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Effect of cell phone on sperm cells in albino rat

Sahoo Himanshu Bhusan[1*], Dwivedi Abhishek[1] and Argal Ameeta[1]

1, Vedica College of Pharmacy, Bhopal, (M.P.) - India
2, Rajiv Gandhi College of Pharmacy, Bhopal, (M.P.) - India

Abstract

With the increase use of cell phones, there are possible interactions of electromagnetic radiation hazard on human beings and their offspring. The recent upsurges of global interest of cell phone have created a fresh impetus on the development of natural disaster, which may or may not lead to cancer or birth defects. The objective of the biological evaluation is to find out the potential of cell phone on sperm cells having some new unknown effects. However the health risks may generate from indirect consequence of cell phone e.g. Cognitive dysfunction, Amnesia, Obesity, Increasing stress, Insomonia, Brain tumour and may have carcinogenic or mutagenic potentials. Here the research work is based on the effect of cell phone on sperm cell by using Albino rat of One month study in a special designed cage. After termination period, there is comparison between Control group (Without cell phone treated group) and treated group (with cell phone). The present finding concludes that there is Significant damage 54 % (* $P < 0.05$) of sperm cells in cell phone treated group.

Keywords: Cell phone, Electromagnetic radiation, Designed cage, Sperm cell.

Introduction

Importantly, the local prevailing lifestyle is associated with major public health problems i.e. the use of tobacco, smoking of cigarette, flooding of cell phone in world market, excessive drinking of alcohol beverages and imbalance of nutritional habits viz. taking high fats, salt, very less vegetables and fruits. So greater effort are needed to inform people to change their life style, to educate their young generation towards health promoting personal habits, to control the public opinion against superstition and to spread awareness amongst the masses in political level. Among all these all unknown factors, Cell phone flooding is drudgery problem which spread its tentacle among world population by crippling the activity of human being by without killing or ends by killing. The human male has one of the poorest sperm production rates of any animal on earth. Whereas most animals produce 20-25 million sperm per gram of testicles per day, human males only produce 4 million. The gorilla is even worse, and has a penis and scrotum that are so small; they are hardly visible.[1]

Epididymal transit is the movement of sperm cell from head through body to tail of the epididymis. Sperm cells are stored in the caudal epididymis at the end of the Spermatogenesis, which can be influenced by age, diet, drug, temperature and successive ejaculation.[2-3] The normal cell of albino rat consists of hook shaped head, a thin neck, mid piece (Acrosome) and tail for whipping. It is only in rats and mice that the head of spermatozoa terminate in a distinct hook shape.[4]

Infertility is inability to conceive after a year of sexual intercourse without the use of contraceptives. In half of the cases, the major causative factor is the male. Males are exposed to the effect of various environmental factors which may decrease their reproductive capabilities. A hazardous effect on male fertility may be manifested by a decrease in the amount of sperm cells, disorder their mortality, as well as structure. The causative agents may be chemical substances, ionizing radiation, Stress, as well as electromagnetic waves.[5-7]

*** Corresponding Author:**
E-mail: bhusan.himanshu@yahoo.co.in, Mob: 08103092353

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Material and methods

Chemicals and reagent: Normal Saline, Methanol (HPLC grade, RFCL Ltd, India.), Eosin Dye (Lobachemie chemical).

Equipment: Cell phone (Nokia N 97), Special designed cage (such that a wooden box is fitted as close to the wall of cage as cell phone stand), Phase contrast Microscope (Nikon Eclipse E200, Japan).

Animal: Male albino rat of Wistar strain (12-16 weeks old and 125-150 gm of body weight) are collected from animal house. They are housed in special designed cage and provided with normal diet and water ads libitium. The experimental room was maintained 12 hour light-dark cycle (Automatically controlled), Room Temp 26 ± 2^{0} C and 45-55 % relative humidity till termination period. After 3-5 days acclimatization period, the animals were taken for experimental purposes. All animals were exposed only once to every experiment.

Design of Experiment: The experiment was performed after getting an approval by the Institutional Animal Ethical Committee. The rats were divided into two groups of six rats each. Group-1 as Control group (Kept without cell phone) and Group-2 as Treated group(Kept with cell phone) in special designed cage.

Both groups were provided with normal diet and water ad libitium under above specified laboratory condition for one month. After termination period, Sperm morphology Assay was Conducted.

Sperm morphology Assay: Both groups of animals were sacrificed. Epididymis was removed and minced in 1 ml of normal saline. The suspension was filtered through a nylon mesh into an eppendroff. To the filtrate, one drop of 1% Eosin dye was added and kept for 30 mints.[8] Two or three drops of this was spreaded over the slide to fix the material. Slides were rinsed and screened for the sperm morphological abnormalities under a high power microscope. Thousands of sperms per group were screened and the sperm presenting the defect in shape and structure of either head or tail or both were considered as abnormal; and the data was presented as percentage incidence of total abnormalities.

Statistical Analysis: The data was expressed as Mean ± S.E. The Student-Newman-Keul test was applied to evaluate the statistical significance of the data obtained, considering $P < 0.05$ as a limit of Significance.

Results and Conclusion

Sperm is the reproductive cell of the male, which contains genetic information and participates in the act of fertilization of an ovum. They are produced in the seminiferous tubules of the testes. The production of sperm is controlled by follicle stimulating hormone released from the anterior pituitary gland. Spermatogenesis takes place when in the tubule undergo meiosis to produce sperm cell with 23 chromosomes. All other body cells have 23 pairs of chromosomes. Spermatids mature into spermatozoa in the epididymis. For a male to be fertile, he must make normal amount of motile sperm and transport these through the epididymis and vas deferens and be capable of erection and ejaculation during which sperms are deposited in the vagina of a fertile female. The sperm must then be capable of swimming through the cervical mucus and up into the female's be able to identify the eggs, stick to its outer coating, expose enzymes that can dissolve through the outer egg shell(Acrosome reaction) and thrust forward through the shell to fertilize the egg. Once fusion has occurred, sperm DNA must be sufficiently normal to allow the embryo to develop. Sperm have four parts with specific functions. These parts are the head, mid piece, tail and Acrosome.[9-10]

Head: It contains 23 chromosomes (genetic material) capable of merging with an egg to produce new individuals.

Acrosome: It resembles a torque which covers the upper portion of the head of the sperm. The covering contains enzymes that help the sperm to penetrate the egg.

Midpiece: It connects the head of the sperm to the tail. It contains many mitochondria that produce ATP. This ATP is used to move the microtubules in the tail and create propulsion for the sperm. Once in the female system, sperm will swim for up to 2 days, looking for an egg.

Tail: It is really a flagellum with the common 9+2 arrangement of microtubules within the tail move past each other and moves the tail in a whip-like motion. ATP provided by the midpiece, which is required for this movement.[11-13]

Sperm morphology Assay: Male infertility can result from abnormal spermatogenesis, sperm motility, errection, ejaculation or failure of sperm egg interactions, genetic abnormalities, excessive heat or electrostatic electricity around the testicles, lifestyle problems such as excessive alcohol, smoking, stress and anti-cancer chemotherapy.[14]

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Sperm abnormalities are induced by exogenous compounds via point mutation or due to the inimical nature of chemicals on spermatogenesis.

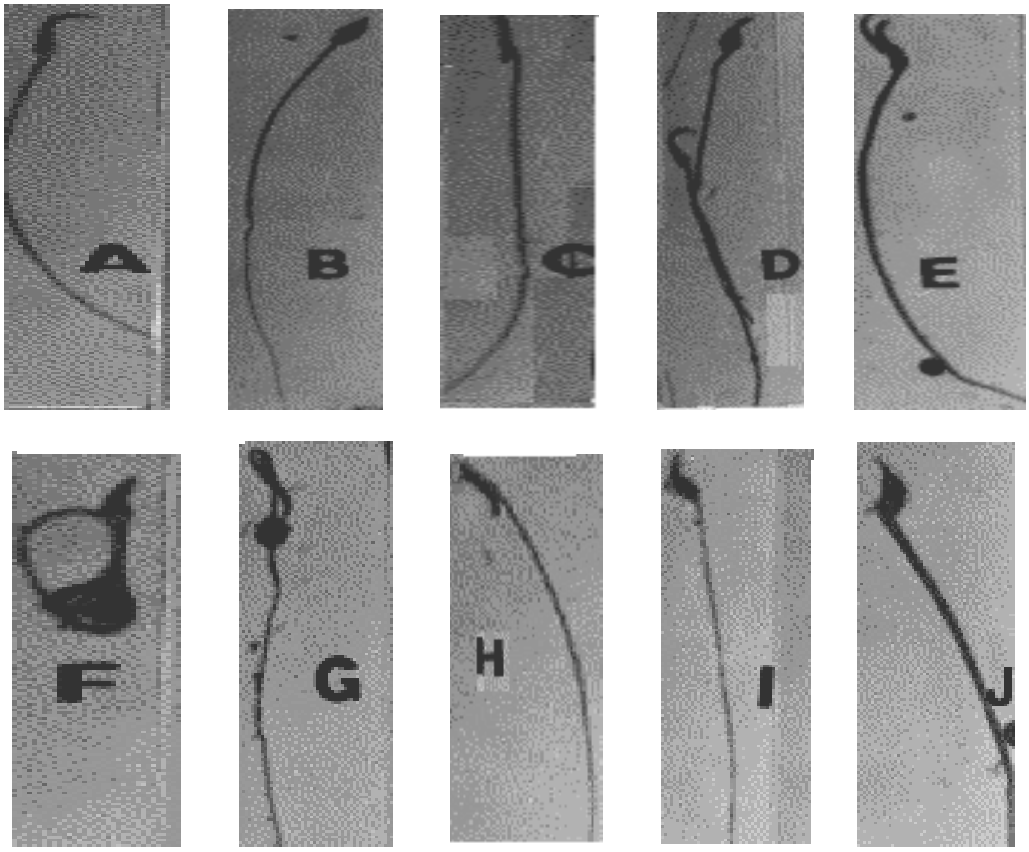

Fig 1: - Different types of sperm abnormalities are as follows

A) Normal sperm;(B) Amorphous head;(C) Hook less;(D) Banana; (E) Double-headed;(F) Coiled with microcephaly; G) Bent at cephalocaudal junction;(H) Bent with projecting filaments;(I) Microcephaly with tail defect; and (J) Defective head with duplication of tail.

The increasing use of cell phone or wireless communication devices has led to concerns that exposure to electromagnetic waves emitted by these devices may cause adverse health effect i.e. DNA double strand break and alteration in antioxidant enzyme activity[15- 16] Moreover, Reactive oxygen species(ROS) may cause a defect in sperm function through lipid peroxidation(LPO). This is because spermatozoa, unlike other cells are unique structure and function and are susceptible to damage by LPO [17.] This is because spermatozoa, unlike other cells, are unique in structure and function, and are susceptible to damage by LPO. ROS are produced by a variety of semen components including immotile or morphologically abnormal spermatozoa, leucocytes, and morphologically normal but functionally abnormal spermatozoa.[18] The study involving 361 men attending an infertility clinic suggested that use of cell phones adversely affects the quality of semen by decreasing sperm counts, motility, viability and morphology, which might contribute to male infertility.[19] The adverse effect of microwave radiations on animal model already has been established, where a decrease in diameter of seminiferous tubule[20-21] Weight of testicular organ (i.e. Caput, Cauda and Corpus), Sperm count [22] and destruction in Leydig cells were obtained. The results obtained from the study of the effect of cell phone on sperm cells are shown in Table-1. The sperm abnormalities are expressed as according to shape or structure compared to normal sperm such as Amorphous head, Hookless Sperm,

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Banana shaped, double headed, Coiled with microcephaly, Bent at Cephalocaudal region, Bent with projecting filaments, Microcephaly with tail defect and defective head with duplication of tail etc. After one month treatment, it was observed that use of cell phone has adverse effect on fertility potential of the male animal. This indicates that there is possibility of lower fertility rate of copulation or insemination [23]. After termination period, we found that the significant sperm abnormalities seen in cell phone treated groups as compared with control group by using the Student –Newman-Keuls test, where $P < 0.05$ as a limit of Significance. An increase in the percentage of sperm morphological abnormalities is associated with the duration of exposure to the waves emitted by cell phone. While analyzing the scientific reports pertaining to electromagnetic waves, it may be suspected that the use of cell phones can decrease male fertility. The presented results of studies require continuation within a longer time span and on a larger group of male in future.

Table-1: Evaluation of Sperm abnormalities on various morphological parameters of sperm cell i.e. Control Vs Treated group

Parameters	Control group (Without cell phone)	Treated group (With cell phone)
Normal	76.66±0.8819	45.10 ± 1.219
Curved flagellum	10.66±0.6667	13.12 ± 0.8484
Flagellum with ansa	7.33±0.3333	* 13.8 ± 1.083
Bent at cephalocaudal region	2.66±0.3333	6.4 ± 0.6899
Amorphous	0.33±0.3333	4.16 ± 0.6987
Double Headed	-	0.31 ± 0.2018
Multiple Abnormality	1.33±0.3333	* 7.34 ± 0.6931
Double tailed	-	-
Hookless flagella	-	-
Coiled with Microcephali	1.0±0.5774	* 9.7 ± 0.4527
Total Sperm Abnormality (%)	23.54	* 54.88 ± 1.219

All values are expressed in Mean ± S.E. (Where N=6), by using Student-Newman-Keuls Test, *P < 0.05 Considered as limit of significance, when compared with control Group.

The difference between two groups differ significantly (*P < 0.05), e.g. in case of Flagellum with ansa in control group (7.33±0.3333) Vs treated group (13.8 ± 1.083), Multiple abnormality in control group (1.33±0.3333) Vs treated group (7.34 ± 0.6931) and coiled with microcephaly in control group (1.0±0.5774) Vs treated group (9.7 ± 0.4527).

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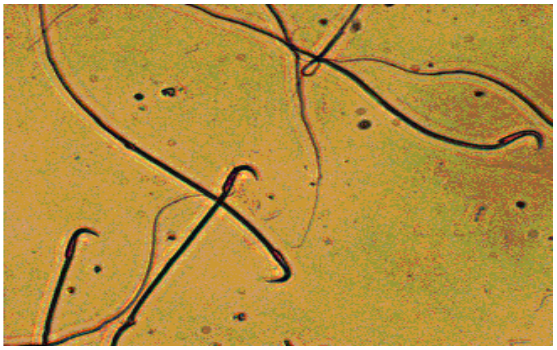

Fig. 2: Control Group (Slide-1)
[Normal Sperm Cell]

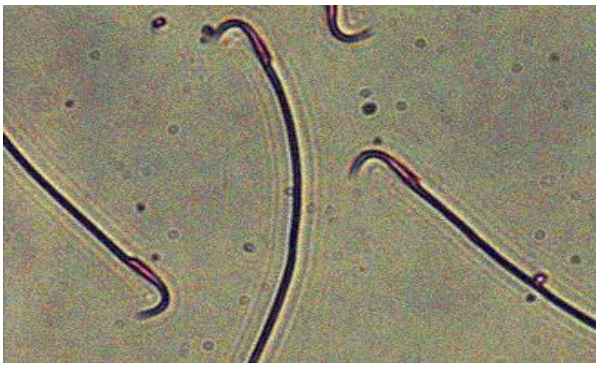

Fig. 3: Control Group (Slide-2)
[Normal Sperm Cell]

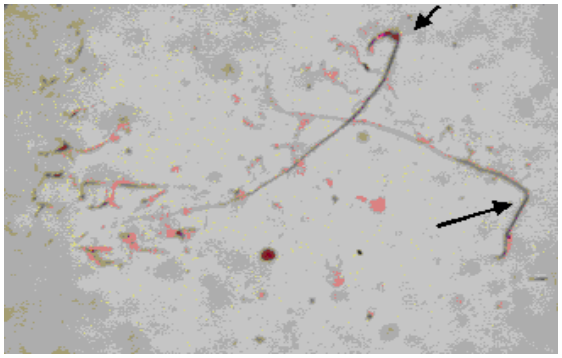

Fig. 4: Treated Group (Slide-1)
[Bent at Cephalocaudal Region]

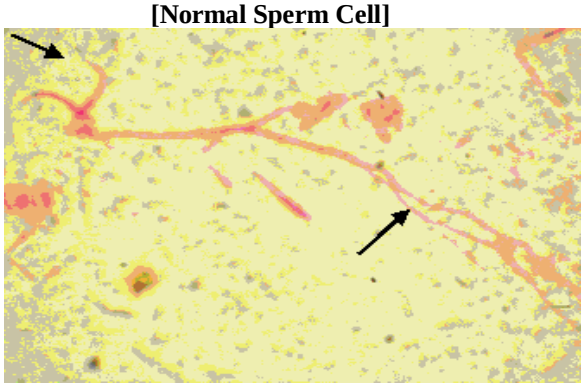

Fig. 4: Treated Group (Slide-2)
[Duplication at head & tail]

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