

Effects of 900 MHz Electromagnetic Fields Emitted by Cellular Phone on Total Cholesterol and Triglyceride Levels of Plasma in Syrian Hamsters (*mesocricetus auratus*)

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ABSTRACT

In this study, the effects of exposure to a 900 MHz electromagnetic field (EMF) on plasma cholesterol and triglyceride levels of adult male Syrian hamsters were evaluated. Seventy two hamsters were used in three independent groups, 24 of which served as controls (without exposure to stress and EMF), 24 of which were exposed to a 900 MHz EMF for 10 days and 24 of which were exposed to a 900 MHz EMF for 50 days. The exposures were performed 1 h/d to a 900 MHz EMF emitted by cellular phones. Levels of total cholesterol and triglyceride in plasma samples were measured. We found significant differences for concentrations of cholesterol ($p<0.05$) and triglyceride ($p<0.01$) between experimental groups. Total cholesterol rate of the plasma in group2 with short term exposure and group3 with long term exposure to EMF (70.35 mg/dl and 65.66 mg/dl respectively) change significantly, in compared with control groups (75.33 mg/dl). Also, plasma Triglyceride, showed similar changes. Consequently, cellular phones EMF (900 MHz) may decrease plasma total cholesterol and triglyceride rates in rodents significantly, especially in long term. These alterations may be due to a reversible accumulation of either triglycerides or of their precursors in liver following acute exposure to a 900 MHz EMF.

Key Words: electromagnetic field, cholesterol, triglyceride, cellular phone, Hamster

INTRODUCTION

With growth in mobile communications, exposure to non-ionizing electromagnetic field (EMF) has increased due to mobile handset and base station antenna. EMF penetrates the animal body and act on all organs, altering the cell membrane potential and the distribution of ions and dipoles. These alterations may influence biochemical processes in the cell [1].

It's shown that, Microwaves (as specially waves from electromagnetic fields of cellular phones) cause to produce temperature and energy distribution in live tissues [2]. Also, these waves with extremely low frequency (in long term) make to get some variations in structure and Biochemical properties of the tissues [3]. according to the studies about of biological effects of EMF emitted from cellular phones (GSM: 900MHz) on laboratory animals, it is reported that 900 MHz EMF make to change the rate of some Endocrine hormones in the rats [4] and hamsters [5] also, It makes oxidative stress in the rats and rabbits [6,7].

Some of the related studies with different frequencies of EMF and magnetic fields (MF) showed that MFs and EMFs may cause decrease in total cholesterol and triglyceride of plasma in human and laboratory animals [8,9,10,11,12,13] also, this effects was more significant in longer time period in exposure to MF and EMF [10,12]. Although there have been many studies in the case of biological effects of EMF with different frequency and time periods, unfortunately it hasn't been studied any possible direct effects of cellular phone EMF (GSM: 900 MHz) on plasma lipids rate such as cholesterol and triglyceride.

Aim of this study was investigated to the effect of 900 MHz EMF emitted from cellular phones on plasma total cholesterol and triglyceride concentration in two exposing durations as short and long term .

Also, we want to answer to this question: Do EMF of cellular phones with reported biological negative effects makes to decrease the cholesterol rates and triglyceride in hamsters?

MATERIALS AND METHODS

-Experimental animals and conditions

72 male Syrian hamsters (each weighing 150 – 160 g at the time of experiment) were used. Animals were divided into 3 groups that each group include 24 hamsters; 1) control group, without of any EMF Exposure, group 2) in short term exposure to EMF, and group 3) in long term exposure to EMF. Animals were selected and each of them maintained concurrent with other groups without (EMF) in separated cages. Male hamsters of group 2 in separated cages were under 900 MHz EMF (emitted from Cellular Phone) for 10 days 1 hour daily. Male hamsters of group 3 in separated cages for 50 days were under 900 MHz EMF for 1 hour daily. They were acclimated for 1 week prior to use, maintained on 12h light : 12h dark cycle in a temperature – regulated (22-23°C) animal room with a continue free access to water and food. The animal studies were carried out in adherence to the guidelines established in the 'Guide for the care and use of Laboratory Animals, US Department of Health and Human Resources (NIH1985). In this experiment, hamsters were in condition similar to pet housing systems. The whole body of each hamster in aquarium-like glass cages covered with aluminum sheets was exposed to electromagnetic fields emitted from the antenna of cellular phone (Sony Ericsson® K750i, condition: ON, SAR: 0.66w/kg), [figure.1]. In the present study, a 900MHz EMF for GSM (Global System for Mobile communication at 900 MHz) system was used.

In experimental time period contributed in exposure to EMF of cellular phone (900 MHz) on some of biochemistry characters serum (cholesterol and triglyceride especially) of Hamster concentration well. Study was conducted in Shabestar university laboratory in spring, 2008. At the end of the experiment, animals were anesthetized by chloroform and blood samples were drawn from the heart ventricle into syringe without anticoagulant from experimental groups, and then the serum total cholesterol and triglyceride concentration levels were measured by Chemiluminescence Immunoassay (Liaison Co[®], Italy) and values of in exposure groups (Group 2 & 3) was compared with control group (without any electromagnetic field).

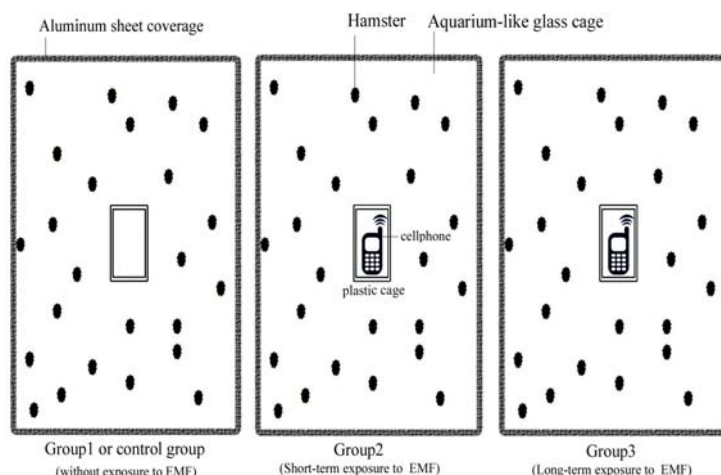


Figure1: Schema of cellular phone EMFs exposure condition

-Statistical Analysis

Data that were collected subjected to analysis of variance, and significant differences. Observed data in means subjected to Duncan's multiple range tests. All data were analyzed by ANOVA using the general linear model (GLM) procedures of the SAS Institute (SAS institute, 2000).

RESULTS AND DISCUSSION

In table 1, the total cholesterol and triglyceride rates of plasma of the hamsters for control group (without of EMF), 10 and 50 days under EMF of cellular phones are presented.

There was a significant difference for concentrations of cholesterol ($p < 0.05$) and triglyceride ($p < 0.01$) between plasma of hamsters in experimental groups.

Total cholesterol concentration of the plasma in group2 with short term Exposure and group3 with long term exposure to EMF (70.35 mg/dl and 65.66 mg/dl respectively) decrease significantly, in compared with control groups (75.33 mg/dl). Also, plasma Triglyceride, showed similar changes (control: 90.33 mg/dl, 72.33 and 58.67 mg/dl in group1 and 2, respectively) [Table 1].

Table1. Concentrations of plasma Total cholesterol and Triglyceride in exposure to cellular phone electromagnetic fields (900 MHz) in Syrian Hamsters

| Experimental groups | exposure time | Total cholesterol (mg/dl) | Triglyceride (mg/dl) |
|-----------------------|------------------|---------------------------|----------------------|
| | | * | ** |
| 1 control | without exposure | 75.33 ^a | 90.33 ^a |
| 2 Short-term exposure | 10 day exposure | 70.33 ^{a b} | 72.33 ^b |
| 3 Long-term exposure | 50 day exposure | 65.66 ^b | 58.67 ^c |
| SEM | - | 1.14 | 2.03 |

^{a,b}Means within columns with no common superscript differ significantly

($P < 0.05$) & ($P < 0.01$)

Linear decrease in total cholesterol concentration incidence with experiment time period and so triglyceride rate decreasing in short term exposure to EMF was more significant in compared with total cholesterol [Table 1].

Studies show the increasing of cholesterol and triglyceride concentrations in rodents in exposure to 50 Hz MF [12, 13]. In Torres-Duran *et al.* [14] in first 24 hours of the experiment, occurs high intensity of the plasma lipids metabolism. So, rats in exposure to 60 HZ EMF had a lower plasma lipids rate as same as this experiment results.

Although this study there show a lower concentration of the plasma lipids in experimental groups in exposure to 900 Hz EMF in compared with control groups [table 1] in laboratory animal , but some of the humans studies such as Israel *et al.* [15] in Physiotherapists in exposure to EMF, show the related rates increasing.

Consequently, cellular phones EMF (900 MHz) may decrease plasma total cholesterol and triglyceride rates in rodents significantly, especially in long time. Probably its reason is related to high metabolism rate of the lipids in body.

The mechanisms for the effects of EMF on lipid metabolism do not well understand yet [9], but these alterations may be due to a reversible accumulation of either triglycerides or of their precursors in liver following acute exposure to a 900 MHz EMF. Because of limited data sources and reports at this case, it is proposed that EMF effects on plasma lipids and relative mechanisms need to be studied in long time.

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