

Histological Studies of the Low Frequency Electromagnetic Fields Effect on Liver, Testes and Kidney in Guinea Pig

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Abstract: This study deals with the effects of 2 and 4 hours exposure of guinea pigs to 0.013 μT and 0.207 μT Electromagnetic Fields (EMF) on the morphology of liver, kidney and testes. Two groups of guinea pigs were continuously exposed for 5 days to EMF of 0.013 μT for 2 and 4 hours per day. Other two groups were exposed for 5 days to EMF of 0.207 μT for 2 and 4 hours per day. A number of effects were observed in some groups which suggest some magnitude of EMF affected in body tissue.

Key words: Electromagnetic field . testes . liver . kidney . guinea pig

INTRODUCTION

In modern society, humans are commonly exposed to Magnetic Field (MF) including Extremely Low Frequency Magnetic Field (ELF_MF), which is generally produced by power lines and many kinds of electric appliances. One of the mostly discussed contemporary problems is if ELF_MF can affect biological systems [1-3]. There have been of considerable discussions about the biological response to the exposure of Electromagnetic Field (EMF). Public hazard and health effect is one of the major concerns [4]. Extremely low frequency (ELF) electromagnetic fields for many years were considered as an absolutely neutral form of radiation, but epidemiological data and results of experimental *in vitro* and *in vivo* studies carried out in recent year have caused more attention to be paid to low frequency 50 or 60 Hz [5].

Extremely low frequency EMF covers the frequency range of 3 Hz to 3 KHz but the most intensely studied frequency is the power frequency of 50/60 Hz because electric appliances and power lines emit 50/60 Hz EMF [6]. The main goal of this study was research of tissue changes on Liver, Testes and Kidney.

MATERIALS AND METHODS

Animals: Male Guinea pigs weighing 363.17 ± 10.58 g (8-9 weeks old) were kept in a room with a 12:12

light/dark photoperiod, temperature of 20-30°C and relative humidity of 50-60%. The Guinea Pigs were housed in plastic cages. Animals were divided into 6 groups. Group A was exposed, 2 h daily for 5 days to nil magnitude. Group B was exposed 2 hours daily for 5 days to a field of 0.013 μT with 5 Hz frequency. Group C was exposed to a field of 0.207 μT with 50 Hz frequency for the same period of time. Group D was treated for 5 days, with 4 h daily exposure to a field of 0.013 μT with 5 Hz frequency. Group E treated for 5 days, with 4 h daily to a field of 0.207 μT with 50 Hz. Control group (F) treated for 5 days, with 4 h daily at nil fields.

Electromagnetic field exposure system: Solenoid (electromagnetic field generator) of a cylindrical armature winding including of 15 rings of armature winding with each ring consisting 100 rounds of wire i.e. a total of 1500 rounds of wire were used in this solenoid. For generating field rate with intended frequencies, function generator connected to solenoid was used (Germany PHYWE make). At the end of experimental time, the control and exposed Guinea Pigs become unconscious with Ether then the liver, kidney and testis were dissected out quickly and for the histological studies, small pieces of the previous tissues were fixed in formalin to get 5 μm thick paraffin sections to be stained with haematoxylin and eosin [7].

RESULTS AND DISCUSSION

The macroscopical morphology of the organs liver, kidney and testes was not normal in some groups.

Liver: In group D were observed the highly *cytoplasmic vacuolation of glycogen* (Fig. 3).

Kidney: The micrographs showed that D and E groups of electromagnetic fields lead to swell in epithelial cells of kidneys' tubules and subsequently cell necrosis that cause to decrease in kidney luminal tubules (Fig. 1). Also glumerulia expanded and adhered to Bumans' capsule (Fig. 2).

Testes: Groups B and D have changes that consist atrophy seminiferous tubes and interstitial tissue and decrease of leydig cells (Fig. 4).

The results showed that EMF didn't have disturbed effects in liver organ, but vacuolation of the cytoplasm was reported in this work that because of glycogenolysis inhibition by EMF. In other organs (kidney, adrenal and testes) indicated disorders of

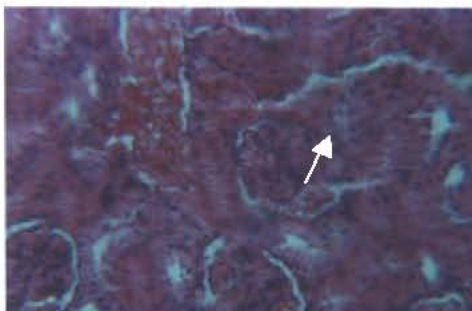


Fig. 1: Light micrographs of kidney from exposed guinea pigs 5 days in D and E groups showing swell in epithelial cells of kidneys' tubules and subsequently cell necrosis that cause to decrease in kidney luminal tubules. H and E, X400

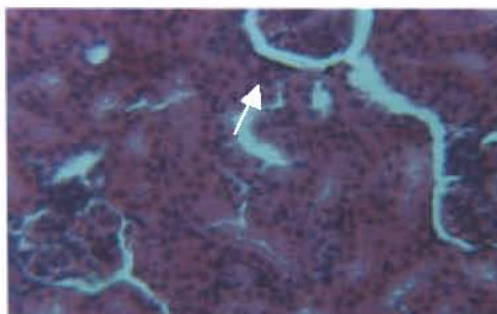


Fig. 2: Light micrographs of kidney from exposed guinea pigs 5 days in D and E groups showing glumerulia expanded and adhered to Bumans' capsule. H and E, X400

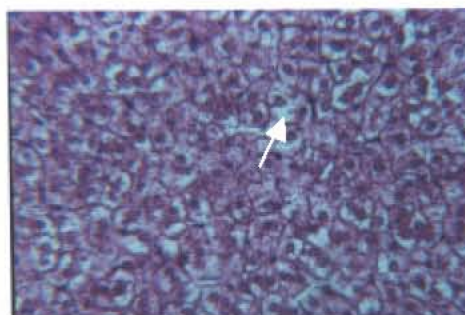


Fig. 3: Light micrograph of liver guinea pigs showing the highly cytoplasmic vacuolation of glycogen in D group. H and E, X400

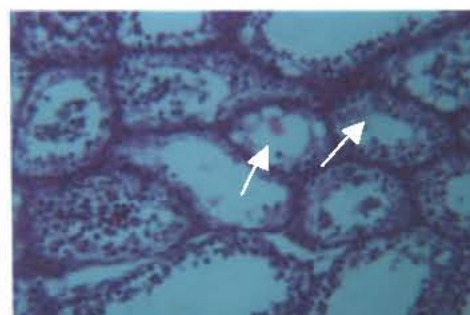


Fig. 4: Section of testes of guinea pigs showing atrophy seminiferous tubes and interstitial tissue and decrease of leydig cells. (H and E, X400)

tissue. In case of function mechanism of electromagnetic fields, it 's believed that EMF with high energy waves cause to rise local temperature where waves contact together and like ionizing rays through formation of free radicals, create their destructive effects [8, 9]. Free radicals attacking lipid and changing their natures and breaking protein bounds cause cell damaging [10, 11]. In testes EMF in groups B and D cause to increase the inter seminiferous tubes space and damaging leydig cells that increase the inter-tissual space because of increasing intra-tissual liquid and emerging edema that probably arise from testes tissue cells damage [12, 13]. In kidney EMF in groups D and E lead to swell in epithelial cells of kidneys' tubules and subsequently cell necrosis that cause to decrease in kidney luminal tubules also glumerulia expanded and adhered to Bumans' capsule. EMF causes glumeruli expanding for reason increasing of glomerulus's endothelial cells.

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