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- Board Certified in Internal Medicine since 2000
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- Course Director, EMF Medical Conference 2021
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My office gets 3-5 calls per month from new patients with microwave syndrome

Medical Conditions Exacerbated by RFR/Microwave Exposure



EMF Associated Illness – Treatment Guidelines

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Rev Environ Health 2015; 30(4): 337-371

Igor Belyaev, Amy Dean, Horst Eger, Gerhard Hubmann, Reinhold Jandrisovits, Olle Johansson, Markus Kern, Michael Kundi, Piero Lercher, Wilhelm Mosgöller, Hanns Moshammer, Kurt Müller, Gerd Oberfeld*, Peter Ohnsorge, Peter Pelzmann, Claus Scheingraber and Roby Thill

EUROPAEM EMF Guideline 2015 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses

DOI 10.1515/reveh-2015-0033 Received October 1, 2015; accepted October 13, 2015

Abstract: Chronic diseases and illnesses associated with unspecific symptoms are on the rise. In addition to chronic stress in social and work environments, physical and chemical exposures at home, at work, and during leisure activities are causal or contributing environmental stressors that deserve attention by the general practitioner as well as by all other members of the health care community. It seems certainly necessary now to take "new exposures" like electromagnetic field (EMF) into account. Physicians are increasingly confronted with health problems from unidentified causes. Studies, empirical observations, and patient reports clearly indicate interactions between EMF exposure and health problems. Individual susceptibility and environmental factors are frequently neglected. New wireless technologies and applications have been introduced without any certainty about their health effects, raising new challenges for medicine and society. For instance, the issue of so-called non-thermal effects and potential long-term effects of low-dose exposure were scarcely investigated prior to the introduction of these technologies. Common EMF sources include Wi-Fi access points, routers and clients, cordless and mobile phones including their base stations, Bluetooth devices, ELF magnetic fields from net currents, ELF electric fields from electric lamps and wiring close to the bed and office desk. On the one hand, there is strong evidence that longterm-exposure to certain EMF exposures is a risk factor for diseases such as certain cancers, Alzheimer's disease and male infertility. On the other hand, the emerging electromagnetic hypersensitivity (EHS) is more and more recognized by health authorities, disability administrators and case workers, politicians, as well as courts of law. We recommend treating EHS clinically as part of the group of chronic multisystem illnesses (CMI) leading to a functional impairment (EHS), but still recognizing that

Belyaev, Igor, et al. "EUROPAEM EMF Guideline 2015 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses." *Rev. Environ. Health* 30 (2015): 337-371.



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The EMF Medical Conference 2021

Prevention, Diagnosis and Treatment of EMF Associated Illness

January 28 - 31, 2021

A Virtual Conference

The EMF Medical Conference (EMFMC) 2021 will convene leading physicians, clinicians, and scientists for a series of presentations on the prevention, diagnosis, and treatment of EMF associated illness. Experts in EMF assessment will present proven methods that can prevent or limit EMF exposure hazards. Attendees will benefit from the Pre-Conference Course, "Electrosmog and Electrotherapeutics 101" on October 23 & 24, 2020 with Magda Havas PhD, Global EMF Expert.

Continuing Medical Education/CME

CME/CE Credit Provided by AKH Inc., Advancing Knowledge in Healthcare. This activity is jointly-provided by AKH Inc., Advancing Knowledge in Healthcare and The Electromagnetic Safety Alliance, Inc.



Two CME Accredited Medical Conferences Have Educated Physicians on EMF Associated Illness

- Continuing Medical Education (CME) accreditation is a standardized, structured and regulated process.
- Both EMF medical conferences provided qualified attendees with continuing medical education credits.
- CME credits are required to renew medical licenses.
 - EMF Medical Conference 2021 (19.5 credits)
 - EMF Conference 2019 (16 credits)



RFR Causes Oxidative Stress

ELECTROMAGNETIC BIOLOGY AND MEDICINE

REVIEW ARTICLE

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Electromagn Biol Med, Early Online: 1–16 © 2015 Informa Healthcare USA, Inc. DOI: 10.3109/15368378.2015.1043557

Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation

Igor Yakymenko¹, Olexandr Tsybulin², Evgeniy Sidorik¹, Diane Henshel³, Olga Kyrylenko⁴ and Sergiy Kyrylenko⁵

¹Institute of Experimental Pathology, Oncology and Radiobiology of NAS of Ukraine, Kyiv, Ukraine, ²Department of Biophysics, Bila Tserkva National Agrarian University, Bila Tserkva, Ukraine, ³School of Public and Environmental Affairs, Indiana University Bloomington, Bloomington, IN, USA, ⁴A.I.Virtanen Institute, University of Eastern Finland, Kuopio, Finland, and ⁵Department of Structural and Functional Biology, University of Campinas, Campinas, SP, Brazil

Abstract

This review aims to cover experimental data on oxidative effects of low-intensity radiofrequency radiation (RFR) in living cells. Analysis of the currently available peer-reviewed scientific literature reveals molecular effects induced by low-intensity RFR in living cells; this includes significant activation of key pathways generating reactive oxygen species (ROS), activation of peroxidation, oxidative damage of DNA and changes in the activity of antioxidant enzymes. It indicates that among 100 currently available peer-reviewed studies dealing with oxidative effects of low-intensity RFR, in general, 93 confirmed that RFR induces oxidative effects in biological systems. A wide pathogenic potential of the induced ROS and their involvement in cell signaling pathways explains a range of biological/health effects of lowintensity RFR, which include both cancer and non-cancer pathologies. In conclusion, our analysis demonstrates that low-intensity RFR is an expressive oxidative agent for living cells with a high pathogenic potential and that the oxidative stress induced by RFR exposure should be recognized as one of the primary mechanisms of the biological activity of this kind of radiation.

Keywords

Cellular signaling, cancer, free radicals, oxidative stress, radiofrequency radiation, reactive oxygen species

informa

healthcare

History

Received 10 January 2015 Accepted 12 April 2015 Published online 7 July 2015

- Review of 100 available peer reviewed studies of oxidative effects of low intensity RFR
- 93/100 confirmed that RFR induces oxidative effects in biological systems
- Conclusion: Low intensity RFR is an oxidative agent for living cells with a high pathogenic potential

Yakymenko, I., Tsybulin, O., Sidorik, E., Henshel, D., Kyrylenko, O., & Kyrylenko, S. (2016). Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. *Electromagnetic Biology and Medicine*, *35(2)*, *186-202*.

Oxidative Stress – Clinical Relevance

"Oxidative stress is now thought to make a significant contribution to ALL inflammatory diseases"

- Cardiovascular disease: HTN, stroke, myocardial infarction, CHF
- Neurodegeneration: MS, Alzheimer's, Parkinson Disease, ALS
- Autoimmunity including SLE and various forms of vasculitis
- Diabetes: including complications (retinopathy, diabetic cardiomyopathy, NAFLD)

McCord, J. M. (2000). The evolution of free radicals and oxidative stress. *The American journal of medicine, 108(8), 652-659.*

Oxidative Stress - an imbalance between reactive oxygen species and antioxidant capacity

Causes/Contributing Factors

- Modern living
- Combustion products
- Chemicals
- Stress
- Ionizing radiation
- Radiofrequency Radiation

Why It's Confusing

- Occurs all over the body, at the molecular level
- Many different types of O₂ related reactions, intermediates and molecules
- Essential for life, but also damaging to cells/tissues

Role of oxidative stress in cardiovascular diseases

Naranjan S. Dhalla, Rana M. Temsah and Thomas Netticadan

Table 1 The cytotoxic reactive oxygen species and the natural defense mechanisms

Reactive oxygen species		Antioxida	ant defence mechanisms	
Free radicals		Enzyma	tic scavengers	
O₂ •- OH• RO0• RO• RS• NO•	Superoxide anion radical Hydroxyl radical Lipid peroxide (peroxyl) Alkoxyl Thiyl Nitric oxide	SOD CAT GTP	Superoxide dismutase $2O_2^{\bullet^-} + 2H^+ \rightarrow H_2O_2 + O_2$ Catalase (peroxisomal-bound) $2H_2O_2 \rightarrow O_2 + H_2O$ Glutathione peroxidase $2GSH + H_2O_2 \rightarrow GSSG + 2H_2O$	
NO ₂ • ONOO ⁻ CCl ₃ • <i>Non-radicals</i> H ₂ O ₂ HOCl ONOO ⁻	Nitrogen dioxide Peroxynitritre Trichloromethyl Hydrogen peroxide Hypochlorous acid Peroxynitrite	Nonenz Vitamin Vitamin Vitamin β-carote Cysteine	$2GSH + ROOH \rightarrow GSSG + ROH + 2H_2O$ ymatic scavengers A C (ascorbic acid) E (α -tocopherol) ne H ₂ O ₂ Kanthine oxidase H ₂ O ₂ Kuperoxide	Aminolutin Angiotensin II ► H ₂ O ₂
¹ O ₂ Singlet oxygen nalla, N. S., Temsah, R. M., & Netticadan, T. 000). Role of oxidative stress in cardiovascular seases. <i>Journal of Hypertension, 18(6), 655-673.</i>		Coenzyn Uric acio Falvonoi Sulfhydr Thioethe	HOCI HOCI HOCI H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2 H_2O_2	CI- MPO HOCI

The superscripted bold dot indicates an unpaired electron and the negative charge indicates a gained electron. GSH, reduced glutathione; GSSG, oxidized glutathione; R, lipid chain. Singlet oxygen is an unstable molecule due to the two electrons present in its outer orbit spinning in opposite directions.

EMFs – An Emerging Risk Factor for Cardiovascular Disease

- Increasing proportion of ST elevation MI patients lack traditional cardiac risk factors (Vernon ST, *Eur J Prev Cardiol* 2017)
- RF is an environmental pollutant with cytotoxic effects
- RF generates oxidative stress, which is implicated in CVD
- RF may contribute to CVD via oxidative cellular damage

Check for updates



European Society of Cardiology

Invited editorial

Cardiovascular disease: Time to identify emerging environmental risk factors

Priyanka Bandara and Steven Weller

European Journal of Preventive Cardobidy 2017, Vol. 24(17) 1819–1823 © The European Society of Cardobidy 2017 Reprints and permissions: sagepub.co.uk/pournalsPermissions.nav DOI: 10.1177/2047/487317734898 journalisa.gepub.co.m/ho.melejpc (\$SAGE

Vernon et al.¹ recently reported a significant increase in the proportion of first-time ST elevation myocardial infarction (STEMI) patients without standard modifiable cardiovascular risk factors (hypercholesterolaemia, hypertension, diabetes and smoking). While the authors correctly highlighted the need for discovering new mechanisms of coronary heart disease based on theirs and other complementing data, we would like to draw the attention of researchers in cardiovascular disease (CVD) to emerging environmental risk factors, focusing here on microwave radiofrequency electromagnetic radiation (RF-EMR).

Human exposure to RF-EMR has exponentially increased over the past three decades due to rapid and widespread deployment of wireless communication and surveillance infrastructure and the use of personal wireless devices. Public exposures have increased from extremely low natural radiofrequency levels² below 10⁻¹⁵ W/m², to above 10⁻² W/m² now.^{3,4} RF-EMR is an environmental pollutant with cytotoxic effects.^{3,6}

Despite the European Academy for Environmental Medicine (EUROPAEM)⁷ and the American Academy of Environmental Medicine (AAEM)⁸ publishing evidence linking RF-EMR to adverse health effects and calling for exposure reduction, there is widespread ignorance about the scientific evidence of radiofrequency-induced biological/health effects within the medical fraternity. This appears to be largely due to the controversial approach by the International EMF Project at the World Health Organization (WHO),⁴ which has ignored the calls by a large group of international electromagnetic field (EMF) scientists⁹ for improved exposure regulation.

The WHO's International Agency for Research on Cancer (IARC) appointed an expert panel to examine the evidence related to cancer in 2011 which classified such evaluation of CVD risk has been carried out. Furthermore, there are serious shortcomings in the few panel reports that have so far evaluated biological/health effects.¹⁵

In our latest review, 242 RF-EMR studies that investigated experimental endpoints related to oxidative stress (OS)16 were identified. A staggering 216 (89%) of them found significant effects related to OS, similar to a previous review.17 These are being further analysed following presentation at the recent Australasian Radiation Protection Society conference.18 Mostly invivo animal studies and in-vitro studies have demonstrated increased markers of endogenous OS and/or affected antioxidant levels in different tissue/cell types upon exposure to RF-EMR. Some studies have further demonstrated amelioration of RF-induced OS upon treatment with various antioxidants. Limited human studies at this stage complement these studies demonstrating OS and/or reduced antioxidant status upon acute radiofrequency exposure under experimental settings,19 in mobile phone users20 and residents near mobile phone base stations.21 Renowned physical scientists have recently presented experimental evidence and a theoretical explanation on how low-intensity RF-EMR can generate OS.22

OS is known to be implicated in CVD^{23,24} and therefore RF-EMR, a new ubiquitous environmental exposure, may contribute to CVD by maintaining chronic OS, and thereby causing oxidative damage to cellular constituents and altering signal transduction pathways.

Acute RF-EMR exposure has been shown to increase blood pressure under experimental conditions,²⁵ while chronic exposure has been found to be associated with an increased CVD risk²⁶ as well as alteration in the diurnal rhythms of blood pressure

Oceania Radiofrequency Scientific Advisory Association (ORSAA) Inc., Brisbane, Australia

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Bandara, P., & Weller, S. (2017). Cardiovascular disease: Time to identify emerging environmental risk factors. In: SAGE Publications Sage UK: London, England.



FIGURE 1: Schematic representation of oxidative stress-related mechanisms underlying disease development in Alzheimer's disease (AD), Parkinson disease (PD), stroke, attention deficit and hyperactivity disorders (ADHD), schizophrenia, and depression.

Diabetes and RFR Circa 1971

- Increase in Blood Glucose Concentration
- Glycosuria (sugar in urine)
- Change in Concentration of Glycogen in Liver (Hyperglycemia)
- Altered Carbohydrate Metabolism
- Liver Enlargement



100

Glaser, Z. (1971). Bibliography of reported biological phenomena ('effects') and clinical manifestations attributed to microwave and radiofrequency radiation. Naval Medical Research Institute Research Report Project MF12. 524.015-0004B. Res. Inst., Nat. Naval Med. Center, Bcthesda, Md.

Oxidative Stress and Pathophysiology of Type 2 Diabetes



Rehman, K., & Akash, M. S. H. (2017). Mechanism of generation of oxidative stress and pathophysiology of type 2 diabetes mellitus: how are they interlinked? *Journal of Cellular Biochemistry*, 118(11), 3577-3585.

Radiofrequency radiation emitted from Wi-Fi (2.4 GHz) causes impaired insulin secretion and increased oxidative stress in rat pancreatic islets

Ali Masoumi^a, Narges Karbalaei^{a,b} (b), S. M. J. Mortazavi^c (b) and Mohammad Shabani^d

^aDepartment of Physiology, Faculty of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran; ^bHistomorph **Stress in rat p** Research Center, Shiraz University of Medical Sciences, Shiraz, Iran; ^cMedical Physics and Medical Engineering Department, Faculty of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran; ^dNeuroscience Research Center, Neuropharmacology Institute, Kerman University of Medical Sciences, Kerman, Iran

ABSTRACT

Purpose: There is a great concern regarding the possible adverse effects of electromagnetic radiation (EMR). This study investigated the effects of EMR induced by Wi-Fi (2.45 GHz) on insulin secretion and antioxidant redox systems in the rat pancreas.

Materials and methods: Adult male Sprague–Dawley rats in the weight range of 230–260 g were divided into control, sham, Wi-Fi exposed groups. After long-term exposure (4 h/day for 45 days) to Wi-Fi EMR, plasma levels of glucose and insulin during intraperitoneal glucose tolerance test were measured. Islet insulin secretion and content, lipid peroxidation, and antioxidant status in pancreas of rats were determined.

Results: Our data showed that the weight gain in the WI-FI exposed group was significantly lower than the control group (p < .05). Wi-Fi (2.45 GHz)-exposed group showed hyperglycemic

level and glucose-stimulated insulin secretion from pancreatic islet were significantly Wi-Fi-exposed group. EMR emitted from Wi-Fi caused a significant increase in lipid per significant decrease in GSH level, SOD, and GPx activities of the pancreas.

Conclusions: These data showed that EMR of Wi-Fi leads to hyperglycemia, increased oxidative stress, and impaired insulin secretion in the rat pancreatic islets.

"Wi-Fi leads to hyperglycemia, increased oxidative stress and impaired insulin secretion"

Salah, M. B., Abdelmelek, H., & Abderraba, M. (2013). Effects of olive leave extract on metabolic disorders and oxidative stress induced by 2.45 GHz WIFI signals. *Environmental Toxicology and Pharmacology*, *36*(*3*), *826-834*.

Masoumi, A., Karbalaei, N., Mortazavi, S., & Shabani, M. (2018). Radiofrequency radiation emitted from Wi-Fi (2.4 GHz) causes impaired insulin secretion and increased oxidative stress in rat pancreatic islets. *International Journal of Radiation Biology, 94(9), 850-857.*

Effects of olive leave extract on metabolic disorders and oxidative stress induced by 2.45 GHz WIFI signals

Myriam Ben Salah^{a,b,*}, Hafedh Abdelmelek^a, Manef Abderraba^b

"RF Exposure induced a diabetes like status"

ABSTRACT

ARTICLE INFO

- Article history: Received 28 March 2013 Received in revised form 16 July 2013 Accepted 23 July 2013 Available online 3 August 2013
- Keywords: Radio frequencies Metabolism Oxidative stress

We investigated the effect of olive leaves extract administration on glucose metabolism and oxidative response in liver and kidneys of rats exposed to radio frequency (RF). The exposure of rats to RF (2.45 GHz, 1h/day during 21 consecutive days) induced a diabeteslike status. Moreover, RF decreased the activities of glutathione peroxidase (GPx, -33.33% and -49.40%) catalase (CAT, -43.39% and -39.62%) and the superoxide dismutase (SOD, -59.29% and -68.53%) and groups thiol amount (-62.68% and -34.85%), respectively in liver and kidneys. Indeed, exposure to RF increased the malondialdehyde (MDA, 29.69% and 51.35%) concentration respectively in liver and kidneys. Olive leaves extract administration (100 mg/kg, ip) in RF-exposed rats prevented glucose metabolism disruption and restored the activities of GPx, CAT and SOD and thiol group amount in liver and kidneys. Moreover, olive leave extract administration was able to bring down the elevated levels of MDA in liver but not in kidneys. Our investigations suggested that RF exposure induced a diabeteslike status through alteration of oxidative response. Olive leaves extract was able to correct glucose metabolism disorder by minimizing oxidative stress induced by RF in rat tissues. © 2013 Elsevier B.V. All rights reserved.



Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health American Journal of Men's Health 1–6 © The Author(s) 2018 Article reuse guidelines: sagepub.com/journals-permissions DOI: 10.1177/1557988318816914 journals.sagepub.com/home/jmh SAGE

Sultan Ayoub Meo, MBBS, PhD¹, Mohammed Almahmoud, MBBS¹, Qasem Alsultan, MBBS¹, Nawaf Alotaibi, MBBS¹, Ibrahim Alnajashi, MBBS¹, and Waseem M. Hajjar, MD, FRCS²

Abstract

The use of mobile phones has remarkably increas of mobile phones boost the installation of mobile residential areas including near school buildings. electromagnetic field (RF-EMF) radiation generate volunteer male students aged between 13 and 16 were from School I and 93 students were from S buildings. In School I, RF-EMF was 2.010 µW/cm² µW/cm² with a frequency of 925 MHz. Students period of 2 years. The Narda Safety Test Solution

Conclusion: Significant impairment in motor

screening task and spatial working memory was identified among the group of students exposed to the high RF-EMF from mobile phone base station.

cognitive functions tasks were measured by the Cambridge Neuropsychological Test Automated Battery (CANTAB). Significant impairment in Motor Screening Task (MOT; p = .03) and Spatial Working Memory (SWM) task (p = .04) was identified among the group of students who were exposed to high RF-EMF produced by MPBSTs. High exposure to RF-EMF produced by MPBSTs was associated with delayed fine and gross motor skills, spatial working memory, and attention in school adolescents compared to students who were exposed to low RF-EMF.

Meo, S. A., Almahmoud, M., Alsultan, Q., Alotaibi, N., Alnajashi, I., & Hajjar, W. M. (2019). Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health. *American Journal of Men's Health*.

RF-EMF and Male Endocrine Disruption



From currently available studies it is clear that radiofrequency electromagnetic fields (RF-EMF) have deleterious effects on sperm parameters (like sperm count, morphology, motility), affects the role of kinases in cellular metabolism and the endocrine system, and produces genotoxicity, genomic instability and oxidative stress.

Fig. 1 Diagrammatic representation of various source of RF EMF exposure effect on brain and testicular organ and deleterious outcome

Kesari, Kavindra Kumar, Ashok Agarwal, and Ralf Henkel. "*Radiations* and Male Fertility." *Reproductive Biology and Endocrinology* 16.1 (2018): 1-16.



Evaluation of the Effect of Radiofrequency **Radiation Emitted From Wi-Fi Router and** Mobile Phone Simulator on the Antibacterial Susceptibility of Pathogenic Bacteria Listeria monocytogenes and Escherichia coli

M. Taheri¹, S. M. J. Mortazavi^{2,3}, M. Moradi¹, S. Mansouri¹, G. R. H and F. Nouri⁵

Abstract

Mobile phones and Wi-Fi radiofrequency radiation are among the main sources of the ex radiofrequency electromagnetic fields (RF-EMF). Previous studies have shown that exposure be associated with a wide spectrum of changes ranged from the modified bacterial growth antibiotic resistance. Our laboratory at the nonionizing department of the lonizing and Research Center has performed experiments on the health effects of exposure to animal mo of electromagnetic fields such as cellular phones, mobile base stations, mobile phone jammers cavitrons, magnetic resonance imaging, and Helmholtz coils. On the other hand, we have pi the challenging issue of the ionizing or nonionizing radiation-induced alterations in the cultures of Listeria monocytogenes and Escherichia coli were exposed to RF-EMFs generated eith simulator and a common 2.4 GHz Wi-Fi router. It is also shown that exposure to RF-EMFs w simulator and a common 2.4 GHz Wi-Fi router. It is also shown that exposure to RF-EMFs w exposure window) makes microorganisms resistant to antibiotics. This adaptive phenomenc health should be further investigated in future experiments. Altogether, the findings of this s and RF simulator radiation can significantly alter the inhibition zone diameters and growth These findings may have implications for the management of serious infectious diseases.

L. monocytogenes and E. coli were exposed to RF-EMF (900 MHz phone simulator and 2.4 GHz Wi-Fi router) for 12 hours.

Conclusions:

- Exposure to RF-EMF within a narrow window of irradiation (an exposure window) makes microorganisms resistant to antibiotics.

These findings may have implications antibiotics. In this study, we assessed if the exposure to 900 MHz GSM mobile phone radiation emitted from common Wi-Fi routers alters the susceptibility of microorganism for the management of serious

Keywords

radiofrequency radiation, bacteria

Taheri, M., Mortazavi, S., Moradi, M., Mansouri, S., Hatam, G., & Nouri, F. (2017). Evaluation of the effect of radiofrequency radiation emitted from Wi-Fi router and mobile phone simulator on the antibacterial susceptibility of pathogenic bacteria Listeria monocytogenes and Escherichia coli. Dose-Response, 15(1), 1559325816688527.

SCIENTIFIC REPORTS natureresearch

Aim:

To investigate the changes in global transcriptome in *E. coli* K12DH5α after 5 hours exposure to 2.4GHz Wi-Fi router.

Conclusions:

- Exposure to Wi-Fi influenced transcriptomes responsible for metabolic and cellular processes, localization, stress response, transposition, motility, chemotaxis, and cell adhesion.

- Undervaluing the problem of telecommunications exposure could cause further rise in infectious diseases or their complications.

Global gene expression analysis OPEN of Escherichia coli K-12 DH5 α after exposure to 2.4 GHz wireless fidelity radiation 8 October 2019

Ilham H. Said-Salman^{1,2}, Fatima A. Jebaii², Hoda H. Yusef¹ & Mohamed E. Moustafa³

This study investigated the non-thermal effects of Wi-Fi radiofrequency radiation of 2.4 GHz on global gene expression in Escherichia coli K-12 DH5α. High-throughput RNA-sequencing of 2.4GHz exposed and non-exposed bacteria revealed that 101 genes were differentially expressed (DEGs) at P < 0.05. The up-regulated genes were 52 while the down-regulated ones were 49. QRT-PCR analysis of pgaD, fliC, cheY, malP, malZ, motB, alsC, alsK, appB and appX confirmed the RNA-seq results. About 7% of DEGs are involved in cellular component organization, 6% in response to stress stimulus, 6% in biological regulation, 6% in localization, 5% in locomotion and 3% in cell adhesion. Database for annotation, visualization and integrated discovery (DAVID) functional clustering revealed that DEGs with high enrichment score included genes for localization of cell, locomotion, chemotaxis, response to external stimulus and cell adhesion. Kyoto encyclopedia of genes and genomes (KEGG) pathways analysis showed that the pathways for flagellar assembly, chemotaxis and two-component system were affected. Go enrichment analysis indicated that the up-regulated DEGs are involved in metabolic pathways, transposition, response to stimuli, motility, chemotaxis and cell adhesion. The downregulated DEGs are associated with metabolic pathways and localization of ions and organic molecules. Therefore, the exposure of E. coll DH5 a to Wi-Fi radiofrequency radiation for 5 hours influenced several bacterial cellular and metabolic processes.

Electromagnetic Fields (EMF) effects on living organisms have been an important research topic for many years. Wireless fidelity (Wi-Fi) waves are part of the non-ionizing radiation of the electromagnetic spectrum. Several studies examined the non-thermal effects of high frequency electromagnetic fields of mobile phones and Wi-Fi on different strains of bacteria1-8. We have found previously that Wi-Fi exposure of Escherichia coli O157H7 increased antibiotic resistance, motility and ability to form biofilm⁹. Bacterial resistance is expanding to most commonly used antibiotics that has been considered as "global health crisis" by the World Health Organization (WHO)10. Flagella represent a critical virulence factor that permit bacterial motility and promote adhesion to the gastrointestinal mucins11. During environmental stress, bacteria produce a polysaccharide matrix and aggregate to form biofilms12. These virulence factors play key roles in infection initiation and development of diseases.

Gene expression in E. coli is influenced by environmental factors such as temperature, pH, and other stress factors13-16. Bacteria may activate strategies to adapt to various environmental stress. Here, we investigated the changes in global transcriptome in E. coli K12 DH5 α after exposure to 2.4 GHz EMF emitted from a Wi-Fi router using high throughout RMA appropriate Ecclorichia coli K-12 DUSG strain was constructed by Douglas in as a model to understand the effects

Said-Salman, I. H., Jebaii, F. A., Hyusef, H., & Moustafa, M. E. (2019). Global gene expression analysis of Escherichia coli K-12 DH5 alpha after exposure to 2.4 GHz wireless fidelity radiation. Scientific Reports, 9, 10. doi:10.1038/s41598-019-51046-7

mber 2019

RT-PCR assays.

ORIGINAL PAPER

Comparable Effects of Low-intensity Electromagnetic Irradiation at the Frequency of 51.8 and 53 GHz and Antibiotic Ceftazidime on Lactobacillus acidophilus Growth and Survival

Diana Soghomonyan · Armen Trchounian

Intervention:

L. Acidophilus exposed to 51.8 and 53 GHz for 1 hour,

© Springer Science+Busin

Published online: 21 Marc +/- ceftazidime, compared to unexposed controls

Abstract The effect irradiation (EMI) with on Lactobacillus acid effects of antibiotic growth rate by EMI v effect of ceftazidime

Conclusions:

revealed. These effect - Strong antibacterial effects on L. acidophilus seen. - Bactericidal effects were comparable to ceftazidime

16 µM) and no enhanced action was observed with combined effects of EMI and the antibiotic. However, EMIenhanced antibiotic inhibitory effect on bacterial survival. The kinetics of the bacterial suspension oxidation-reduction potential up to 24 h of the growth was changed by EMI and ceftazidime. The changes were more strongly expressed by combined effects of EMI and antibiotic

Introduction

Lactic acid bacteria (LAB) are heterogeneous group of gram-positive and catalase-negative microorganisms. They can synthesize lactic acid from lactose. Most of them are





L. acidophilus growth specific rate, in control and after EMI/abx exposures (p < 0.001)

Take Home Messages

- Radiofrequency EMF (RF-EMF) exposure is scientifically proven to cause harm to all life forms.
- Oxidative stress is a key mechanism of harm
- Human harm from RF-EMF is common, but often misdiagnosed
- Peer reviewed clinical practice guidelines for treatment of EMF Associated Illness were published in 2015
- Two major medical conferences provided CME credits for participating physicians

Biological effects of RF-EMF exposure are scientific facts – not fiction

Additional Resources

CME Accredited Lectures on Clinical Considerations of RF-EMF Exposure

• Antibiotic Resistance and Clinical Implications of RF-EMF Bacterial Effects

https://www.bitchute.com/video/v8b2iBWo6uuB/

 Neurologic and Cardiometabolic Effects of EMF <u>https://www.bitchute.com/video/mIVcZOKd8fsE/</u>