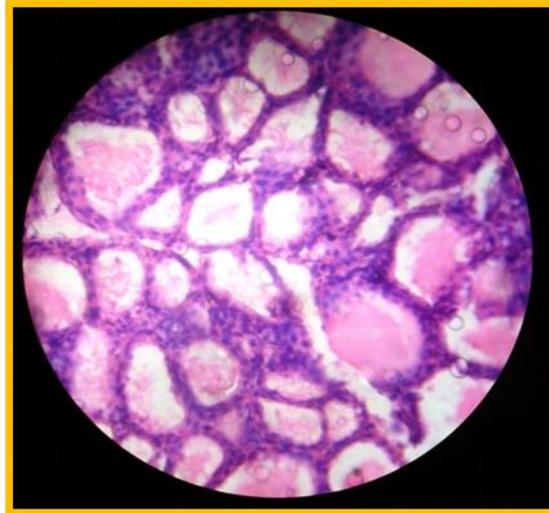


Fig V:- H& E stained (10 x) Photomicrograph of thyroid gland of experimental group of rat after 2nd month of exposure.

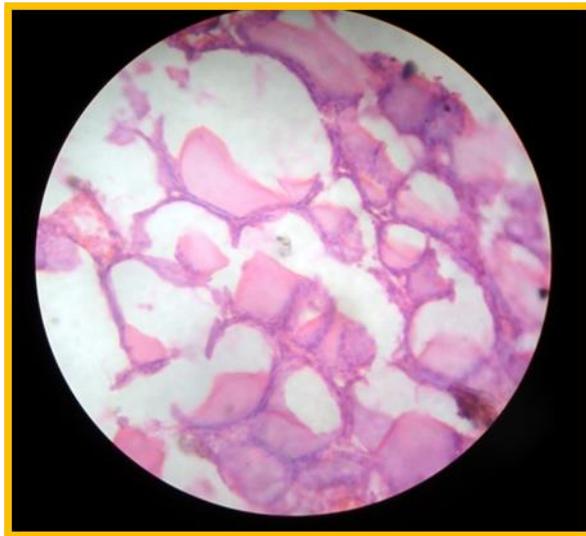


Fig VI:- H& E stained (10 x) Photomicrograph of thyroid gland of experimental group of rat after 3rd month of exposure

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