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Analysis of the Biochemical Parameters of Liver, Kidney Functions and Thyroid Stimulated Hormone in Children after Exposure to Mobile Phone Base Station Radiation and Therapeutic Action of Olive Oil

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Abstract

This study aims to investigate the effects of non- ionizing radiation emitted from the base station on the children blood and possible protective role of olive oil supplementation, total of 120 children (6-12 years) were divided to three groups. The first group served as control group. The second group exposed to electromagnetic field (E.M.F) alone, the third group exposed to E.M.F of and given 2.5 ml/day olive oil supplementation for 5 weeks. The second and the third groups lived nearby mobile phone base station (100-150 m), more than 5 years. The liver parameters [ALT], [AST], [ALP] and Bilirubin as well as the kidney parameters (urea Uric acid and creatinine) and TSH were assumed. EMF exposure caused increased the concentrations of urea, uric acid and creatinine but TSH decreased. Activities of serum (AST), (ALT), (ALP) and bilirubin were increased. Also, signs of improvements in the previous biochemical parameters and TSH were noticed after treatments with olive oil supplementation.

Keywords:

Electromagnetic Field,
TSH
Blood Serum,
Liver and kidney function,
Olive oil,
Base station.

1. Introduction:

With growth in mobile communications, exposure to non-ionizing electromagnetic field (EMF) has increased due to mobile handset and base station antenna, Biological effects of electromagnetic field (EMF) and Their consequences on human health are receiving increasing scientific interest and has become the subject of great public debate. Considering the importance of this issue, in 1996, the World Health Organization (WHO) in collaboration with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) started an international project on the effects of electromagnetic fields for assessing the potential risks of these waves for human health (Bernhardt & Matthes, 1997; Grandolfo, 2009). The controversy

has been stimulated by some epidemiologic studies that have reported a relation between magnetic field exposure and human diseases (Everaert & Bauwens, 2007; Meena, Verma, Kohli, & Ingle, 2016). The biological effects of exposure to EMR from mobile phones variable, depending on many factors including duration of exposure, distance from the various sources, species and tissues as well as the conditions of exposure (Ahlbom et al., 2008). Electromagnetic field penetrates the human body and acts on all organs, altering the cell membrane potential and the distribution of ions and dipoles. These alterations may influence biochemical processes in the cell (Joshi & Khanna, 2015; Lotfi & Shahryar, 2009).

Previous studies of the effect of electromagnetic fields on living organisms showed that the initial effect of an electromagnetic field is the triggering of key biochemical processes in various metabolic pathways. The physiochemical action, ion, dipolar, macrostructure, electrolytic polarization, and other factor may also play a role such as molecular excitation, biochemical activation, generation of radicals, chemical bond weakening, hydration change, altered relaxation time of atom vibration, and altered spin of dipoles (B Kula, 1988). Also, these waves with extremely low frequency (in long term) make to get some variations in structure and Biochemical properties of the tissues (Lerchl et al., 2008). Electromagnetic fields are harmful to public health (Ishida et al., 2016). EMR may be absorbed by various body organs according to places the mobiles are carried especially liver and kidneys (Ozguner et al., 2005). It has been reported that exposure to EMR (electromagnetic radiation) could affect the nervous system because of mobile use near brain (Salford et al., 2008), Concerning the endocrine system, the sensitivity of pineal gland, pituitary gland, adrenal gland and thyroid gland as well as of the pancreas, testicles and ovaries to EMFs had been investigated (Karasek & Woldanska-Okonska, 2004), one of the most exposed and vital organs are the thyroid gland. It is a target for different types of electromagnetic radiation (Sinha, 2008). Olive oil, is considered as the pillar of the Mediterranean diet, since it improves the major risk factors for cardiovascular disease, such as the lipoprotein profile, blood pressure, glucose metabolism and antithrombotic profile. Endothelial function, inflammation and oxidative stress are also positively modulated. Some of these effects are attributed beside the monounsaturated fatty acids (MUFA) to the minor components of virgin olive oil (Pérez-Jiménez et al., 2005) Hydrocarbons, polyphenols, tocopherols, sterols, triterpenoids and other components, despite their low concentration, non-fatty acid constituents may be of importance because studies comparing monounsaturated dietary oils have reported different effects on cardiovascular disease. Most of these compounds have demonstrated antioxidant (Al Jamal & Ibrahim, 2011). The present work is aimed to study of some biochemical studies such as liver functions, kidney functions parameters and thyroid stimulating hormone (TSH) were assumed on children after exposure to mobile phone base station radiation and the therapeutic action of olive oil.

2. Materials and Methods:

One hundred and twenty of male children (aging 6-12 years) exposed to non-ionizing radiation emitted from the base station in KhanYounis country in Gaza strip-Palestine were. They were divided into three groups, as follows:

1. The first group served as control.
2. The second group was exposed to E.M.F.
3. The third group was exposed to E.M.F and given 2.5 ml/day orally olive oil all over the experimental periods (5weeks). The dose was determined by previous studies (Ismail, 2000).

The second and the third groups lived nearby mobile phone base station (100-150) m more than 5 years. and exposed to electromagnetic field with constant power in the range from (1.4–4.7) mw/cm², which it is used in their country and measured during the experiment using power meter. The electric field with the range (60–130) V/m. The antenna received the signal from mobile base station at the area. The mobile system used in Gaza is GSM (Global system for mobile) which frequency equals 900 MHz.

3. Measurement of blood indices:

Blood samples were received at 3 ml. Urea determination is based upon the cleavage of urea with urea's (Berthelot's reactions) according to (Fawcett & Scott, 1960) method. The kit was purchased from Boehringer Mannheim diagnostics. Serum uric acid determined using the SPINREACT reagent kits and following their instruction manual described by (Fossati, Prencipe, & Berti, 1980). Serum creatinine determined without protein precipitation according to (Bartels & Wüthrich, 1994). Serum aminotransferase (ALT, AST) determined according to the method of (Reitman & Frankel, 1957). Serum alkaline phosphatase determined according to the method of (Bessey, Lowky, & Brock, 1946). Serum bilirubin determined according to the method of (Sims & Horn, 1958). The level of TSH measured by ELISA kits from Dia Metra, Italy (Fisher, 1996).

4. Results:

Results of effect of exposure to non-ionizing radiation emitting base station on various stress related parameter in blood illustrated in Table 1 & 2. Table 1 summarizes the mean value of children blood serum, activities of serum alanine transaminase [ALT], Alkaline phosphatase [ALP] and aspartate transaminase [AST] and bilirubin, as affected by E.M.F. exposure with/without treatment with olive oil. It shows that activities of serum AST, ALT, ALP and Bilirubin

increased following E.M.F exposure alone. However, these activities AST and ALT were increased 32.5% and 41% respectively and activities of ALP and Bilirubin

reduced 1.19%, -10% after treatment by olive oil when compared to cases exposed to E.M.F alone and compared to controls.

Table 1 Serum AST, ALT, Alkaline phosphatase and Bilirubin activities in children after exposure of electromagnetic field and the therapeutic action of olive oil

Parameter	Control N=30	Electromagnetic field N=50	Electromagnetic field + Olive Oil N=40
AST (U/L)	15.3±0.52	17.4±.48	20.27±0.48
%change		13.7	32.5
P value		< 0.05	< 0.01
ALT (U/L)	17.5±0.55	18.62±.42	24.67±0.5
%change		6.4	41
P value		> 0.05	< 0.01
Alk.Ph (U/L)		73.48±1.77	45.13±0.71
%change	44.6±2.2	64.75	1.19
P value		< 0.01	> 0.05
Bilirubin (mg/dl)		0.81±0.02	0.63±0.05
%change	0.7±0.02	15.4	-10
P value		< 0.01	< 0.05

All values expressed as mean ± S.E.

Non-Significant differences at P> 0.05

Significant differences at P ≤ 0.05

Significant differences at P<0.01

Table 2 points out the mean serum urea, uric acid and creatinine compared to the controls. In general, E.M.F exposure in cases increased significantly urea, uric acid and creatinine compared to the controls. However, these increments reduced after the treatment by olive oil. Thyroid-stimulating hormone (TSH) level in cases exposed to E.M.F alone were significantly lower than that in controls (1.78 ±0.8 VS 2.5±0.2, %difference= -

28.8, p <0.01). However, the activity of TSH was near to the control in cases exposed to E.M.F after treatment by olive oil (2.46 ±0.16 VS 2.5±0.2 %difference= -1.6 and p >0.05). All results were analyzed using SPSS program for windows (statistical package for the social sciences Inc. Chicago, Illinois. Means were compared by independent- sample t-test.

Table 2 Effect of electromagnetic field exposure on Urea, Uric acid, Creatinine and simulating thyroid (TSH) on children after exposure of electromagnetic field and the therapeutic action of olive oil

Parameter	Control N=30	Electromagnetic field N=40	Electromagnetic field + Olive Oil N=40
Urea (mg/dl)	24±0.04	27.8±1.0	24.4±0.42
%change		15.8	1.6
P value		<0.01	> 0.05
Uric acid (mg/dl)	3.6±0.28	4.26±0.11	3.2±0.15
%change		18.3	-11.11
P value		< 0.01	< 0.05
Creatinine (mg/dl)	0.51±0.01	0.83±0.017	.66±0.02
%change		62.7	29.4
P value		< 0.01	< 0.01
TSH (mU/L)	2.5±0.2	1.78±.08	2.46±.16
%change		-28.8	-1.6
P value		< 0.01	> 0.05

5. Discussion:

In the present study, Serum transaminases (AST & ALT), ALP and bilirubin exhibited a general increase in cases exposed to E.M.F compared to the controls. The

observed elevation of serum AST, ALT and ALP activates in response to E.M.F exposure is in agreement with the study of (Fatma, Ahkam, Samir, Nomaan, & Sawsan, 2015) who observed the increases of liver enzyme activates ALAT, ASAT and ALP in serum and liver tissue significantly and increased oxidative stress marks (MDA & H₂O₂) after exposure to mobile phone radiation in the liver of male rats. Bilirubin is a naturally occurring antioxidant of physiological importance (Stocker, Yamamoto, McDonagh, Glazer, & Ames, 1987) and as such, could have a role in protecting lipid and lipoproteins against oxidation. The decreased bilirubin concentrations in this study in addition to being a reflection of hepatic dysfunction could be associated with decreased levels in lipid peroxidation. (Ockner, Manning, & Kane, 1982) reported that a low level of bilirubin prevented solubilization of cholesterol and its clearance through the bile, thereby giving rise to elevated blood cholesterol concentration. The results in this study do not support this report since no significant changes found in both total cholesterol and HDL. The findings suggested that olive oil suppresses E.M.F exposure in cases may be, by modulating the antioxidant defense status of the children in response to their antioxidant action. The decreases may have resulted from disturbed protein synthesis in the liver. These results was in agreement with (Boguslaw Kula, Sobczak, Grabowska-Bochenek, & PISKORSKA, 1999). The significant elevation of blood urea is a good indicator for kidney disorders. Urea is the principle end product of protein catabolism. Enhanced protein catabolism accelerated amino acid deamination for gluconeogenesis is possible an acceptable postulate to interpret the elevated levels of urea (Bishop, Duncan, Brett, & Lawrence, 2004). Uric acid is the end product of the catabolism of tissue nucleic acid, i.e. purine bases metabolism (Martin & Okolie, 2012). The increment in uric acid concentration might be due to degradation of purines or to an increase of uric acid levels by either overproduction or inability of excretion (Reddy, Monigari, & Hande, 2015). The increment in creatinine concentration in response to E.M.F exposure was in agreement with (Ragy, 2015). Creatinine is the last variable of non-protein nitrogenous blood constituents. It appears in the serum in amount proportional to the body's muscles mass and is more readily excreted by kidneys than urea and uric acid (Sharma & Singh, 2014) Elevated creatinine concentration is associated with abnormal renal function, especially as it relates to

glomerular function (Bishop et al., 2004). Presence of iron- particles (magnetite's) in body tissue, particularly in the brain, could enhance free radical activity in the cells and thus increase the cellular damaging effect of E.M.F (Panagopoulos, 2011). Liver was used in this study because it's high iron content. This makes the liver more susceptible to the effects of the magnetic fields (Hernando, Levin, Sirlin, & Reeder, 2014), Recent scientific studies have been focusing on the use of plant products as therapeutic agents (Fatma et al., 2015; Gargari, Mobasser, Valizadeh, & Asghari-Jafarabadi, 2015; Ragy, 2015).

6. Conclusions:

EMFs may have deleterious effects in the liver, kidney and thyroid activity. so, advised to include, liver, kidney and thyroid function test, in periodic medical examination of people exposed to non-ionizing radiation emitted from base station. Also, Olive oil supplementation may ameliorate liver, kidney and thyroid activity in such peoples. However, further investigation is required to clarify the degree of liver, kidney and thyroid function alteration by electromagnetic field emitted from base station and the relation between olive oil supplementation and liver, kidney and thyroid hormone.

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دراسة بيو كيميائية على وظائف الكلى والكبد والمرهون المحفز للغدة الدرقية (TSH) على النطفال الذين يتعرضون للإشعاعات من محطات تقوية الإرسال والتأثير العلاجي لزيت الزيتون

كلمات مفتاحية:
موجات كهرومغناطيسية،
مصل الدم،
وظائف الكلى والكبد،
زيت الزيتون،
محطات الإرسال.

تهدف الدراسة الحالية إلى دراسة بعض المقاييس على دم 120 طفل من الذكور تتراوح أعمارهم من 6-12 سنة وقيمون على بعد 100-150م بالقرب من هذه المحطات ولمدة أكثر من 5 سنوات، حيث تم دراسة تأثير إعطاء جرعة من زيت الزيتون قدرها 2.5 مل يوميا على مجموعة من هؤلاء الأطفال ولمدة خمس أسابيع متتالية، حيث تم تقسيم الأطفال إلى 3 مجموعات. المجموعة الأولى كانت المجموعة الضابطة أما المجموعة الثانية تعرضت للموجات الكهرومغناطيسية فقط أما المجموعة الثالثة تعرضت لنفس الموجات مع إضافة زيت الزيتون 2.5 مل يوميا لمدة 5 أسابيع. وقد أكدت الدراسة أن تعرض هؤلاء الأطفال للموجات الكهرومغناطيسية فقط قد أحدث زيادة في معدل اليوريا وحمض البولييك والكرياتينين والفوسفاتيز القلوي والبيليروبين والمجموعة الناقلة لمجموع الأيض (AST,ALT) ونقصا في هرمون المحفز للغدة الدرقية (TSH) مقارنة مع المجموعة الضابطة. وقد أدى إعطاء زيت الزيتون للمجموعة التي تعرضت للإشعاعات إلى تحسن في معظم القياسات السابقة.