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Effect of Mobile Phone Radiation on Pancreas of Rats

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Abstract
Mobile phones are now a part and parcel of our life. We all is well aware of its use but the other side of the coins says that it is also causing great damage to our body. Keeping this factor in mind the main aims and objective of my study is to read the effect of mobile phone radiations on various changes occurring in pancreatic tissues of male spargue dawley rats. In order to carry out the experiment male rats of weighting 90-110 gms which were divided into two groups ie control and experimental were subjected to mobile phone radiations for a duration of 3 months continiously for one hour daily in specially designed cage for exposing them to radiations. At the end of each month both the group of rats were sacrificed and pancreatic tissues were collected and underwent processing to obtain histological slides stained with H& E. Also fasting blood glucose level was measured of both the group of rats. The experiment showed that Control group of rats showed the normal histological picture ie well formed acini and islet of langerhans, however rats sacrified from experimental group of first month also showed more or less normal histological picture as that of control group. Rats sacrificed after second month of radiation doses showed changes in the histological picture as the acini showed disturbances in architecture also the blood vessels showed engorgement. A completely distorted histological picture which could be very well appreciated was observed after the study of slides obtained by the sacrifice of rats which underwent 3 months of radiation exposure. As far as the fasting glucose level is concerned it also showed a continious increase with increase in the dose of radiation which may be due to effect of radition on beta cells of pancreas. hence it was concluded that the radiation which is emitted from the mobile phone has a damaging effect on pancreatic tissues of rats and hence its metabolism.
Keywords: *mobile radiation, pancreas, microscopic picture, glucose level.*

Introduction

Technology has introduced a device called as mobile phones for the benefit of mankind. It is now widely used by people all over the world. The emergence and evolution of mobile phones is one of the fastest in the history of innovation[(1)]. It is being used both by adults and children. The number of mobile phone users is constantly increasing and estimated total number of mobile phone users worldwide has surpassed 4.8 billion. This means that almost more than two-thirds of the world population is using this technology[(2)].

Electromagnetic Radiation (EMR) being emitted by variety of sources have become a very frequent source of contamination for the human environment due to production of non-ionizing radiation (NIR)[(3)].

This phenomenon has raised concerns about the possible hazards of the electromagnetic field radiation emitted by mobile phones on human health[4,5,6,7,8,9].

The EMF radiation generated by mobile phones can inflict its results through both thermal and non-thermal effects[10,11].

Despite the large number of studies published over a decade, it still remains uncertain that their use may lead to serious debilitating problems in the different body structures while placing the mobile phones or during its use[12,13,14,15]

Mobile phones are mainly placed in the front or side pockets (close to the heart, liver and pancreas) or hung with a waist belt (close to the reproductive organs). The excessive use of mobile phones has been followed by common public debate about possible adverse effects on human health. Thus, the present study was designed to investigate the effects of the Electromagnetic Field Radiation (EMFR) generated by mobile phones as regards the morphological findings in the l pancreata of albino rats.

Aims and Objective

To uncurtain the effect of electromagnetic radiation being emitted by mobile phone radiation on pancreas of rats & its microscopic study.

Material and Methods

The entire study was conducted in the Department of Anatomy of BRD Medical College, Gorakhpur Uttar pradesh.

Animal model

A total of 42 male albino rats of spargue dawley species with age of around 2 months and weighing 100-120 gm (fig1) with same genetic background and knowing disease free were recrutied for the experiment. The animals after the procurement underwent acclimitization for around one week during which they underwent 12 hourly day and night cycle and were fed with their diet with water ad-libidum.[16] the experimental animal protocol was approved by the animal ethical committee of college board and the experiment were performed according to the suggested guidelines.

Experimental Protocol

Albino rats were equally divided into 2 groups one control and other experimental having 21 rats each. Group A rats which were the control rats were given the same environment as that of group B rats which were the experimental one except exposure to radiation. They were even kept in different rooms to avoid any exposure with mobile phone. However Group B rats were exposed to mobile phone radiations

Radiation Set Up

Normal plastic cage available for rats were taken and the base of it were carpeted with thermocol sheet. The cage was partitioned using a wooden plank and the area seperated was fitted with mobile phone of GSM model with frequency bandwidth of 900 MHz, power of 2 watt & SAR value of 0.38 W/Kg.(Fig 2)

When the experiment was started a call was given on the mobile phone being kept in the cage and it is kept on answering mode for a duration of 3 hours.

During this the rats remain in touch with the mobile phone and were receiving the radiations same as that of human being interacting on mobile and keeping it near its body.[17,18,19] (Fig 3)

This entire experiment was repeated for 6 months and at the end of every 2 months 7 rats from each group were sacrificed and blood sample was collected and sent to lab for glucose analysis.

Histopathological examination

After the sacrifice of rats pancreas were collected and kept in 10 % of formalin and the tissues were processed using routine tissue processing technique and were stained with Hematoxylin and eosin. Tissue slides were prepared and were examined both under high and low power magnification.

Statistical analysis

The data obtained for the level of glucose was analysed and mean and standard deviation was calculated and t-test was applied on the data.

Fig 1: Albino Rats Getting Weighed.

Fig 2: Radiation set up in cage.

Fig 3: Rats undergoing exposure to mobile phone radiations during experiment.

Observation

Fasting Blood Glucose in Rat

Normal fasting blood glucose level in rat: 80-120 mg/dl

Table 1: Table showing mean of blood glucose level in control vs experimental group of rats

Month	Group	Fasting glucose level in mg/dl
	Control (mean)	Experimental (mean)
2nd month	88 mg/dl	100mg/dl
4th month	90mg/dl	112mg/dl
6th month	82mg/dl	159mg/dl

Table 2: Comparison of glucose of experimental and control group of Rats for 2nd month

	1st day		2nd month	
R.no	Control	Experimental	Control	Experimental
1	81	86	88	100
2	83	81	81	102
3	88	98	94	106
4	82	100	83	110
5	83	105	85	109
6	101	80	103	110
7	94	107	99	111

Table 3: Difference in glucose of rats after 2 months

R.no	Control	Experimental
1	7	14
2	2	21
3	6	8
4	1	10
5	2	4
6	2	30
7	5	4

Table 4: Comparison of glucose of experimental and control group of Rats for 4th month

	1st day		4th month	
R.no	Control	Experimental	Control	Exprimental
1	91	82	106	112
2	81	92	108	114
3	85	93	99	118
4	88	87	98	120
5	88	85	101	121
6	93	87	103	112
7	85	84	98	117

Table 5: Difference in glucose of rats after 4 months

R.no	Control	Experimental
1	15	30
2	27	22
3	14	25
4	10	33
5	13	36
6	10	25
7	13	33

Table 6: Comparison of glucose of experimental and control group of Rats for 6th month

	1st day		6th month	
R.no	**Control**	**Experimental**	**Control**	**Experimental**
1	90	98	103	132
2	100	97	106	136
3	81	99	89	140
4	84	92	101	143
5	89	103	83	146
6	87	105	99	148
7	86	97	97	141

Table 7: Difference in glucose of rats after 6 months

R.no	Control	Experimental
1	13	34
2	6	39
3	8	41
4	17	51
5	6	43
6	12	43
7	11	44

Microscopic Finding

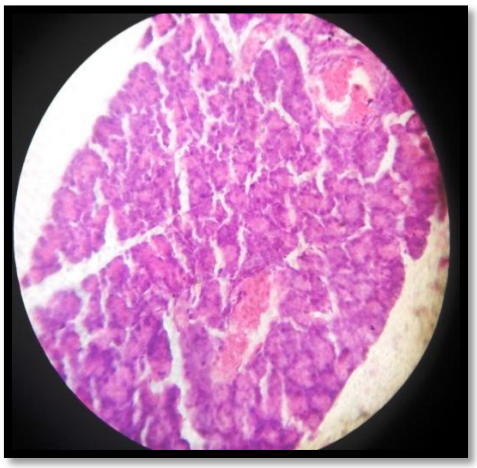

Fig 4:- Microscopic picture showing control group of rats.

1. Control: Majority is formed by the presence of exocrine part of pancreas that is the serous cells. Arranged in small lobule.
2. Lobules are demarcated by thin connective tissue septa.
3. Within the serous acini are the isolated pancreatic acini called as Pancreatic islets which represent the endocrine part.
4. Presence of duct is well appreciated

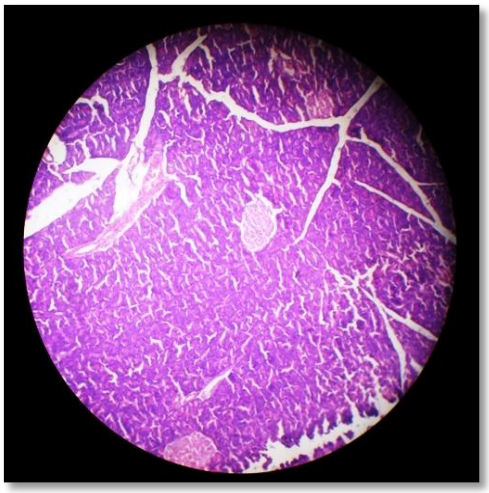

Fig 5:- Microscopic picture showing 2nd month of experimental group of rats.

2nd Month

No major appreciable changes were observed in the microscopic structure of pancreas.

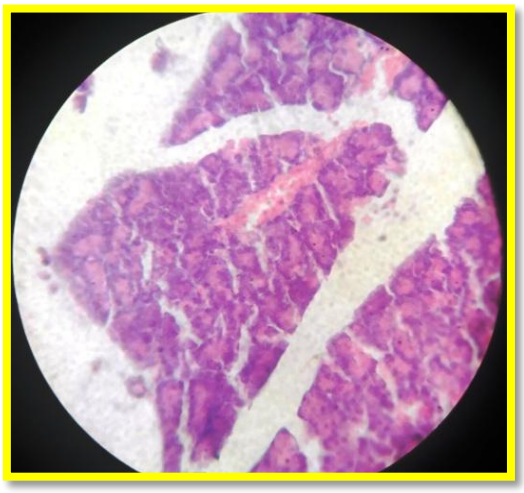

Fig 6: Microscopic picture showing 4th month of experimental group of rats.

4th Month

Rats sacrificed after second month of radiation doses showed changes in the histological picture as the acini showed disturbances in architecture also the blood vessels showed engorgement.

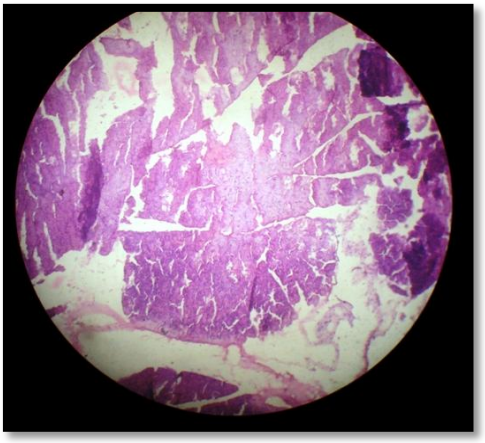

Fig 7a:- Microscopic picture showing 6th month of experimental group of rats.

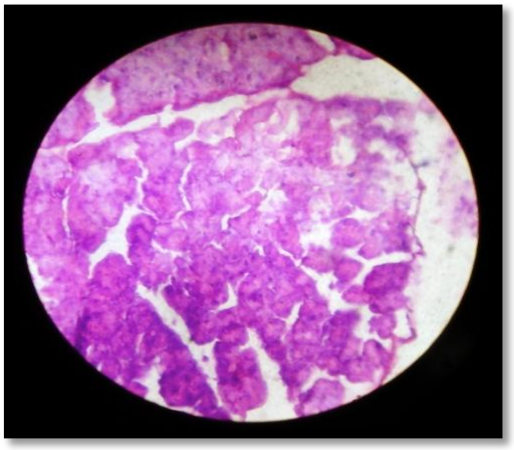

Fig 7b:- Microscopic picture showing 6th month of experimental group of rats at higher magnification.

6th Month

Clear distinction of acini was missing.

Shape of the acini were found distorted

Results

Glucose analysis

Table 8: Statistical analysis of glucose level at 2nd month

Group	Mean	SD	P-Value
Control	98.14285714	6.593647737	**0.085**
Experimental	105.5714	8.182443	

Table 9: Statistical analysis of glucose level at 4th month

Group	Mean	SD	P-Value
Control	119	3.545621042	**0.31**
Experimental	115	9.433981	

Table 10: Statistical analysis of glucose level at 6th month

Group	Mean	SD	P-Value
Control	115	9.433981132	**0.0013(very significant)**
Experimental	137	10.36018	

As per the analysis of glucose level during six month of studies we found that there is a continious increase in the level of glucose with increase in the dose of radiation. (table 1)

Even the statistical analysis of the data says that value obtained during 6th month of study is quiet statistically significant.(table 10)

Microscopic Analysis

1. After the 2nd month of exposure no major changes which could be appreciated were seen at the microscopic level.(fig 5)
2. After the 4th month of exposure there occurs a disturbance in acini of pancreas architecturally and also the blood vessels were engorged.(fig 6)
3. After the 6th month of exposure clear cut distinction of the acini was missing and the architecture was very much distorted. Also the blood vessels were more engorge.(fig 7a,b)

Discussion

The Electromagnetic Field Radiation generated by mobile phones may affect different organs and their functions via three mechanisms: an EMW-specific effect; a thermal molecular effect, or a combination of both[20]. Animal model studies have shown that electromagnetic field radiation generated by mobile phones has a broad range of damaging effects on different organs/systems. As far as the present study is concerned, we found that long-term use of mobile phones can cause inflammation in pancreatic cells of albino rats as compared to their matched control. Moreover, the pancreatic inflammation increased with the duration of exposure to mobile phone radiation.

Imaida et al.[21] conducted a study on rats exposed to nearfield EMR. They reported that the histopathological findings in the pancreas revealed

changes, but the differences among the groups were not significant.

Oral et al.[22] observed that exposure to 900-MHz radiation emitted by mobile phones can cause endometrial apoptosis and oxidative stress in rats.

Lahijani et al.[23] demonstrated the histopatho-logical and ultra-structural change in the livers of preincubated chicken embryos exposed to EMFs.

Keeping in mind the results of previous studies, it can be ascertained that long term use of mobile phones can cause several effects, including inflammation of the pancreas. Since there was not much literature in descriptions of any association of mobile phones and their effects on pancreatic cells, in the present study we were prompted to study the morphological and histological findings in pancreatic cells of albino rats.

Conclusion

1) There is increase in the level of glucose with increase in the exposure which is even statistically significant and may be due to disturbance in beta cells of pancreas.(table 1)
2) With increase in duration of time and exposure changes are taking place in pancreas at microscopic level.(Fig 6,7a,b)

Since exposure to mobile phone radiation is causing changes at the level of glucose and even at microscopic level of pancreas this may be a predisposing factor for diabeties.

Hence we should use this device very judiciously.

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