

The effect of low-frequency electromagnetic field (ELF-EMF) on serum paraoxanase (PON1) and malondialdehyde (MDA) levels

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Abstract

Background: This study was carried out on individuals using constantly blow-dryers and hair-dryers in hair-dressing saloons. We aimed to investigate the effects of ELF-EMF caused by blow/hair dryers on PON1 and MDA serum levels of users.

Method: The study was conducted on 32 individuals (mean age; 24± 6) selected randomly from among those constantly using blow/hair dryers in haircutting and hairdressing saloons.

The subjects included into the study were divided into two groups: group 1 (n=16, 8 males, 8 females using hairdresser) as experimental group; Group 2 (n=16, 8 males, 8 females non-using hairdresser) as control group.

Results: In the study, PON 1 and MDA values of the subjects (Males and Females) in control and experimental groups were compared separately by taking the same-genders into account.

PON 1 levels for males in control group were found as mean±std=52,71±14,43; and for males in experimental group as mean±std=40.32±6.18, $p<0.043$. MDA levels for males in control group were found as mean±std =14.37±4.12, for males in experimental group as mean±std=18.17±3.49, $p<0.05$.

PON 1 levels for females in control group were measured as mean±std=67.87±8.10, for females in experimental group as mean±std=32.67±8.01, $p<0.0001$. MDA levels for females in control group were determined as mean±std=21.12±6.58, for females in experimental group as mean±std=18.42±4.08, $p<0.34$.

In the study, it was observed that PON 1 and MDA values measured for those individuals who constantly use blow/hair dryers and thus are exposed to ELF-EMF varied considerably.

Conclusion: It was concluded that individuals who work constantly with electric appliances producing electromagnetic field should be informed of the hazards of these machines, and preventive measures should be taken against these hazards

Keywords: ELF-EMF, PON1, MDA, hair dryer

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Introduction

Recently, the concerns of people about the possible effects of the electromagnetic fields (EMFs) on their health have been heightened with the increasing distribution and utilization of power frequency electric currents. For this reason, most scientists have focused on the effects of extremely low frequency (ELF; $f < 300$ Hz) EMF exposure on people's health and they have conducted several epidemiological and laboratory studies to define the risks of EMF exposures¹. In recent years several lines of evidence have indicated that serum paraoxonase (PON1), and perhaps other mammalian paraoxonases, act as important guardians against cellular damage from toxic agents, such as organophosphates, oxidized lipids in the plasma low density lipoproteins (LDL), and against bacterial endotoxins². The PON1 gene product, serum paraoxonase, is synthesized by the liver and associated with HDL. It is capable of hydrolyzing lipid peroxides in vitro and is therefore believed to be responsible, at least in part, for these anti-oxidative and anti-inflammatory properties³. Radiation, oxygen toxicity, postischemic reperfusion injury, infections, inflammations, as well as aging-related diseases, cataracts, atherosclerosis, carcinogenesis, diabetes and neurological diseases are among the factors increasing the production of oxygen free radicals. The increase in very low levels of lipid peroxidation in healthy tissues free oxygen radicals can be used as an indication of tissue damage. One of the degradation products of lipid peroxidation, malondialdehyde (MDA)⁴. This study was carried out on individuals using constantly blow-dryers and hair-dryers in hair-dressing saloons. We aimed to investigate the effects of ELF-EMF caused by blow/hair dryers on PON1 and MDA serum levels of users.

Materials and Methods

The study was conducted on 32 individuals (mean age; 24 ± 6) selected randomly from among those constantly using blow/hair dryers in haircutting and hairdressing saloons.

The subjects included into the study were divided into two groups: group 1 (n=16, 8 males, 8 females using hairdresser) as experimental group; Group 2 (n=16, 8 males, 8 females non-using hairdresser) as control group.

In the serum of the subjects, PON 1 serum levels (U/L) were measured spectrophotometrically⁵. MDA serum levels ($\mu\text{Mol/L}$), however, were measured by inducing MDA-TB (Thiobarbituric acid) complex of peroxidation products⁶.

Statistical analysis

The statistical analyses of the data obtained in the study were performed by using SPSS 15.0 Windows Package Program. $P (p < 0.05)$ was considered significant.

Result

The statistical analyses of the data obtained in the study were performed by using SPSS 15.0 Windows Package Program. $P (p < 0.05)$ was considered significant.

In the study, PON 1 and MDA values of the subjects (Males and Females) in control and experimental groups were compared separately by taking the same-genders into account. The result of comparison of PON1 and MDA parameters are presented in Figure 1 and 2.

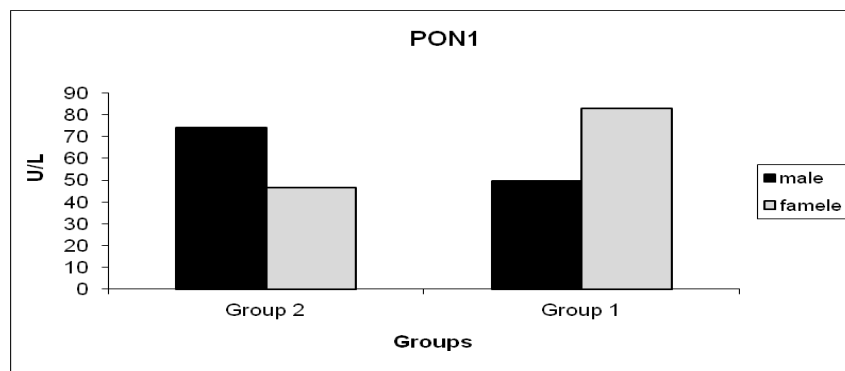


Figure 1. PON1 values (mean ± SD) for the two groups, Mann - Whitney U test

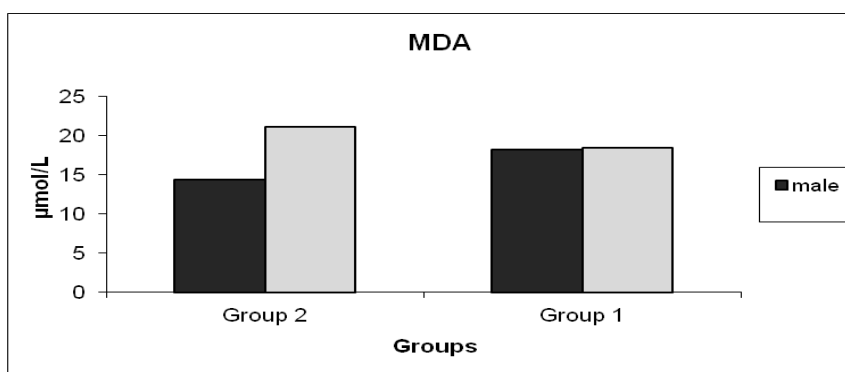


Figure 2. MDA values (mean ± SD) for the two groups, Mann - Whitney U test

PON 1 levels for males in control group were found as mean±std=52,71±14,43; and for males in experimental group as mean±std=40.32±6.18, $p<0.043$. MDA levels for males in control group were found as mean±std =14.37±4.12, for males in experimental group as mean±std=18.17±3.49, $p<0.05$.

PON 1 levels for females in control group were measured as mean±std=67.87±8.10, for females in experimental group as mean±std=32.67±8.01, $p<0.0001$. MDA levels for females in control group were determined as mean±std=21.12±6.58, for females in experimental group as mean±std=18.42±4.08, $p<0.34$.

Discussion

In the study, it was observed that PON 1 and MDA values measured for those individuals who constantly use blow/hair dryers and thus are exposed to ELF-EMF varied considerably.

It was concluded that individuals who work constantly with electric appliances producing electromagnetic field should be informed of the hazards of these machines, and preventive measures should be taken against these hazards.

In recent years, the effects of (EMF) on the activities of antioxidant enzymes were studied in various animals. In the study of Eraslan, (50 Hz 2 mT) MDA levels increased on days 60 and 90, but not on day 45, in comparison to the controls ⁷. When magnetic fields range were increased, MDA levels were also increased ⁸.

The results obtained provide evidence that rat brain is sensitive to the effects of an acute exposure to ELF-EMF. ELF-EMF may alter the antioxidant status of the brain ⁹. Paraoxonase (PON) is an

aromatic esterase that requires calcium for activity. PON is believed to play an important role in protection of LDL and HDL particles from oxidation, in antioxidant effect against lipid peroxidation on cellular membranes, and in anti-inflammatory process. Reactive oxygen species molecules are highly reactive and can attack almost every cell component, causing further damage to the surrounding tissues. An elevated oxidative stress and free oxygen radicals have been associated with the increased risks of various cancers¹⁰.

It was found a similar outcome in terms of Paraoxonase and Malondialdehyde. Samano, Eraslan and Koylu's study results show that variability are similar to ours, despite some differences. In our study, according to a study control, we found a significant increase in levels of MDA in male and a significant decrease levels of MDA in female. There with all, we found a significant decrease in levels of PON1 in male and a significant increase levels of PON1 in female. Studies on the possible harmful effects of ELF-EMF's will continue in the future. For this reason, this study, the effects of ELF-EMF's can offer contributions to in future studies.

Acknowledgements

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