SIPS 2017

SURABAYA INTERNATIONAL PHYSIOLOGY SEMINAR

PROCEEDINGS OF THE SURABAYA INTERNATIONAL PHYSIOLOGY SEMINAR

Surabaya, October 12-14, 2017

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Surabaya International Physiology Seminar

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Edited by Soetjipto, Muhammad Miftahussurrur, Ferry Efendi, Purwo Sri Rejeki and Bambang Purwanto

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Malaysia

Daniel John Green
University of Western Australia
Australia

Fadzil Hamzah
Sport Center of Changi General Hospital
Singapore

Deanne Helena Skelly
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FOREWORD

Dean of Faculty of Medicine, Universitas Airlangga

Assalamu'alaikum Wr. Wb.

Distinguished Guests, all the Participants, Ladies and Gentlemen

On behalf of Faculty of Medicine, Universitas Airlangga, it is my great pleasure to welcome all the speakers, moderators, and participants on **Surabaya International Physiology Seminar 2017 (SIPS 2017)**, which will be held from today, October 12th until October 14th, 2017. I would like to express my hearty welcome to all the international speakers, **Prof. Cheng Hwee Ming**, from University of Malaya, Malaysia; **Prof. Daniel John Green**, from University of Western Australia; **Dr. Fadzil Hamzah**, from Sport Center of Changi General Hospital, Singapore and **Dr. Deanne Helena Skelly**, from Griffith University, Australia.

The aim of SIPS 2017 is to provide a platform for academicians, educators, researchers, practitioners, undergraduate and postgraduate students to share and discuss the knowledge of the recent issues, opinions, researchers about the development and innovation of physiology in medical science, dentistry, veterinary, plants and agriculture, sports and sciences.

I believe this event is a great purpose in order to develop knowledge, experiences and best practices that can be applied for the good, especially in the field of healthcare as a whole.

Finally, I would like to express my sincere acknowledgements to those who take part and especially for Department of Medical Physiology, Faculty of Medicine, Universitas Airlangga for their effort in holding this event and wishing all to have success.

Wassalamu'alaikum Wr. Wb.

Prof. Dr. Soetojo, MD.
Faculty of Medicine, Universitas Airlangga

Chair of Committee / Head of Physiology Department, Faculty of Medicine, Universitas Airlangga

Assalamu 'alaikum Wr. Wb

Greetings,

On behalf of SIPS committee and Physiology Department, Universitas Airlangga, we are welcoming to Surabaya, City of Heroes.

This year, the annual meeting of Indonesian Physiology Society (IAIFI) is hosted at Surabaya, entitled **"Surabaya International Physiology Seminar Workshop (SIPS)"**. We present some update workshop and lectures in order to bring physiology research from basic to clinical application on humanities, animal welfare and good environment. All participants have opportunities to publish their research in presentation, poster and ISBN proceeding. Selected papers will be submitted to SCOPUS indexed proceeding/ journal and awarded as Best Poster and Best Oral Presentation.

We hope that all participants will get some interesting experiences for next 3 days, 12-14 October 2017. Enjoy our lectures and workshops, taste the culinary and take your time to sightseeing around Surabaya.

Wassalamu 'alaikum wr. wb.

Dr. Bambang Purwanto
Chairman of Committee / Head of Physiology Department
Faculty of Medicine, Universitas Airlangga

Welcome Address - Surabaya International Physiology Seminar Workshop (SIPS)

Dear fellow Physiologists and Participants,

On Behalf of the Indonesian Physiological Society (IAIFI) and the Physiology Department Faculty of Medicine Universitas Airlangga, I would like to welcome you all to Surabaya International Physiology Seminar (SIPS), held on 12-14 of October 2017.

Finally after long-awaited Surabaya gets a turn again to host and organize the International Physiology Seminar. Hence the Steering– and Organizing Committee consisting of young energic physiologists are determined to make the Seminar a successful one. The theme of the seminar is:

"The Role of Physiology in Translation Research: From Basic to Application"

This annual meeting covers a wide range of topics of Physiology on Medicine, Dentistry, Veterinary, Plants and Agriculture, Sports and Sciences. We sincerely hope that SIPS 2017 enable to provide a platform for academicians, educators, researchers, practitioners and postgraduate students to present and discuss researches, development and innovations in wide range of topics as mentioned above. It will provide all participants to share knowledge, exchange new ideas and their experiences in many research topics, for then it will enhance future collaborations.

With great interest and enthusiasm I look towards the success of this Seminar, and wish all of you every success and a pleasant stay in Surabaya.

May Allah Swt. bestow upon us His Blessings.

On Behalf of the Steering and Organizing Committee Senior Physiologist,
Prof. R. Soedarso Djojonegoro

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Full Papers

Aluminum Foil Shield Diminishes the Electromagnetic Radiation of Mobile Phones in the Cerebellum of Adult Male Rats

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Keywords: Aluminum Foil, Cerebellum, Electromagnetic Radiation of Mobile Phone, Malondyaldehide, Oxidative Stress.

Abstract: Aluminum foil (AF), which is a good conductor and non-magnetic, is proposed to reflect almost all of the electromagnetic wave's exposure. The effect of aluminium foil to the malondialdehyde (MDA) levels of adult male rats' cerebellum exposed to the electromagnetic radiation (EMR) from the mobile phones was analyzed. Thirty-two adult male rats were placed equally into four groups (n=8). Group I is the control group without AF or EMR; group II is given the AF only; group III is treated to the EMR; group IV is treated to the EMR with AF shield. A mobile phone was taped at the inner floor of a plastic box container where the animal was placed. The AF shield has thickness of 2mm and the size of 20 x 16cm (Klin Pak, Indonesia) and covered the mobile phones wholly inside the plastic bag (in group IV). The mobile phone used has a specificity absorption rate Europe (SAR EU) of 0.84 - 1.86W/ kg with a frequency band of 2100MHz (GSM 2100 MHz). The exposure to the mobile phone's EMR was four hours daily for 30 days. The MDA levels were measured with the spectrophotometer (TBARS method) and analyzed statistically using *KruskalWallis Test* and *Mann Whitney U* ($p<0.05$). The MDA levels in P2 were significantly lower compared to those of P1 ($p<0.05$). Meanwhile, the MDA levels in P1 were significantly higher compared to the control group ($p<0.05$). In conclusion, aluminum foil could provide protective effect against the exposure of EMR oxidative stress in rat cerebellum.

1 INTRODUCTION

The use of mobile telecommunication devices (mobile phones) in everyday life is increasing, along with the development of modern society (Miyakoshi, 2013). The public has abandoned static home phones and switched to battery-based phones which can be taken anywhere (Tarigan *et al.*, 2013; Kogoya, 2015). The population of mobile phone users is over 80% in some countries (Tang *et al.*, 2015).

Mobile phone is a two-way communication tool that uses electromagnetic waves which is the wave radiofrequency (RF) (Swamardika, 2009). Mobile phones produce electromagnetic wave radiation (EMR) due to the presence of electric fields and magnetic fields (Talib *et al.*, 2010). Mobile phone EMR can increase the production of free radicals, which will increase lipid peroxidation resulting in oxidative stress and lead to the activation of apoptotic pathways (Ozben, 2007).

The brain is one of the most sensitive organs targeted by EMR, where mitochondrial injury occurs earlier and worse than other organs (Hao *et al.*, 2015). Electromagnetic wave radiation emitted by wireless devices can interfere with learning and memory and cause degenerative effects on the human brain by increasing oxidative stress and decreasing enzymatic antioxidant brain tissue, which may affect the physiological function of the nerves (Nazziroglu and Akman, 2014).

Aluminum foil is a good conductor and non-magnetic; therefore, it can reflect almost any exposure to electric waves, thus providing protection against EMR (Ott, 1976; Pratap *et al.*, 2014). Aluminum foil can reflect about 90% of electromagnetic waves at

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wavelengths of 200nm (nanometers) up to 1μm (micrometer), increasing to about 99% at wavelengths above 1μm, and may weaken more than 80dB (decibels) of EMR at frequencies over 100MHz. The magnetic field will lose about 63% of its energy with a single sheet of aluminum foil (Pratap *et al.*, 2014).

2 METHODS

This research uses laboratory experimental research with Posttest Only Control Group Design method. The study was approved by the Medical Research Ethics Committee, Faculty of Medicine, Universitas Airlangga (No. 176/EC/KEPK/FKUA/2017) to use experimental animals as research objects. The research was conducted in July and August 2017 at Pharmacology Laboratory, Faculty of Medicine, Universitas Airlangga, and MDA level examination was conducted in the Pharmacology Laboratory, Faculty of Medicine, Universitas Brawijaya. The number of samples was calculated by Frederer formula of 32 male white rats Wistar strain (*Rattus norvegicus*) then divided into four treatment groups, each group consisted of eight rats. The K1 group (Control 1) was a group of untreated rats. Group K2 (Control 2) was a group of rats protected by aluminum foil shield. The P1 group (Treatment 1) was a group of rats given exposure to mobile phone EMR with the specificity absorption rate Europe (SAR EU) 0.84-1.86W/kg and frequency 2100MHz (GSM 2100MHz). Group P2 (Treatment 2) was a group of rats given exposure to mobile phone and aluminum foil shield. Each rat was inserted into a 30x25x7cm plastic container. The plastic container for the K1 group was an empty container. The plastic container for the K2 group was given an aluminum foil shield on the bottom of the baking sheet. The plastic container for the P1 group had a mobile phone placed on the bottom of the baking sheet. The plastic container for the P2 group had a mobile phone and aluminum foil shield placed on the bottom of the baking sheet. Treatment was given four hours/day for 30 days.

After euthanasia with ketamine, cerebellar preparations were taken for examination of MDA level. The examination of cerebellar MDA level was performed by using the method of measuring the concentration of Thiobarbituric Acid Reactive Substances (TBARS) using a spectrophotometer with a wavelength of 532nm. Quantitative data were the levels of cerebellar MDA in mmol/L in analysis with Kruskall Walllis and Mann Whitney U test using statistical product and service solutions (SPSS) software version 23 ($p < 0.05$).

3 RESULTS

Table 1 lists the mean and standard deviations of rat cerebellar MDA levels at the end of treatment. The lowest levels of rat cerebellar MDA levels were obtained in the K1 group while the highest was in the P1 group (Figure 1).

Table 1: Average of MDA cerebellar level.

Groups	Cerebellar MDA level (X ± SD)
K1 (n=8)	0.08 ± 0.02
K2 (n=8)	0.12 ± 0.07
P1 (n=8)	0.38 ± 0.13
P2 (n=8)	0.09 ± 0.05

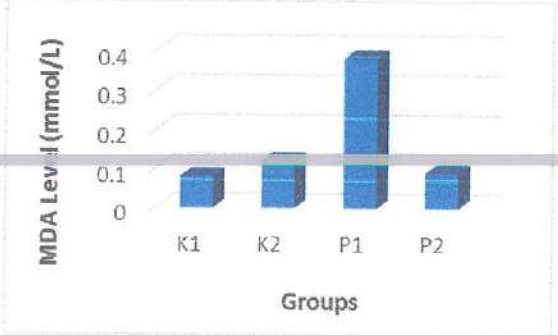

Figure 1: Graph of average of cerebellar MDA levels.

The normality test of Saphiro Wilk and homogeneity test of Levene Test showed variable of MDA levels content not normally distributed ($p<0.05$) and not homogeneous ($p<0.05$), but Kruskal Wallis test showed there was difference of MDA levels ($p < 0.05$).

Table 2 lists the Mann Whitney U test of MDA levels. Mann Whitney U test results showed that MDA levels of P1 group differed significantly with K1 group, K2 group and P2 group.

Table 2: Mann Whitney U test result of cerebellar MDA level.

Group (I)	Groups (J)	p
K1	K2	0.43
	P1	0.001*
	P2	0.207
K2	P1	0.002*
	P2	0.401
P1	P2	0.001*

* $p < 0.05$

4 DISCUSSION

In this study it was found that cerebellar MDA levels in P2 group were significantly lower than P1 group, and there was no significant difference in comparison with K2 group and K1 group. In addition, cerebellar MDA levels in the P1 group were significantly higher than in the control group. It can be argued that mobile phone EMR causes elevated levels of cerebellar MDA in P1 groups compared to the control group, but there was an attempt to improve the level of cerebellar MDA by administration of aluminum foil shield in group P2 compared to P1 group. This is possible because aluminum foil shield can reflect almost any exposure to electric waves, thus providing protection against EMR (Pratap *et al.*, 2014). The aluminum foil shield has non-magnetic properties, so it can reflect almost all incidents of electrical waves, can weaken electric fields over 80dB at frequencies over 100MHz and approximately 63% of magnetic field energy (Pratap *et al.*, 2014).

The level of cerebellar MDA in the P1 group was higher than in the control group because of the occurrence of oxidative stress in the cerebellum. MDA levels are generally used as a marker of oxidative stress due to free radicals (Gawel *et al.*, 2004; Asni *et al.*, 2009). Increased free radicals lead to increased MDA production. Oxidative stress that causes elevated cerebellar MDA levels in the P1 group may be due to mobile phone EMR. Radiofrequency radiation can affect individuals by increasing the production of free radicals, which increases lipid peroxidation (LPO), thus causing oxidative damage (Ozben, 2007). Free radicals can cause damage to enzymes, proteins, cell membranes, subcellular organelles, lipofuchsin pigments and DNA. Radiofrequency radiation increases ROS production or interferes with ROS production by reducing enzymatic antioxidant activity (Consales *et al.*, 2012). Radiofrequency radiation produces ROS by stimulating the oxidation of NADH (nicotinamide adenine dinucleotide) cell membranes, leading to extracellular superoxide production and oxidative stress, resulting in cellular damage (Consales *et al.*, 2012). Exposure to RF radiation in rat cerebellum can lead to increased activity of the enzyme NADH oxidase, which increases the production of ROS (Friedman *et al.*, 2007). Changes in enzyme activity and GSH decrease can be considered as an indicator of increased ROS production that occurs during the exposure period and may reflect the pathophysiological process of exposure (Dogan *et al.*, 2012). Excessive ROS production can reduce serum levels of melatonin, which are efficient free radical binders, and gene expression stimulation of some important endogenous antioxidant enzymes, leading to decreased activity and total suppression of antioxidant capacity (Kesari *et al.*, 2013). Decreased melatonin levels due to inhibition of melatonin production by EMR can cause vertigo (Enny, 2014).

The brain, being one of the most sensitive target organs for mobile phone EMR, is where mitochondrial injury occurs earlier and worse than other organs. It caused increasing levels of cerebellar MDA of the P1 group due to mobile phone EMR (Hao *et al.*, 2015). The brain absorbs about 50% of electromagnetic waves energy when using mobile phones near the head (Dimbylow and Mann, 1994). The brain is susceptible to ROS because of the high brain oxygen consumption, the mitochondrial neurons produce 0^2, the simple antioxidant defense mechanism and the polyunsaturated fatty acid (PUFA) of neuron membrane (Friedman, 2011). Fat is often the target of oxidation because it has a molecular structure with reactive double bonds (Ho *et al.*, 2013; Gawel *et al.*, 2004). Malondialdehyde is formed when ROS reacts with fatty acids from the cell membrane resulting in fatty peroxidation, which causes the breakdown of fatty acid chains into various toxic compounds.

The results of this study are in accordance with the research of Hussein (2016), who analyzed mobile phone radiation with frequency 1800MHz, SAR 0.6W/kg for 120 min/day for three months. It caused a significant elevation of MDA level and significant inhibition in the activities of SOD and GPX in the brain regions (hippocampus and cerebellum). Exposure to RF-radiation emitted from mobile phones is associated with overproduction of ROS and altered antioxidant activities.

5 CONCLUSIONS

Based on the results of the research, it was found that giving mobile phone EMR with SAR 0.84-1.86W / kg, frequency 2100MHz, four hours/day for 30 days caused increased levels of cerebellar MDA and aluminum foil shield can provide protection by reducing the effects of radiation.

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