

EFFECT OF OLIVE OIL ON SOME BLOOD BIOCHEMICAL PARAMETERS OF CHILDREN EXPOSED TO GSM RADIATION

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Abstract. Children exposure to radio waves near mobile phone base stations is receiving a great attention in last years. This work is focused on the effects of radiation emitted by the base stations on the children's blood and also on the conjugated effect of olive oil on their blood. Children of 6–12 years residing around base stations for more than five years are divided into three groups. The first one served as a control. The second group is assumed to be exposed only to mobile phone radiation, while the third group is exposed to mobile phone radiation and treated with 2.5 mL/day of olive oil for five weeks. The second and the third groups are living nearby mobile phone base stations (100–150) m, more than 5 years. The biochemical parameters of children blood have been evaluated. It was noticed that the concentrations of serum glucose, triglycerides, total cholesterol, and albumin are increased but total concentrations of the proteins and globulins were decreased. Signs of improvements in the previous biochemical parameters were noticed during children treatments with olive oil supplementation.

Key word: Global mobile phone radiation, olive oil, blood picture, glucose, albumin, triglycerides, total cholesterol, total proteins.

INTRODUCTION

Mobile phones are used more and more in our modern life. Also, technological devices have become essential components of our daily time on Earth. A lot of electromagnetic waves are today emitted by radar, communication equipment, mobile phone base stations, high voltage lines, radio and television transmitters, substations, and electrical equipment at home and work, in addition to many electrical systems in the environment [13, 14]. The Global System for Mobile Communications (GSM, 850–900 MHz) is currently the most extensive system for mobile telecommunications [6]. The widespread use of mobile phones in recent years has raised rapidly, and several researches have approached the

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effect of mobile phone radiation on different tissues. Many countries have tried to determine the effect of the emitted electromagnetic radiation by mobile phones which, over the last two decades, has received a rapid growth in the number of people using them. People and animals are exposed to radiofrequency electromagnetic radiation emitted by mobile phones base stations and one needs to evaluate the possible harmful effects on human health [4]. The mobile phone radiation induced damage depends on the frequency, intensity, power, and duration of exposure to the electromagnetic field [8]. Alghamdi *et al.* [4] investigated the effects of electromagnetic fields on some hematological parameters of male white mice. Exposure to electromagnetic fields is responsible for the variations of some hematological parameters in mice. Alglaib *et al.* [5] examined the histopathological effects of direct exposure to electromagnetic radiation from mobile phones in adult male albino rats. Fatma *et al.* [9] observed that the radiofrequency electromagnetic radiation of mobile phones induces oxidative stress in rat. Agarwal *et al.* [2] showed no conclusive link between male infertility and cell phone usage. Rubin *et al.* evaluated that the pain level of headache may increase during exposure, but the pain decreased immediately when exposure decreased [14]. Agarwal *et al.* evaluated the effects of mobile phone electromagnetic waves radiation during talk mode on unprocessed (neat) ejaculated human semen [3]. They observed no significant difference in sperm concentration of exposed and unexposed samples. However, the sperm motility was significantly lower in exposed samples as compared with unexposed samples. It was concluded that mobile phone radiation causes oxidative stress in neat semen and leads to decrease in spermatozoon motility and viability [4]. The effect of magnetic fields on cancer in children residing near Swedish high voltage power-lines has been evaluated by Feychting *et al.* [10]. This study is focused on the effects of electromagnetic radiation produced by the mobile base stations on the children's blood in the case of the children residing around base stations for five years and treated with olive oil.

METHODOLOGY

One hundred and twenty voluntary male children (aging 6–12 years) have been chosen for the experimental work. They were divided into three groups as follows [1]: the first group served as control, the second group was exposed to electromagnetic field (EMF) emitted from the base station radiation, and the third group was exposed to electromagnetic field radiation and orally treated with 2.5 mL/day of olive oil during the experimental periods (5 weeks). The second and the third groups lived near the mobile phone base stations (100–150 m) more than 5 years and were exposed to electromagnetic radiation with constant power in the

range of 1.4–4.7 mW/cm², measured during the experiment. The electric field was situated in the range 60–130 V/m. The antenna received the signal from mobile base stations at the specific area. The mobile system used in Gaza is GSM (Global System for Mobile), with a frequency of 900 MHz. A questionnaire including details about health was filled by the children. Blood samples were collected in order to measure some biochemical parameters of all subjects.

DATA ANALYSIS

Data were analyzed using SPSS program for windows (Statistical Package for the Social Sciences Inc. Chicago, Illinois). Mean values were compared by independent-sample t-test. Percentage change was also calculated. All values were expressed as mean $\pm$ S.E. Non-significant differences were considered when $P > 0.05$. Significant differences were considered when $P \leq 0.05$.

RESULTS AND DISCUSSION

Our results are synthetically presented in the Tables 1 and 2 as follows. The blood biochemical parameters, in the cases of children exposed to radiation and treated or not treated with olive oil, are presented in Table 1. One can notice that exposure to electromagnetic radiation alone has increased the serum glucose level by 6.8 % compared to the control level. However, the children treatments with olive oil has reduced the blood level by 10.9 % compared to the control level. Mean values of serum triglycerides, at the end of the experimental period, were 100.0, 112.0, and 96.8 mg/dL in the treated group, control, and electromagnetic radiation + olive oil, respectively. On the other hand, mean values of serum cholesterol were 130.0, 145.0, and 169.0 mg/dL, respectively.

Table 1

Glucose, triglycerides, and total cholesterol parameters in children after exposure to electromagnetic radiation and the therapeutic action of olive oil

Parameter	Control <i>N</i> = 30	Electromagnetic field <i>N</i> = 50	Electromagnetic field + olive oil <i>N</i> = 40
Glucose (mg/dL)	80.0 $\pm$ 3.2	85.5 $\pm$ 2.4	71.3 $\pm$ 4.2
% change		6.8	–10.9
<i>P</i> value		< 0.05	< 0.05
Triglycerides (mg/dL)	100.0 $\pm$ 4.6	112.0 $\pm$ 2.7	96.8 $\pm$ 9.9
% change		12.1	–3.2
<i>P</i> value		< 0.05	> 0.05

All values are expressed as mean $\pm$ S.E. Non-significant differences are at $P > 0.05$. Significant differences are at $P \leq 0.05$. Highly significant differences are at $P < 0.01$.

Total protein, albumin, and globulin concentrations, in the cases of blood serum after children exposure to electromagnetic radiation and treated with olive oil, are presented in Table 2. Significant increase in the albumin level may be due to the antioxidant of albumin due to the drop total oxidation status (TOS) of serum level in plasma. The concentration of albumin has been increased when exposed to electromagnetic radiation. Also, by using olive oil, the albumin is decreased. Furthermore, the serum albumin concentrations may be modulated by radiation.

Table 2

Total protein, albumin, and globulin parameters in children after exposure to electromagnetic radiation and the therapeutic action of olive oil

Parameter	Control N = 30	Electromagnetic field N = 50	Electromagnetic field + olive oil N = 40
Total proteins (mg/dL)	7.25 ± 0.05	6.30 ± 0.18	8.00 ± 0.23
% change		-13	10
P value		< 0.05	< 0.05
Albumin (mg/dL)	3.25 ± 0.05	4.00 ± 0.69	3.70 ± 0.94
% change		23	13.8
P value		< 0.01	< 0.05
Globulin (mg/dL)	4.00 ± 0.02	2.30 ± 0.03	4.30 ± 0.01
% change		-42	7
P value		< 0.01	< 0.05

All values are expressed as mean ± S.E. Non-significant differences were considered when $P > 0.05$, significant differences when $P \leq 0.05$, and highly significant differences when $P < 0.01$.

In Table 2, total proteins were decreased with a percentage of 13 %, while albumin value was increased with 23 % in response to electromagnetic field exposure as compared to control levels. Olive oil was more efficient in lowering the elevated values of total proteins and albumin. However, globulin values were decreased in all cases with a percentage of 42 % and 7 % respectively, as compared to the controls. Result revealed a general increase in serum glucose levels in response to electromagnetic field, with/without olive oil treatment, that could be attributed to impairing hepatic structure noticed by Abuo Elnaga [1], who observed a post irradiation reduction of glycogen in cells, due to the decrease of T_3 and T_4 hormones of the thyroid, which lessen the glucose entrance into the cells. Electromagnetic field exposure may, indirectly, play a specific role in carbohydrate metabolism. Also, the mobile phone frequency exposure together with olive oil showed a decrease in serum glucose as compared to the control. In this respect, Al Jamal *et al.* studied the protective effect of olive oil, attributed to its antioxidant and free radical scavenging properties [6]. Olive oil had positive effects on lipid profile and blood glucose level in both asymptomatic participants and type 2

diabetic subjects. One can suppose that olive oil ameliorates the principal functions of the liver which are related to the regulation of carbohydrate metabolism and blood glucose homeostasis [11]. Concerning lipid metabolism, the results demonstrated that the triglycerides and total cholesterol levels were increased in response to electromagnetic frequency. The possible explanation of these observed increments may be in direct or indirect action of mobile radiation on lipid metabolism or lipid peroxidation [12]. The significant decreased levels of total proteins in the cases of subjects exposed to electromagnetic field is in agreement with that observed by Kostoff and Lau [11]. The decrease of total proteins could be attributed to an increase in amino acid deamination. In another study, we observed a decrease in globulin, in the cases of children exposed only to electromagnetic waves. The decreases may have resulted from disturbed protein synthesis in the liver. These results were in agreement with those of Kula [12].

CONCLUSION

In this work, the effects of electromagnetic radiation produced by the mobile base stations have been evaluated on the children's blood. It is found that electromagnetic field exposure increased the concentrations of serum glucose, and triglycerides, but the treatment with olive oil has been decreased the effect of exposure on both parameters. The total concentrations of proteins, globulins, and albumins were modified after exposure to electromagnetic field, but the treatment with olive oil had improved their blood levels attaining those of the normal state.

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